Technical Specifications for the Telecommunications Terminal Equipment for Public Switched Telephone Network

National Communications Commission

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Contents

(譯者註：4.2.7 與 4.2.8 在目錄以及產品別測試要求明細表中的順序相符，但是在後面內文中卻顛倒，請確認，謝謝!)

Technical Specifications for the Telecommunications Terminal Equipment for Public Switched Telephone Network

1. Source of law and scope of application
   1.1 Source of law
   The Specifications are promulgated pursuant to Paragraph 1, Article 44 of the Telecommunications Management Act.
   1.2 Scope of application
   The Specifications apply to the telecommunications terminal equipment connected to a public switched telephone network and the series or bridging equipment used for the telecommunications terminal equipment. The specifications specify the technical conditions and properties of the equipment mentioned above when it is connected to a public switched telephone network via a linear interface without compromising its normal functioning and generating interference.

   The communications and telecommunications terminal equipment connected to public switched telephone network (hereinafter as "PSTN") is grouped into Types A, B, C through J. All types of telecommunications terminal equipment shall comply with the chapters of the Specifications. The requirements are provided in product type test lists, 3 pages in total, in detail. The name and type of telecommunications terminal equipment are:

   A. Telecommunications terminal equipment connected to PSTN: with telephone set;
   B. Telecommunications terminal equipment connected to PSTN: with answering machine;
   C. Telecommunications terminal equipment connected to PSTN: with master and slave line telephones;
   D. Telecommunications terminal equipment connected to PSTN: with fax machine;
   E. Telecommunications terminal equipment connected to PSTN: with modem;
   F. Telecommunications terminal equipment connected to PSTN: with caller ID;
   G. Telecommunications terminal equipment connected to PSTN: with switchboard;
   H. Telecommunications terminal equipment connected to PSTN: with touch tone telephone system;
   I. Telecommunications terminal equipment connected to PSTN: with hearing aid;
   J. Telecommunications terminal equipment connected to PSTN: with functions or products other than Types A through I above.

Product test requirement list

Chapter	Test name	A	B	C	D	E	F	G	H	I	**J**
3.	Electromagnetic compatibility	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4.1	PSTN interface	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4.1.1	Basic requirements	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4.1.2	Surge protection	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4.1.2.1	Surge test for telephone cable	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4.1.2.2	Surge test for AC power cable	※	※	※	※	※	※	※	※	※	※
4.1.3	Polarity change for telephone cable	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4.1.4	Leak current limitation	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4.1.5	Insulation resistance	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4.1.6	Ringing characteristics	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4.1.6.1	Ringing response	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4.1.6.2	Ringing impedance	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

4.1.6.3	AC impedance on open circuit	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4.1.7	DC resistance on closed circuit	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4.1.8	Signal transmission level limitation	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4.1.9	Transverse balance limitation	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4.1.10	Return loss	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4.1.11	Pulse dialing	※	※	※	※	※	※	※	※	※	※
4.1.12	Dual-tone, multi-frequency dial signal	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4.1.12.1	Frequency combination	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4.1.12.2	Signal level	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4.1.12.3	Signal level difference	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4.1.12.4	Signal time	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4.1.12.5	Down time	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4.1.13	Series equipment	※	※	※	※	※	※	※	※	※	※
4.1.13.1	DC voltage drop of series equipment	※	※	※	※	※	※	※	※	※	※
4.1.13.2	Insertion loss of series equipment	※	※	※	※	※	※	※	※	※	※
4.2	Handset functions	Y	※	※	※	※	※	※	※	Y	※
4.2.1	Transmission equivalence	Y	※	※	※	※	※	※	※	Y	※
4.2.1.1	Transmission equivalence for transmitting	Y	※	※	※	※	※	※	※	Y	※
4.2.1.2	Transmission equivalence for receiving	Y	※	※	※	※	※	※	※	Y	※
4.2.2	Frequency response – transmission characteristics	Y	※	※	※	※	※	※	※	Y	※
4.2.2.1	Frequency response – transmitting	Y	※	※	※	※	※	※	※	Y	※
4.2.2.2	Frequency response – receiving	Y	※	※	※	※	※	※	※	Y	※
4.2.3	Sidetone equivalence	Y	※	※	※	※	※	※	※	Y	※
4.2.4	Distortion	Y	※	※	※	※	※	※	※	Y	※
4.2.4.1	Distortion – transmission	Y	※	※	※	※	※	※	※	Y	※
4.2.4.2	Distortion – receiving	Y	※	※	※	※	※	※	※	Y	※
4.2.5	Volume control – receiving	Y	※	※	※	※	※	※	※	Y	※
4.2.6	Continuous sound pressure level of receiver	Y	※	※	※	※	※	※	※	Y	※
4.2.7	Volume control – receiver (with hearing aid)	※	※	※	※	※	※	※	※	Y	※
4.2.8	Magnetic flux test for receiver (with hearing aid)	※	※	※	※	※	※	※	※	Y	※
4.3	PSTN-connected wireless telephone functions	※	※	Y	※	※	※	※	※	※	※
4.3.1	Radio frequency requirements	※	※	Y	※	※	※	※	※	※	※
4.3.2	Password requirements	※	※	Y	※	※	※	※	※	※	※
4.3.3	Transmitter requirements	※	※	Y	※	※	※	※	※	※	※
4.3.3.1	Carrier frequency	※	※	Y	※	※	※	※	※	※	※
4.3.3.2	Modulation sensitivity	※	※	Y	※	※	※	※	※	※	※
4.3.3.3	Audio distortion	※	※	Y	※	※	※	※	※	※	※
4.3.4	Receiver requirements	※	※	Y	※	※	※	※	※	※	※
4.3.4.1	Available sensitivity	※	※	Y	※	※	※	※	※	※	※
4.3.4.2	Available bandwidth	※	※	Y	※	※	※	※	※	※	※
4.3.4.3	Audio distortion	※	※	Y	※	※	※	※	※	※	※
4.3.4.4	Signal to noise ratio	※	※	Y	※	※	※	※	※	※	※

4.3.4.5	Adjacent channel rejection	※	※	Y	※	※	※	※	※	※	※
4.3.4.6	Spurious response rejection	※	※	Y	※	※	※	※	※	※	※
4.3.5	Radiated electric field strength and radiated interference test	※	※	Y	※	※	※	※	※	※	※
4.4	Functional characteristics of switchboard	※	※	※	※	※	※	Y	Y	※	※
4.4.1	General characteristics	※	※	※	※	※	※	Y	Y	※	※
4.4.1.1	Power interruption	※	※	※	※	※	※	Y	Y	※	※
4.4.1.2	Trunk cut-off	※	※	※	※	※	※	Y	Y	※	※
4.4.2	Static noises	※	※	※	※	※	※	Y	Y	※	※
4.4.3	Transmission loss	※	※	※	※	※	※	Y	Y	※	※
4.4.4	Crosstalk loss	※	※	※	※	※	※	Y	Y	※	※
4.5	Communication protocol requirements	※	※	※	Y	Y	※	※	※	※	※
4.6	Caller ID	※	※	※	※	※	Y	※	※	※	※
4.6.1	FSK signal test criteria	※	※	※	※	※	Y	※	※	※	※
4.6.1.1	AC and DC boundaries	※	※	※	※	※	Y	※	※	※	※
4.6.1.2	Timing	※	※	※	※	※	Y	※	※	※	※
4.6.1.3	Signal status	※	※	※	※	※	Y	※	※	※	※
4.6.1.4	Packet status	※	※	※	※	※	Y	※	※	※	※
4.6.1.5	Presentation layer message status	※	※	※	※	※	Y	※	※	※	※
4.6.2	DTMF signal test criteria	※	※	※	※	※	Y	※	※	※	※
4.6.2.1	NIT status DC resistance	※	※	※	※	※	Y	※	※	※	※
4.6.2.2	NIT state disengagement	※	※	※	※	※	Y	※	※	※	※
4.6.2.3	DTMF signal	※	※	※	※	※	Y	※	※	※	※
4.6.2.4	DTMF code / number	※	※	※	※	※	Y	※	※	※	※
4.6.2.5	Anti-interference test for series equipment	※	※	※	※	※	Y	※	※	※	※
4.7	Automatic redial	※	※	※	※	※	※	※	※	※	※
4.7.1	Automatic redial	※	※	※	※	※	※	※	※	※	※
4.7.1.1	Number of automatic redials and time limit	※	※	※	※	※	※	※	※	※	※
4.7.1.2	Disconnect time limit for automatic redial	※	※	※	※	※	※	※	※	※	※
4.7.2	Automatic answering requirements	※	※	※	※	※	※	※	※	※	※

Notes:

(1) Y indicates the chapters to be met for telecommunications terminal equipment.

(2) ※ indicates the chapters to be met if the telecommunications terminal equipment is provided with such a function.

(3) Requirements in 4.4.4 Crosstalk Loss shall be met if the telecommunications terminal equipment consists of two or more trunks.

2. Definitions, symbols and acronyms

2.1 Definitions

Pseudo feeder circuit: a piece of test simulation equipment used to simulate the power feed from the central office to telephone line.

Reference load impedance: the reference load impedance is 600Ω for general test items if not specified, except otherwise specified for specific test items.

Pseudo loop: a piece of test simulation equipment used to simulate the characteristics of transmission line from the central office to telecommunications terminal equipment.

Automatic dialing: the action where the dial signal is sent automatically after the loop current is introduced to telecommunications terminal equipment.

Automatic loop current introduction: the automatic introduction of loop current to equipment without human intervention.

Automatic redial: the repeated dialing of the same number due to previous dialing failure.

Dial attempt: the process where telecommunications terminal equipment sends out an address signal for communications.

Communicating status: a piece of equipment is in the communicating status after dialing or responding after being called, until the communications stop.

Ground: a connection point in the telecommunications terminal equipment that is connected to power line grounding, or a connection point of equipment that needs to be grounded during testing.

Grounding environment condition: if telecommunications termina equipment is not provided with a grounding terminal, the metal conductor on its surface shall be used as an alternative ground; if the telecommunications terminal equipment does not have metal conductor on the surface, a copper plate shall be laid under the equipment as the alternative ground; the size of the copper plate shall be larger than the footprint of the telecommunications terminal equipment.

Dialing: the dialing of telecommunications terminal equipment starts from the first signal being sent out and ends after the last signal is sent out.

Dialing status: the telecommunications terminal equipment is in a dialing status between the beginning to the end of dialing.

Between-number status: the telecommunications is in the between-number status after the first number is sent out and before the next number is sent out.

Longitudinal conversion loss: an expression of the impedance balance to ground for telecommunications terminal equipment.

Network terminal point: a physical connection point at the end of network, used to connect telecommunications terminal equipment.

Public switched telephone network: the public switched network to which a piece of telecommunications terminal equipment is connected.

Closed circuit status: the status from the stabilization of DC current to before dialing as the loop current is introduced to telecommunications terminal equipment.

Equipment action status: the action status of telecommunications terminal equipment can be standby status, loop status, dialing status, between-number status, communicating status, ringing status and conversion between statuses.

Standby status: the status of telecommunications terminal equipment other than conversion between statuses, dialing status, ringing status, loop status, between-number status, or communicating status.

Return loss: an expression of telecommunications terminal equipment to network impedance matching.

Ringing status: the time from the beginning of the first ringing to the end of last ringing when the telecommunications terminal equipment is not being called.

Exchange signal: the code transmitted between telecommunications terminal equipment and telephone network.

Communication message: A message sent by telecommunications terminal equipment and not for network switch equipment.

Conversion between status: the transition from standby status to loop status, from ringing status to communicating status, or from communicating to standby status during dialing.

Transverse voltage: the electric potential difference between both ends of telecommunications terminal equipment telephone line.

Longitudinal voltage: half of the sum of vectors of electric potential differences between tip and ground and between ring and ground in the telecommunications terminal equipment telephone line.

2.2 Symbols

Ω	: Ohm
dB	: Decibel
dBspl.	: Decibel, sound pressure level
a.c.	: Alternative current
d.c.	: Direct current
dBm	: Decibel milliwatt
dBV	: Decibel volt
DTMF	: Dual-tone multi-frequency
V	: Volt
mA	: Milliamp
R	: Resistance
ZR	: Reference impedance
ERP	: Ear reference point
MRP	: Mouth reference point
r.m.s	: Root mean square
RL	: Return loss

2.3 Acronyms

ACTE	: Automatic conversion terminal equipment
DTMF	: Dual-tone, multi-frequency signal
HGP	: High-frequency group power output of DTMF dial signal

LGP : Low-frequency group power output of DTMF dial signal

PBX : Private branch exchange

PSTN : Public switched telephone network

RVA : Automatic voice equipment in automatic conversion equipment in which a pre-recorded message provides the caller a voice instruction for conversion.

TE : Terminal equipment

3. Electromagnetic compatibility requirements

CNS 13438 C6357 “Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement” is the technical specifications and test criteria for electromagnetic compatibility.

4. Communication requirements

4.1 Public switched telephone network interface specifications

4.1.1 Basic requirements

(1) Independent bodies other than those that shall be equipment for Type I telecommunications enterprises shall not be modified into equipment for Type I telecommunications enterprises

(2) The functions of PSTN in terms of switching, testing, transmission and fee charging shall not be compromised by the connection of telecommunications terminal equipment to network.

(3) The normal use of other series equipment shall not be compromised when the telecommunications terminal equipment is not in use or malfunctions.

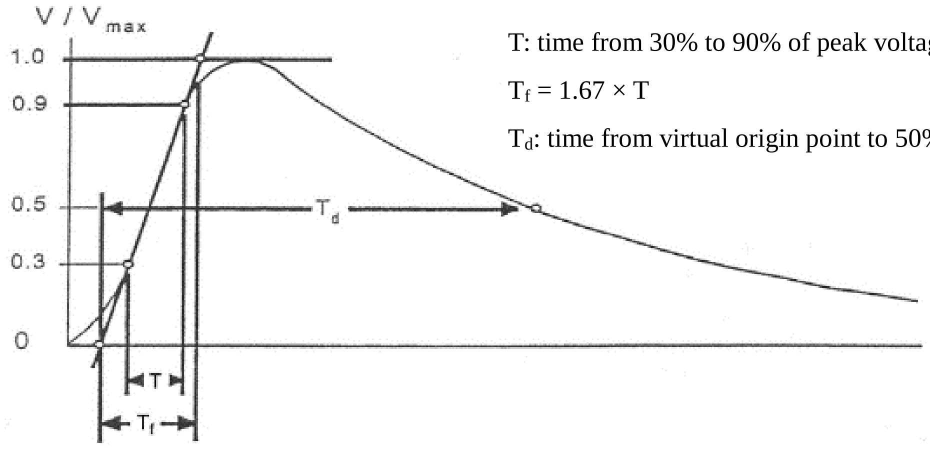
4.1.2 Surge protection

Surge voltage waveform:

Front time (T_f)=1.67 × T (time from 30% to 90% of peak voltage);

Impact time (T_d): time from virtual origin point to 50% of peak voltage.

Open-circuit surge voltage waveform is shown as follows:



T: time from 30% to 90% of peak voltage

$T_f = 1.67 \times T$

T_d: time from virtual origin point to 50% of peak voltage

4.1.2.1 Surge test for telephone cable:

4.1.2.1.1 Lateral surge test:

Specifications: all operating functions shall be normal after the telecommunications terminal equipment is subject to the lateral surge test (at both ends of telephone line).

1. For the lateral surge waveform: front time (T_f) ≦10us, impact time (T_d) ≧ 560us and peak voltage≧800V. The surge generator shall be capable of peak current energy at 100A or more.
2. With the telecommunications terminal equipment at open circuit and all operating conditions, the surge waveform mentioned above is applied to both ends of the telephone line with positive surge applied once and negative surge applied once.

Purpose: to simulate the lateral surge voltage in the telephone line caused by a lightning strike.

Test method:

1. The lateral surge test setup is shown in Figure 1.

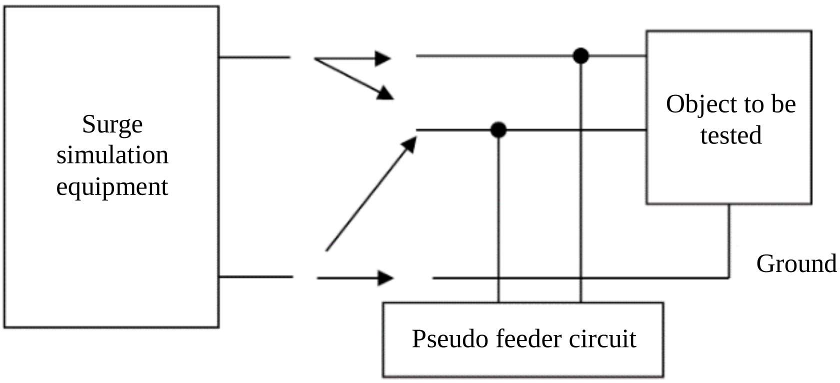


Figure 1 Surge test setup

2. Lateral surge test method
   (1) Set the front time (T_f), impact time (T_d) and peak voltage of the lateral surge voltage waveform.
   (2) Place the object to the tested at open circuit.
   (3) Apply the surge between both ends of the telephone line, once in the forward direction and once in the reverse direction.
   (4) Record and check the functions of the object to be tested.
   (5) Set the object to be tested at all operating conditions and repeat steps (3) and (4).

Test equipment:

1. Surge simulation equipment
2. Pseudo feeder circuit

4.1.2.1.2 Longitudinal surge test (telephone line to ground):

Specifications: all operating functions shall be normal after the telecommunications terminal equipment is subject to the longitudinal surge test.

1. For the longitudinal surge waveform: front time (T_f) ≦10us, impact time (T_d) ≧160us and peak voltage≧1500V. The surge generator shall be capable of peak current energy at 200A or more.
2. With the telecommunications terminal equipment at open circuit and all operating conditions, the surge waveform mentioned above is applied between short circuit and ground at both ends of the telephone line with positive surge applied once and negative surge applied once.

Purpose: to simulate the longitudinal surge voltage in the telephone line caused by a lightning strike.

Test method:

1. The longitudinal surge test setup is shown in Figure 1.
2. Test method for longitudinal surge:
   (1) Set the front time (T_f), impact time (T_d) and peak voltage of the longitudinal surge voltage waveform.
   (2) Place the object to the tested at open circuit.
   (3) Apply the surge between short circuit and ground at both ends of the telephone line, one in the forward direction and one in the reverse direction.
   (4) Record and check the functions of the object to be tested.
   (5) Set the object to be tested at all operating conditions and repeat steps (3) and (4).

Test equipment:

1. Surge simulation equipment
2. Pseudo feeder circuit

4.1.2.2 Surge test for AC power cable:

Specifications: all operating functions shall be normal after the telecommunications terminal equipment is subject to the surge test for AC power cable.

1. For the AC power cable surge waveform: front time (T_f) ≦2us, impact time (T_d) ≧10us and peak voltage≧2500V. The surge generator shall be capable of peak current energy at 1000A or more.
2. With AC power fed to the telecommunications terminal equipment (on and off), the surge is applied between both ends of the power cable, three times in the forward direction and three times in the reverse direction.

Purpose: to simulate the surge voltage in the AC power cable caused by a lightning strike.

Test method:

1. The AC power cable surge test setup is shown in Figure 2.

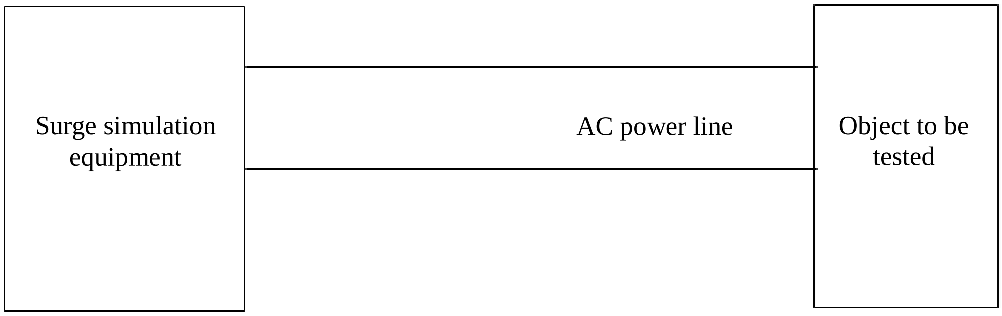


Figure 2 AC power cable surge test setup

2. AC power cable surge test method:
   (1) Set the front time (T_f), impact time (T_d) and peak voltage of the AC power cable surge voltage waveform.
   (2) Switch the object to the tested ON.
   (3) Apply the surge between both ends of the power cable, three times in the forward direction and three times in the reverse direction.
   (4) Record and check the functions of the object to be tested.
   (5) Switch the object to be tested OFF and repeat steps (3) and (4).

Test equipment:

1. Surge simulation equipment
2. Utility power

4.1.3 Polarity change for telephone cable:

Specifications: the connection of telecommunications terminal equipment to PSTN with either polarity shall comply with the requirements set forth in the Specifications.

Purpose: to ensure that the telecommunications terminal equipment can be connected to PSTN with either polarity.

Test method: all the test items in the Specifications are applicable for either polarity.

4.1.4 Leak current limitation

Specifications: the telecommunications terminal equipment shall pass the 60Hz AC voltage listed in Table 1 applied between combinations of test points (1), (2) and (3).

Test point (1): all telephone line connection points;

Test point (2): all power cable connection points;

Test point (3): possible combinations of all exposed surfaces outside of the object to be tested.

The test voltage is increased from 0V to the voltage listed in Table 1 gradually in 30 seconds and stay at the test voltage for 1 minute. At any point of the 90 seconds of test time, the leak current between power source of the voltage and test point shall not exceed the peak at 10mA.

Table 1 Voltages of various combinations of electric connections

Test voltage connection points (test points)	AC voltage for testing
(1) and (3)	1000V/60Hz
(1) and (2)	1500V/60Hz
(2) and (3)	1500V/60Hz

Purpose: to prove the complete insulation protection between the telephone line and power cable connection points of the object to be tested and PSTN.

Test method:

1. The leak current limitation test setup is shown in Figure 3.

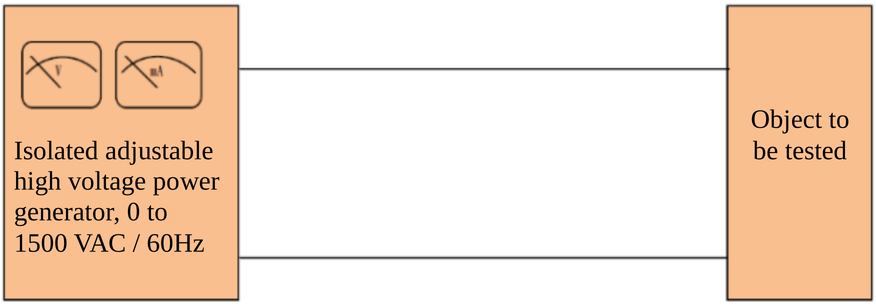


Figure 3 Leak current limitation test setup

2. Leak current limitation test method:
   (1) Select the object to be tested at the appropriate test point according to Table 1.
   (2) Set the object to be tested at open circuit.
   (3) Regulate the high-voltage power supply generator to increase the voltage from 0V to the AC voltage listed in Table in 30 seconds. Maintain the maximum test voltage for 60 seconds.
   (4) Record the maximum current in the 90 seconds of test time.
   (5) Select the maximum leak current.
   (6) Set the object to be tested at all operating conditions and repeat test steps (3) through (5).

(7) Repeat test steps (2) through (6) on all test point combinations listed in Table 1.

Test equipment:

1. Isolated adjustable high-voltage power supply generator
2. AC voltmeters (V1 and V2)

4.1.5 Insulation resistance:

Specifications: with 100Vdc, the insulation resistance between the following test points of telecommunications terminal equipment shall be greater than 5 MΩ。

1. Two-line telecommunications terminal equipment:
   (1) Between T and R of telephone line;
   (2) Between short circuit and AC power cable at both T and R of telephone line;
   (3) Between short circuit and ground at both T and R of telephone line.
2. Four-line telecommunications terminal equipment:
   (1) Between T/T1 short circuit and R/R1 short circuit of telephone line;
   (2) Between T/T1, R/R1 short circuit and ground of telephone line;
   (3) Between T/T1, R/R1 short circuit and AC power cable of telephone line.

Purpose: to check the high-impedance insulation characteristics of telecommunications terminal equipment between telephone line connection point, power cable and grounding casing.

Test method:

1. The insulation resistance test setup is shown in Figure 4.
2. Insulation resistance test method:
   (1) Set the object to be tested at open circuit.
   (2) Set the DC voltage at 100Vdc.
   (3) Connect the output to T and R of telephone line of the object to be tested.
   (4) Test and record DC current. Determine the insulation resistance =100÷Idc。
   (5) The output is connected to the test points defined in the specifications in sequence.
   (6) Test and record DC current. Determine the insulation resistance between test points.

Test equipment:

1. 100V DC power supply
2. DC voltmeter (V)
3. DC ammeter (A)

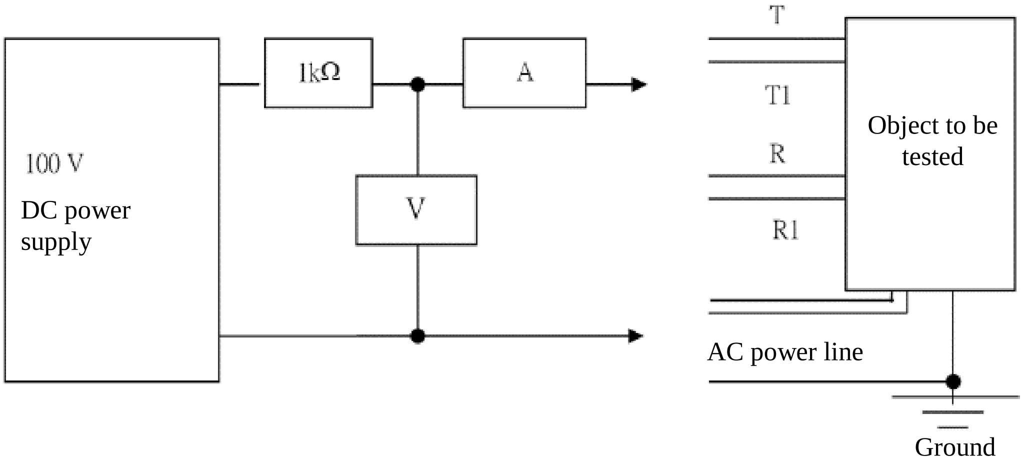


Figure 4 Insulation resistance test setup

4.1.6 Ringing characteristics:

4.1.6.1 Ringing response:

Specifications: the telecommunications terminal equipment, when connected to a 5 kΩ resistor in series, shall respond to a 20Hz/ 45 V rms ringing signal with 1 second on and 2 seconds off plus a 48 Vdc pseudo feeder circuit voltage if the equipment is provided with ringing detection.

Purpose: to prove that the telecommunications terminal equipment complies with the minimum standard of ringing response characteristics.

Test method:

1. The ringing response test setup is shown in Figure 5.

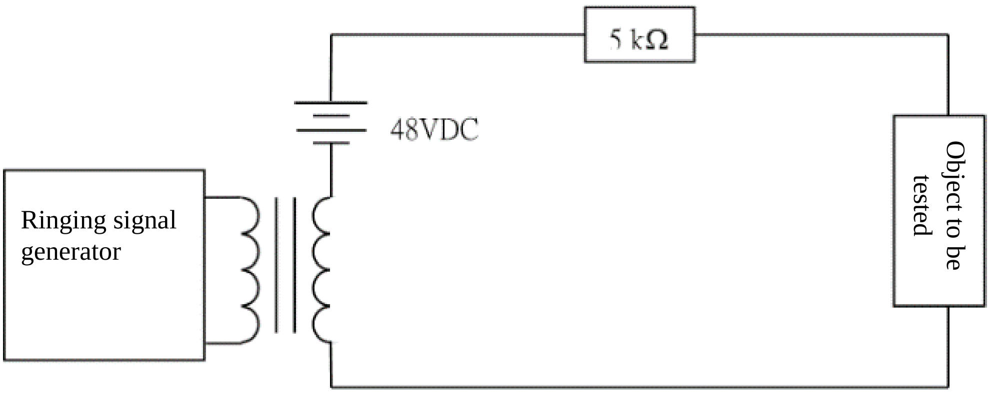


Figure 5 Ringing response test setup

2. Ringing response test method:
   (1) Set the object to be tested at open circuit.
   (2) Set the ringing signal generator to generate a ringing signal at 20Hz and with a signal level of 45Vrms.
   (3) Check the object to be tested for any audible sound or other responses.

Test equipment:

1. DC power supply
2. Ringing signal generator (frequency generator + ringing amplifier)

4.1.6.2 Ringing impedance

Specifications: when the telecommunications terminal equipment is applying a ringing signal of 20Hz and 75Vrms, the ringing impedance shall not be lower than 5kΩ and the capacitance shall be lower than 3.0uF.

Purpose: the ringing impedance of the telecommunications terminal equipment shall be high enough on receiving a ringing signal.

Test method:

1. The ringing impedance test setup is shown in Figure 6.

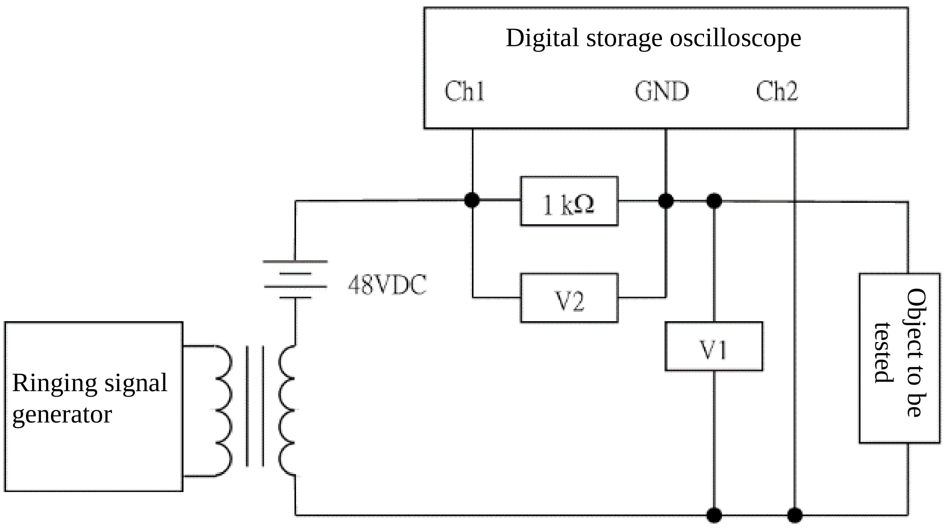


Figure 6 Ringing impedance test setup

2. Ringing impedance test method:
   (1) Set the object to be tested at open circuit.
   (2) Set the ringing signal generator at 20Hz and regulate the signal output level V1 at 75Vrms across the object to be tested.
   (3) Test the AC voltage V2.
   (4) Determine the ringing impedance of the object to be tested Z = V1 ÷ V2 × 1000.
   (5) Monitor and record the waveforms of V1 and V2 using a digital logging oscilloscope.
   (6) Determine the phase difference of V1 and V2, θ, and capacitance of the object to be tested, C.
      (a) θ= △t ÷50ms × 360°
      (b) C = 1 /ω× Z × sinθ, where ω= 2×π× f
      θ: phase difference

△ t: time difference for V1 and V2 waveforms

Test equipment:

1. Digital logging oscilloscope
2. Ringing signal generator (frequency generator + ringing amplifier)
3. DC power supply
4. AC voltmeter (V1 and V2)

4.1.6.3 AC impedance on open circuit

Specifications: with the telecommunications terminal equipment at open circuit, an AC signal with frequency ranging from 200 Hz to 3200 Hz and signal level of 3Vrms is applied at both ends of telephone line and the AC impedance shall fall in the acceptable region shown in Figure 7.

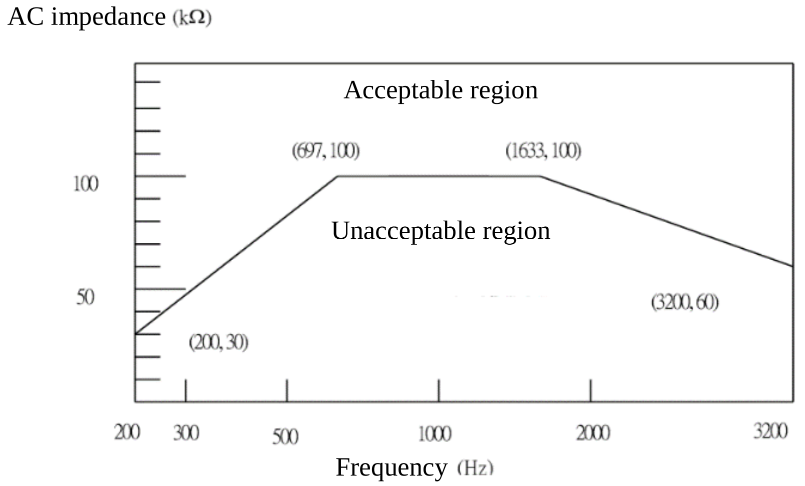


Figure 7 AC impedance characteristics on open circuit

Purpose: the impacts on the telecommunications terminal equipment in series is prevented.

Test method:

1. The setup for the AC impedance on open circuit test is shown in Figure 8.

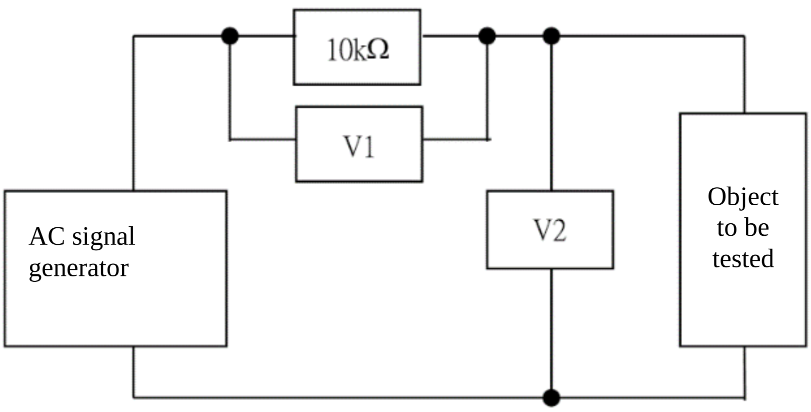


Figure 8 Setup for the AC impedance on open circuit test

2. AC impedance on open circuit test method:
   (1) Set the object to be tested at open circuit.
   (2) Set the AC signal generator at 200 Hz and regulate the output signal level until V2 reads 3Vrms.
   (3) Test and record V1 readings.
   (4) Determine the AC impedance, $Z = V2 \div V1 \times 10\ k\Omega$.
   (5) Slowly increase the frequency of AC signal generator from 200 Hz to 3200 Hz, while maintaining V2 reading at 3Vrms.
   (6) Repeat test steps (3) and (4).

Test equipment:

1. AC signal generator
2. AC voltmeter (V1 and V2)

4.1.7 DC resistance on closed circuit:

Specifications: when operating any function with the telecommunications terminal equipment on closed circuit, the DC voltage vs. loop current between telephone lines shall fall in the allowable region in Figure 9 (this property applies only when the telecommunications terminal equipment can reach the closed-circuit condition).

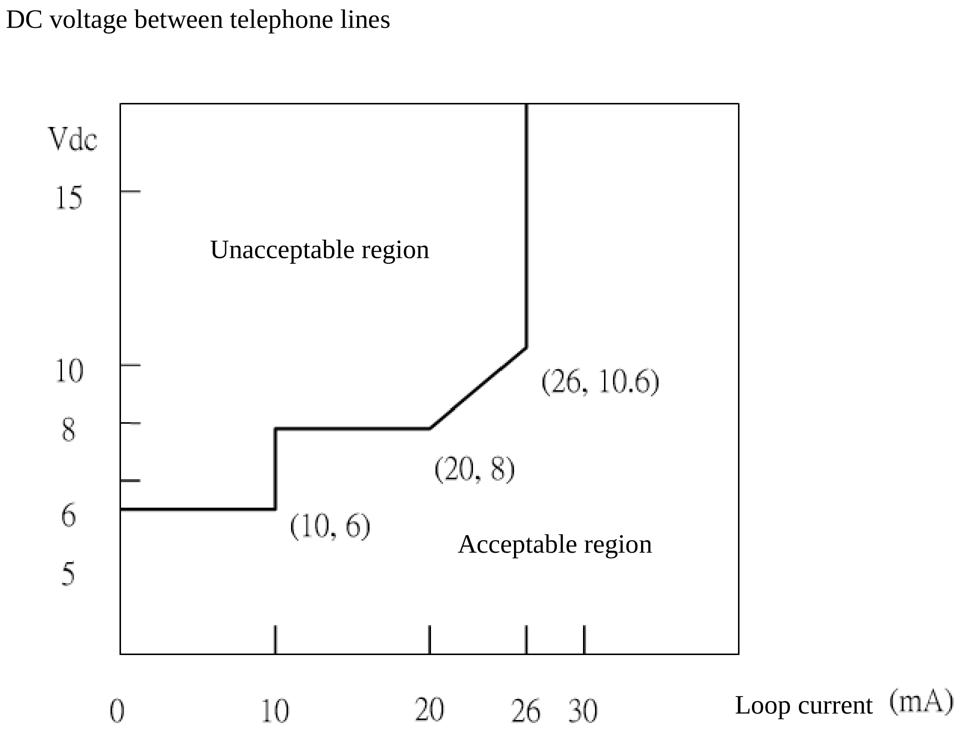


Figure 9: DC voltage vs. current

Purpose: to prove the DC loop characteristics of the telecommunications terminal equipment in a steady state.

Test method:

1. The DC resistance on closed circuit test setup is shown in Figure 10.
2. DC resistance on closed circuit test method:
   (1) Set the object to be tested at closed circuit.
   (2) Regulate the variable resistor until the DC ammeter reads 10mA and 20mA. Plot the individual DC voltage values in Figure 9. The DC current at every test point shall be watched for 5 seconds or longer.
   (3) Regulate the variable resistor until the DC voltmeter reads 10.6V. Plot the DC voltage values in Figure 9.
   (4) Set the object to be tested at all closed-circuit operating conditions and repeat test steps (2) and (3).

Test equipment:

1. DC power supply
2. DC voltmeter
3. DC ammeter
4. Variable resistor

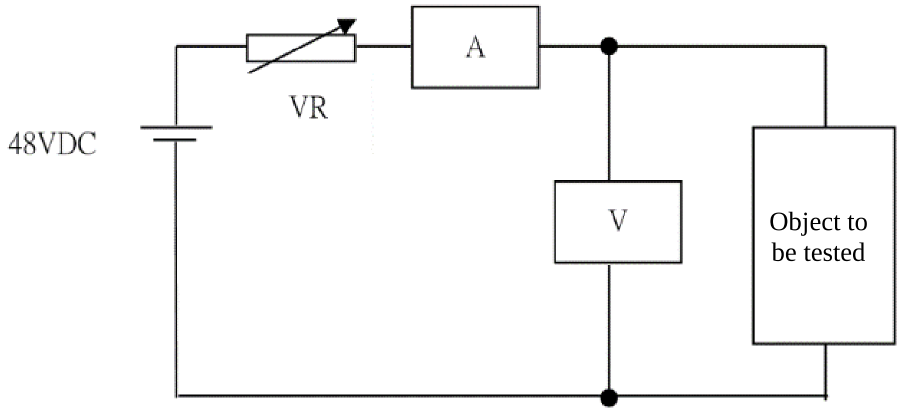


Figure 10 DC resistance on closed circuit test setup

4.1.8 Signal transmission level limitation:

Specifications: the signal output level of internally transmitted signals of telecommunications terminal equipment, except DTMF signal, that are sent to PSTN shall comply with the following:

1. Between 200 Hz and 4000 Hz and with 600 Ω as the load, the average output level shall not be greater than –10dBm in 1 minute. The user shall not be able to regulate beyond this limit.
2. Between 4kHz and 8kHz and with 600 Ω as the load, the average output level shall not be greater than –20dBm in 1 minute.
3. Between 8kHz and 12kHz and with 600 Ω as the load, the average output level shall not be greater than –40dBm in 1 minute.

4. Between 12kHz and 40kHz and with 600 Ω as the load, the average output level shall not be greater than –60dBm in 1 minute.

The internally transmitted signals of telecommunications terminal equipment for dedicated line, except DTMF signals, shall comply with this requirement.

Purpose: the power of audio or data signals generated and transmitted by the internal audio source of the telecommunications terminal equipment to PSTN, except dial signals, are properly limited.

Test method:

1. The signal transmission level limitation test setup is shown in Figure 11.
2. Signal transmission level limitation test method:
   (1) Set the object to be tested at the maximum signal state desired for transmission.
   (2) Set the band-pass filter at the band between 200Hz and 4000Hz.
   (3) Test and record the maximum average transmitted signal power level (dBm).
   (4) Set the band-pass filter at 4kHz~8kHz/ 8kHz~12kHz…… /36kHz~40kHz bands.
   (5) Test and record the maximum average transmitted signal power level (dBm) of every frequency band.
   (6) Set the object to be tested at other transmitted internal signal statuses. Repeat test steps (2) through (5).

Test equipment:

1. Pseudo feeder circuit
2. Band-pass filter
3. Root-mean-square AC voltmeter
4. R: reference load, 600 ohms

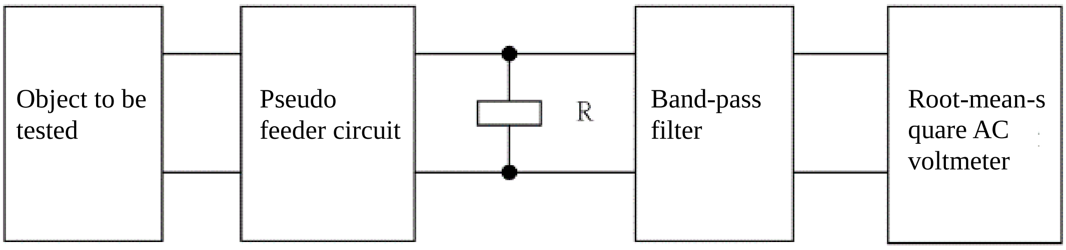


Figure 11 Signal transmission level limitation test setup

4.1.9 Transverse balance limitation:

Specifications: the telecommunications terminal equipment is tested at open circuit, closed circuit and both positive and negative polarities. The minimum transverse balance values are specified in Table 2:

Table 2 Transverse balance values

State	Frequency	Balance
Closed circuit	200Hz≦f≦4000Hz	40dB
Open circuit	200Hz≦f＜1000Hz	60dB
Open circuit	1000Hz≦f≦4000Hz	40dB

Technical description: the transverse balance coefficient is expressed as follows:

Transverse Balance m-l = 20 log10 Vm / Vl

Where

Vl: longitudinal voltage generated across the longitudinal terminal R2 (500Ω);

Vm (0.775V): transverse voltage sent from a signal at the balance power application band between 200Hz and 4000Hz of a lateral impedance, R0, (calibration circuit) across the telephone line interface; when the telecommunications terminal equipment is replaced by R0, the balance voltage source, Vm, shall be set at 0.775 volts.

Purpose: to prove the imbalance of ground impedance expressed as the balance of output signal.

Test method:

1. The transverse balance limitation test setup is shown in Figure 12.
2. Transverse balance limitation test method:
   (1) Set the AC signal generator at 200 Hz.
   (2) Connect R0 (calibration circuit) to the test circuit in Figure 12.
   (3) Regulate the AC signal generator until the voltage output (Vm) is 0.775V for the frequency-selective voltmeter setting bandwidth 10 Hz test across R0.
   (4) Connect the frequency voltmeter across R2 to test Vl.
   (5) Regulate variable capacitors C3 and C4 until Vl reaches the minimum signal level (which shall be greater than 20dB, the transverse balance value corresponding to the test frequency).
   (6) Replace R0 with the object to be tested and set at open circuit.
   (7) Test the lateral voltage (Vm) and transverse voltage (Vl).
   (8) Determine the balance using the following equation: transverse balance) = 20 log Vm / Vl
   (9) Reverse the connection of the telephone line of the object to be tested. Repeat test steps (7) through (9). The smaller of the two results is the transverse balance of the object to be tested at 200 Hz.
   (10) Set the AC signal generator at each of 500, 1000, 2000, 3000 and 4000 Hz at least. Repeat test steps (2) through (10).
   (11) Set the object to be tested at all operating conditions and repeat test steps (1) through (10).

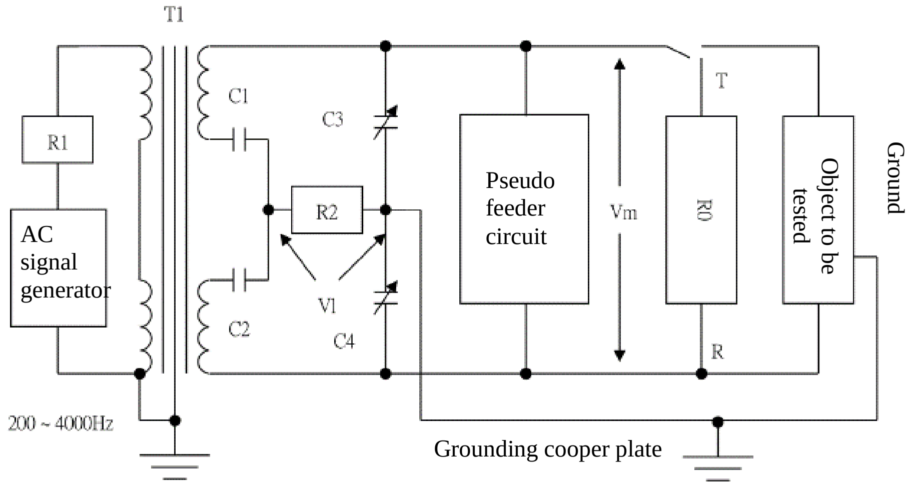


Figure 12 Transverse balance limitation test setup

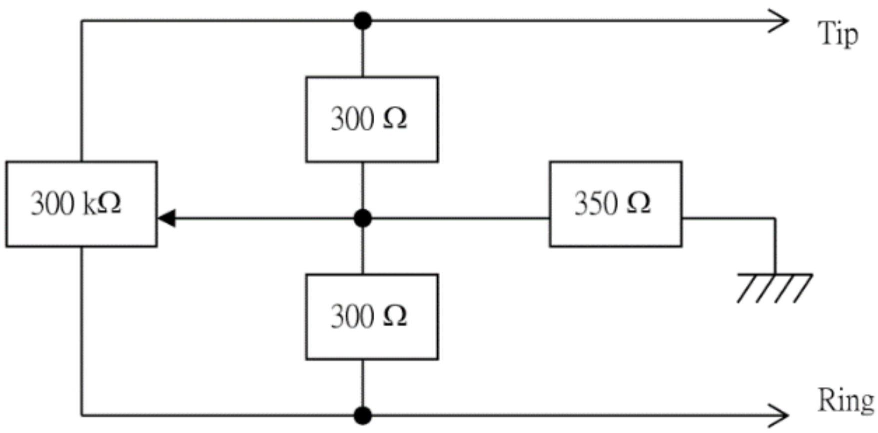


Figure 13 R0 calibration circuit wiring

Test equipment:

1. AC signal generator (Zosc shall be smaller than or equal to 600Ω)
2. Pseudo feeder circuit
3. R0: calibration circuit; see Figure 13
4. R2: lateral resistance, 500Ω
5. T1: 600Ω: 600Ω distributed audio transformer
6. C1/C2: 8mF±0.1%, 400V
7. C3/C4: 100 ~ 500pF adjustable billicapacitor
8. R1: Zosc + R1 = 600Ω

4.1.10 Return loss:

Specifications: for the telecommunications terminal equipment at all operating conditions and with the pseudo loop at 0 km, the return loss shall comply with the following:

1. When the test is performed with a 600 Ω load, the return loss in the frequency band between 500 Hz and 2500 Hz shall be ≧8dB.
2. When the test is performed with a 600 Ω load, the return loss in the frequency bands between 200 Hz and 500Hz and between 2500Hz and 3200 Hz shall be ≧6dB.

Purpose: to maintain the stability of PSTN, the telecommunications terminal equipment needs an impedance that allows for appropriate telephone control function.

Test method:

1. The return loss test setup is shown in Figure 14.

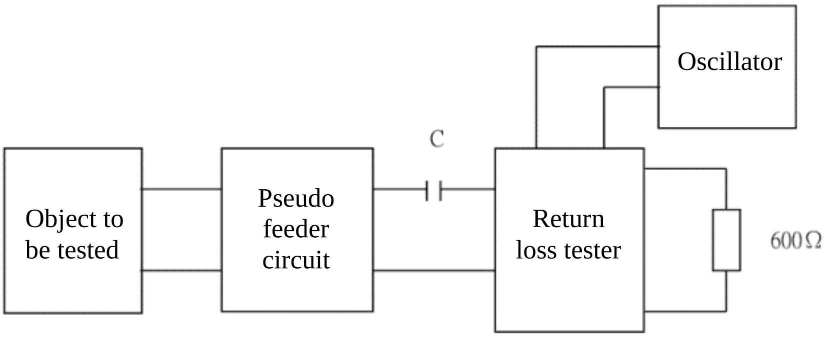


Figure 14 Return loss test setup

2. Return loss test method:
   (1) Set the object to be tested at closed circuit and send no signal.
   (2) Set the pseudo loop at 0 km and the object to be tested at closed circuit.
   (3) Increase gradually the frequency of oscillator from 200 Hz to 3200 Hz. Record the minimum return losses at the bands of 200~500, 500~2500 and 2500~3200Hz.
   (4) Set the object to be tested at all operating conditions. Repeat test step (3).

Test equipment:

1. Pseudo feeder circuit
2. Return loss tester
3. Oscillator
4. C: 125uF±10%

4.1.11 Pulse dialing:

Specifications: for the normal pulses sent when a button is pushed on the telecommunications terminal equipment, the result shall comply with the following:

1. Pulses per seconds: 10±1 P.P.S
2. Make / break ratio: 33±3%
3. Minimum interval between numbers: 600msec

For pulse signals, the triggering current is: 18 mA for high triggering current and 6mA for low triggering current.

Purpose: to ensure that the telecommunications terminal equipment sends the pulse dialing signals appropriate to PSTN.

Test method:

1. The pulse dialing test setup is shown in Figure 15.

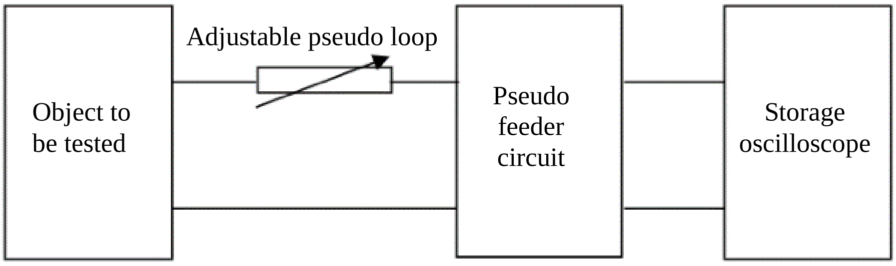
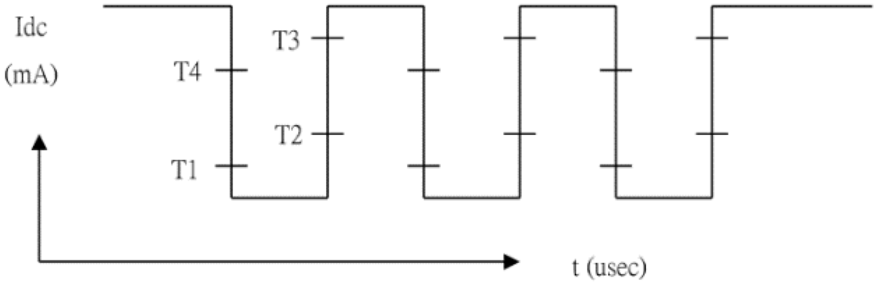


Figure 15 Pulse dialing test setup

2. Pulse dialing test method:
   (1) Set the pseudo loop at 0 km.
   (2) Send a pulse dialing signal from the object to be tested.
   (3) Test and record the DC current signals from the pulse dialing signal.
   (4) Set the pseudo loop at 5 km. Repeat test steps (2) and (3).
   (5) Determine the average pulse speed, average connection rate and minimum interval between numbers using the following equations.



T1 & T2: the time of low triggering current

T3 & T4: the time of high triggering current

Make interval	:	begins≧T3	ends≦T4
Brake interval	:	begins≦T1	ends≧T2
Rise time	:	begins≧T2	ends≧T3
Fall time	:	begins≦T3	ends≦T1
Period	:	begins≧T4	ends≧T3

- Pulses per second (P.P.S.) = 1 ÷Period
- Make / Brake ratio = Make interval ÷Period × 100%
- Minimum interval between numbers: minimum time difference between two arbitrary dial number signals

Test equipment:

1. Adjustable the pseudo loop
2. Pseudo feeder circuit
3. Storage oscilloscope

4.1.12 Dual-tone, multi-frequency (DTMF) dial signal:

4.1.12.1 Frequency combination

Specifications: Table 3 shall be met when DTMF dial signal frequency combination is used for the telecommunications terminal equipment. When the pseudo loop is set at 0 km and 5 km, the allowable tolerance for the provided frequency characteristics shall be within ±1.5 %.

Table 3 DTMF dial signal frequencies

Frequencies for high-frequency groups	Frequencies for low-frequency groups			
	1209	1336	1477	1633
697	**1**	**2**	**3**	**A**
770	**4**	**5**	**6**	**B**
852	**7**	**8**	**9**	**C**
941	*****	**0**	**#**	**D**

Purpose: to ensure that the telecommunications terminal equipment sends the DTMF dial signal combinations appropriate to PSTN.

Test method:

1. The frequency combination test setup is shown in Figure 16.

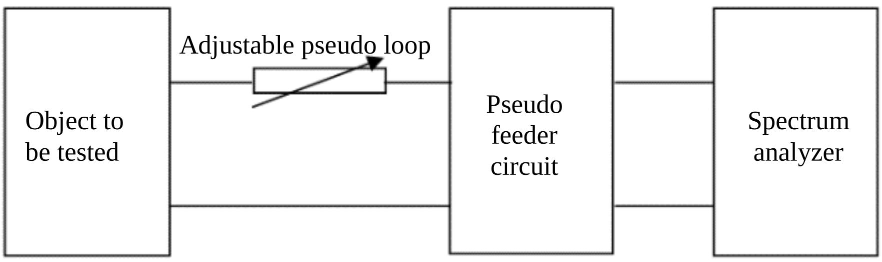


Figure 16 Frequency combination test setup

2. Frequency combination test method:
   (1) Set the pseudo loop at 0 km.
   (2) Set the object to be tested to send DTMF “1” signal.
   (3) Test and record the frequency of DTMF signal.
   (4) Determine the frequency deviation.
   (5) Send other dial signals that can be generated by the object to be tested one by one repeatedly and repeat test steps (3) and (4).
   (6) Set the pseudo loop at 5 km. Repeat test steps (2) through (5).

Test equipment:

1. Adjustable pseudo loop
2. Pseudo feeder circuit
3. Spectrum analyzer

4.1.12.2 Signal level

Specifications:

1. The signal level of DTMF dial signal shall fall within –6±2dBm for any high-frequency group and –8±2dBm for any low-frequency group, with the reference impedance of 600 ohms as the load for the telecommunications terminal equipment and the pseudo loop at 0 km.
2. The signal level of DTMF dial signal shall ≧-21dBm, with the reference impedance of 600 ohms as the load for the telecommunications terminal equipment and the pseudo loop at 5 km.

Purpose: to check that the telecommunications terminal equipment transmits the appropriate DTMF dial signals.

Test method:

1. The signal level test setup is shown in Figure 17.
2. Signal level test method:
   (1) Set the pseudo loop at 0 km.
   (2) Set the object to be tested to send DTMF “1” signal.
   (3) Test and record the signal levels of DTMF signals for high- and low-frequency groups.
   (4) Send other dial numbers that the object to be tested can generate one by one repeatedly and repeat test step (3).
   (5) Set the pseudo loop at 5 km. Repeat test steps (2) through (4).

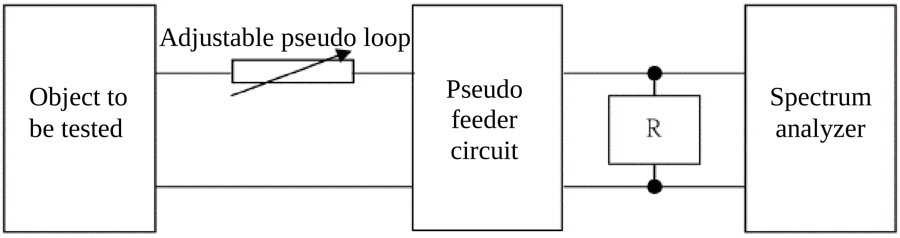


Figure 17 Signal level test setup

Test equipment:

1. Adjustable pseudo loop
2. Pseudo feeder circuit
3. Spectrum analyzer
4. R: 600Ω reference load

4.1.12.3 Signal level difference

Specifications: with the pseudo loop at 0 km, send any DTMF dial signal frequency combination and the signal level of high-frequency group shall be 0 ~ 3dB greater than that of low-frequency group.

Purpose: to check that the telecommunications terminal equipment transmits the appropriate DTMF dial signals.

Test method:

1. The signal level difference test setup is shown in Figure 17.
2. Signal level difference test method:
   (1) Set the pseudo loop at 0 km.
   (2) Set the object to be tested to send DTMF “1” signal.
   (3) Test and record the signal levels of DTMF signals for high- and low-frequency groups.
   (4) Determine the signal level difference.
   (5) Send other dial numbers that the object to be tested can generate one by one repeatedly and repeat test steps (2) through (4).

Test equipment:

1. Adjustable pseudo loop
2. Pseudo feeder circuit
3. Spectrum analyzer

4.1.12.4 Signal time

Specifications: the time that the telecommunications terminal equipment sends any individual DTMF dial signal frequency combination shall not be less than 40 ms. This requirement applies only to telecommunications terminal equipment with automatic dialing while the telecommunications terminal equipment is tested under the automatic dialing mode.

Purpose: to check that the telecommunications terminal equipment sends DTMF dial signals at appropriate time.

Test method:

1. The signal time test setup is shown in Figure 18.

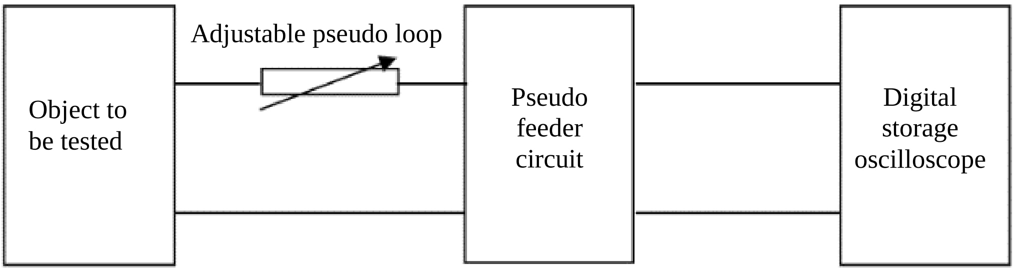


Figure 18 Signal time test setup

2. Signal time test method:
   (1) Set the pseudo loop at 0 km.
   (2) Set the object to be tested at closed circuit and automatic dial mode.
   (3) Transmit DTMF signals.
   (4) Test and record all DTMF signals.
   (5) Determined and record the minimum signal time.
   (6) Set the pseudo loop at 5 km and repeat test steps (2) through (5).

Test equipment:

1. Adjustable pseudo loop
2. Pseudo feeder circuit
3. Digital logging oscilloscope

4.1.12.5 Down time

Specifications: the down time between two arbitrary DTMF dial signal combinations sent by the telecommunications terminal equipment shall not be less than 50 ms. This requirement applies only to telecommunications terminal equipment with automatic dialing while the telecommunications terminal equipment is tested under the automatic dialing mode.

Purpose: to check that the telecommunications terminal equipment sends DTMF dial signals at appropriate time.

Test method:

1. The down time test setup is shown in Figure 18.
2. Down time test method:
   (1) Set the pseudo loop at 0 km.
   (2) Set the object to be tested at closed circuit and automatic dial mode.
   (3) Transmit DTMF signals.

(4) Test and record all DTMF signals.

(5) Determine the minimum down time between any two DTMF dial signals.

(6) Set the pseudo loop at 5 km and repeat test steps (2) through (5).

Test equipment:

1. Adjustable pseudo loop
2. Pseudo feeder circuit
3. Digital logging oscilloscope

4.1.13 Series equipment

4.1.13.1 DC voltage drop of series equipment:

Specifications: for series equipment, the DC voltage drop across the telephone line shall be smaller than 3Vdc for the loop current of 30mA, and 6Vdc for the loop current of 60mA.

Purpose: the wiring shall function normally at all times while the other telecommunications terminal equipment connected to the series equipment is set at closed circuit.

Test method:

1. The test setup for DC voltage drop of series equipment is shown in Figure 19.
2. Test method for DC voltage drop of series equipment:

(1) Regulate the variable resistor, VR, until the loop current of 30mA is obtained.

(2) Test and records the readings of DC ammeter, V1.

(3) Set the object to be tested at open circuit and connect to the test setup as shown in Figure 19.

(4) Test and records the readings of DC ammeter, V2.

(5) Determine the DC voltage drop = V2 – V1.

(6) Regulate the variable resistor, VR, until the loop current of 60mA is obtained. Repeat test steps (2) through (5).

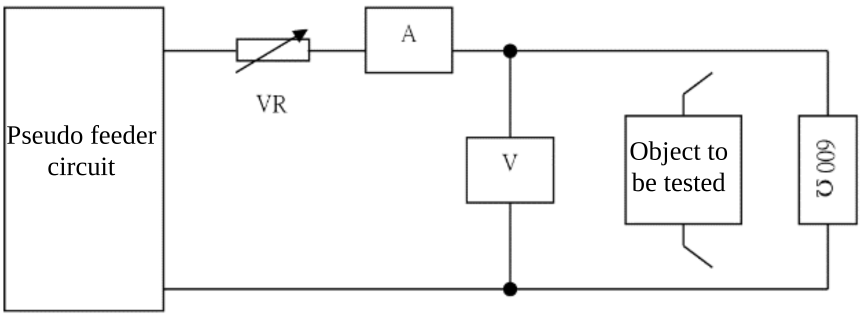


Figure 19 Test setup for DC voltage drop of series equipment

Test equipment:

1. Pseudo feeder circuit
2. DC ammeter, A
3. DC voltmeters, V1 and V2
4. VR: variable resistor

4.1.13.2 Insertion loss of series equipment:

Specifications: the insertion loss of series equipment shall be less than 1.5 dB when tested with 1500 Hz signal level at – 10dBV and reference load of 600Ω.

Purpose: the wiring shall function normally at all times while the other telecommunications terminal equipment connected to the series equipment is set at closed circuit.

Test method:

1. The test setup for insertion loss of series equipment is shown in Figure 20.
2. Test method for insertion loss of series equipment:
   (1) Set the AC signal generator at 1500 Hz and regulate the output level until the AC voltmeter measures –10dBV across the 600-ohm resistor.
   (2) Set the object to be tested at open circuit and connect to the test setup as shown in Figure 20.
   (3) Test and record the readings of AC voltmeter, V (in dBV).
   (4) Determine the insertion loss = –10dBV – V.

Test equipment:

1. AC signal generator
2. Pseudo feeder circuit
3. AC voltmeter

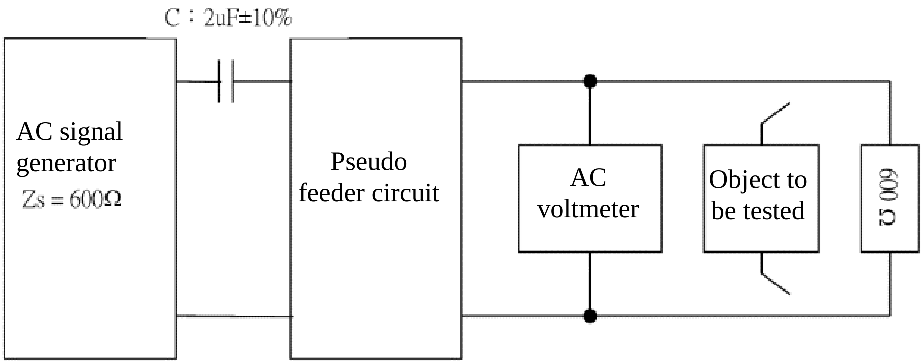


Figure 20 Test setup for insertion loss of series equipment

4.2 Handset functions

4.2.1 Transmission equivalence

4.2.1.1 Transmission equivalence for transmitting (OREM-A specification h)

Specifications: perform the transmission equivalence test according to the OREM-A method. The transmission equivalence for transmitting shall fall between +11 and -2 dB with the pseudo loop at 0 km and +11 and 0dB with the pseudo loop at 5 km.

Purpose: the telecommunications terminal equipment is capable of matching the transmitting end for appropriate transmitting volume.

Test method:

1. The test setup for transmission equivalence for transmitting is shown in Figure 21.
2. Test method for transmission equivalence for transmitting:
   (1) The transmission equivalence for transmitting is determined by testing the frequency response curve using the method described in OREM-A.
   (2) Test the frequency range from 200Hz to 5000Hz for the frequency response curve according to the OREM-A method.
   (3) Fit the handset on the artificial ear and mouth according to the OREM-A method.
   (4) Set the pseudo loop at 0 km.
   (5) The nominal sound pressure level for the artificial mouth at the MRP position is 0.6 dBPa.
   (6) Test and record the transmission equivalence for transmitting from the transmission equivalence tester.
   (7) Set the pseudo loop at 5 km. Repeat test steps (5) and (6).

Test equipment:

1. AC signal generator
2. Amplifier
3. Artificial mouth
4. Ear cover
5. Telephone set voice line
6. Pseudo loop
7. Pseudo feeder circuit
8. dB matrix: objective reference equivalence matrix (OREM) or level logger

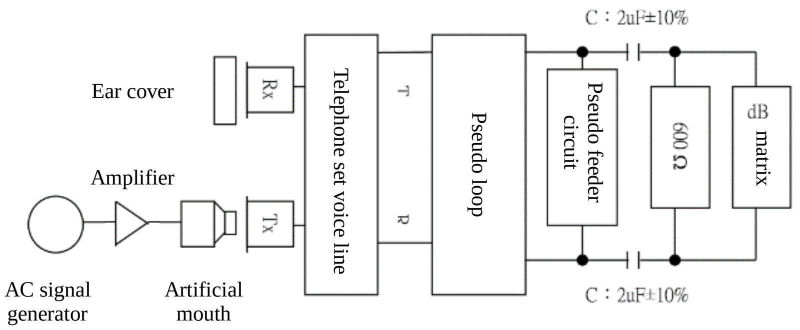


Figure 21 Test setup for transmission equivalence for transmitting

4.2.1.2 Transmission equivalence for receiving (OREM-A specification)

Specifications: perform the transmission equivalence test according to the OREM-A method. The transmission equivalence for receiving shall fall between 5 and -6 dB with the pseudo loop at 0 km and 5 and -4 dB with the pseudo loop at 5 km.

Purpose: the telecommunications terminal equipment is capable of matching the receiving end for appropriate receiving volume.

Test method:

1. The test setup for transmission equivalence for receiving is shown in Figure 22.

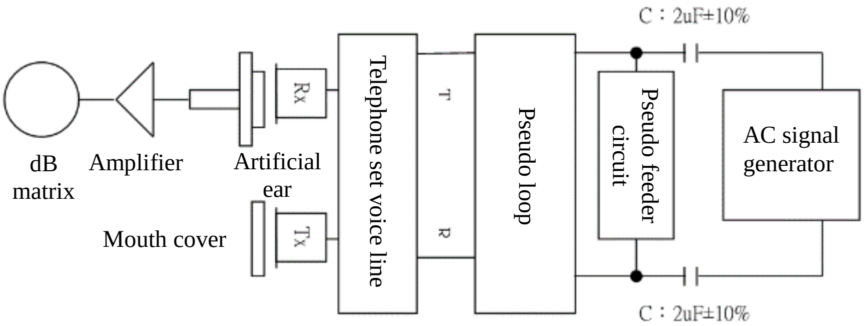


Figure 22 Test setup for transmission equivalence for receiving

2. Test method for transmission equivalence for receiving:
   (1) The transmission equivalence for receiving is determined by testing the frequency response curve using the method described in OREM-A.
   (2) Test the frequency range from 200Hz to 5000Hz for the frequency response curve according to the OREM-A method.
   (3) Fit the handset on the artificial ear and mouth according to the OREM-A method.
   (4) Set the pseudo loop at 0 km.
   (5) Generate a 570mV open-circuit voltage signal with the AC signal generator and send the signal to the pseudo feeder circuit.
   (6) Test and record the transmission equivalence for receiving from the transmission equivalence tester.
   (7) Set the pseudo loop at 5 km. Repeat test step (5).

Test equipment:

1. AC signal generator
2. Amplifier
3. Artificial ear
4. Mouth cover
5. Telephone set voice line
6. Pseudo loop
7. Pseudo feeder circuit
8. dB matrix: objective reference equivalence matrix (OREM) or level logger

4.2.2 Frequency response – transmission characteristics

4.2.2.1 Frequency response – transmitting (OREM-A specification)

Specifications: perform the transmission equivalence test according to the OREM-A method. The transmission frequency response tested with the pseudo loop at 0 km shall not be greater than the upper limit or smaller than the lower limit of the frequency band between 180Hz and 5000Hz in Figure 23; the 1000 Hz frequency point in the frequency response diagram is placed at the level of 0 dB in Figure 23.

Purpose: the telecommunications terminal equipment is capable of matching the appropriate transmission frequency response with the receiving end.

Test method:

1. The transmission frequency response test setup is shown in Figure 21.
2. Transmission frequency response test method:
   (1) Fit the handset to the artificial ear and mouth according to the OREM-A method.
   (2) Set the pseudo loop at 0 km.
   (3) The nominal sound pressure level for the artificial mouth at the MRP position is 0.6 dBPa.
   (4) Test the frequency band range from 200 Hz to 5kHz according to the OREM-A method for frequency response curve.
   (5) Test and record the transmission frequency response.

Test equipment:

1. AC signal generator
2. Amplifier
3. Artificial mouth
4. Ear cover
5. Telephone set voice line
6. Pseudo loop
7. Pseudo feeder circuit
8. dB matrix: objective reference equivalence matrix (OREM) or level logger

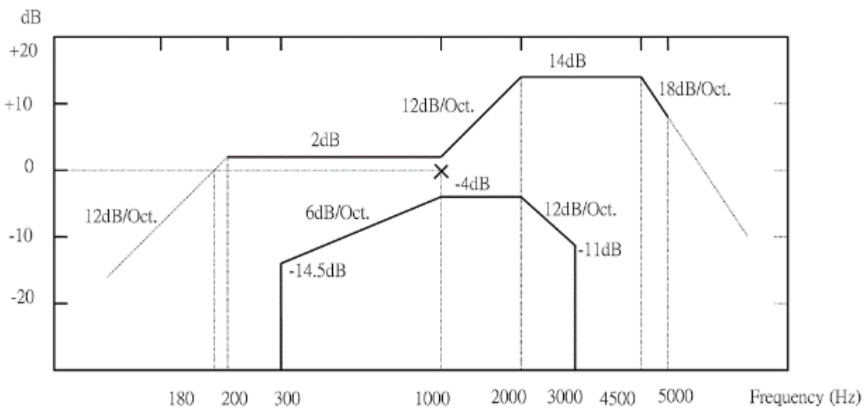


Figure 23: Frequency response for transmission

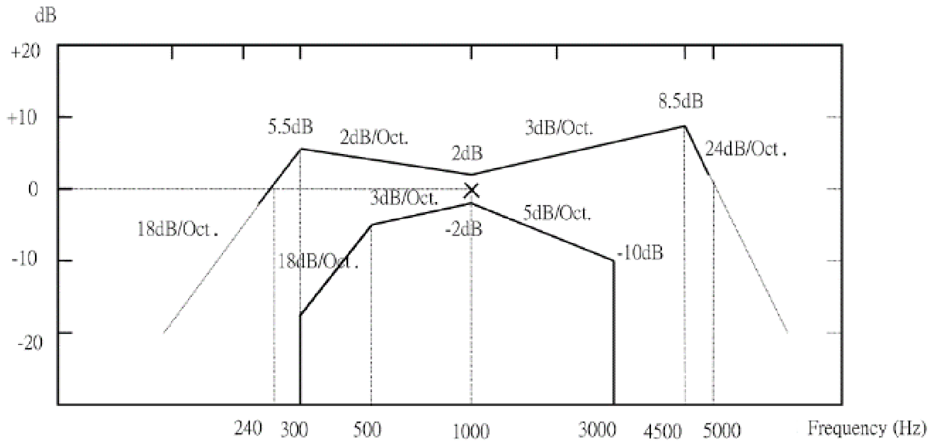


Figure 24 Frequency response for receiving

4.2.2.2 Frequency response – receiving (OREM-A specification)

Specifications: perform the transmission equivalence test according to the OREM-A method. The transmission frequency response tested with the pseudo loop at 0 km shall not be greater than the upper limit or smaller than the lower limit of the frequency band between 240Hz and 5000Hz in Figure 24; the 1000 Hz frequency point in the frequency response diagram is placed at the level of 0 dB in Figure 24.

In case that the handset is provided with adjustable receiver gain, it shall be set at the nominal output level and maximum output level for testing and this requirement shall be met for both.

In case that the handset is provided with adjustable receiver gain for hearing aid, it shall be set at the nominal output level for testing and this requirement shall be met.

Purpose: the telecommunications terminal equipment is capable of matching the appropriate transmission frequency response with the receiving end.

Test method:

1. The receiving frequency response test setup is shown in Figure 22.
2. Receiving frequency response test method:
   (1) Fit the handset to the artificial ear and mouth according to the OREM-A method.
   (2) Set the pseudo loop at 0 km.
   (3) Generate a 570mV open-circuit voltage signal with the AC signal generator and send the signal to the pseudo feeder circuit.
   (4) Test the frequency band range from 200 Hz to 5kHz according to the OREM-A method for frequency response curve.
   (5) Test and record the receiving frequency response.

Test equipment:

1. AC signal generator
2. Amplifier
3. Artificial ear
4. Mouth cover
5. Telephone set voice line
6. Pseudo loop
7. Pseudo feeder circuit
8. dB matrix: objective reference equivalence matrix (OREM) or level logger

4.2.3 Sidetone equivalence (OREM-A specification)

Specifications: perform the transmission equivalence test according to the OREM-A method. The sidetone equivalence shall be ≧4 dB as the test is performed with the pseudo loop at 0 km and 5 km.

In case that the handset is provided with adjustable receiver gain, it shall be set at the nominal output level for testing.

Purpose: the telecommunications terminal equipment is capable of matching the appropriate sidetone volume with the receiving end.

Test method:

1. The sidetone equivalence test setup is shown in Figure 25.
2. Sidetone equivalence test method:
   (1) The sidetone volume is tested according to the OREM-A method.
   (2) Fit the handset to the artificial ear and mouth according to the OREM-A method.
   (3) The nominal sound pressure level for the artificial mouth at the MRP position is 0.6 dBPa and the test frequency band is 200Hz~5kHz.
   (4) Set the pseudo loop at 0 km.
   (5) Perform the test from the transmission equivalence tester and record the sidetone volume values.
   (6) Set the pseudo loop at 5 km and repeat test step (5).

Test equipment:

1. AC signal generator
2. Amplifier × 2
3. Artificial ear
4. Artificial mouth
5. Telephone set voice line
6. Pseudo loop
7. Pseudo feeder circuit
8. dB matrix: objective reference equivalence matrix (OREM) or level logger

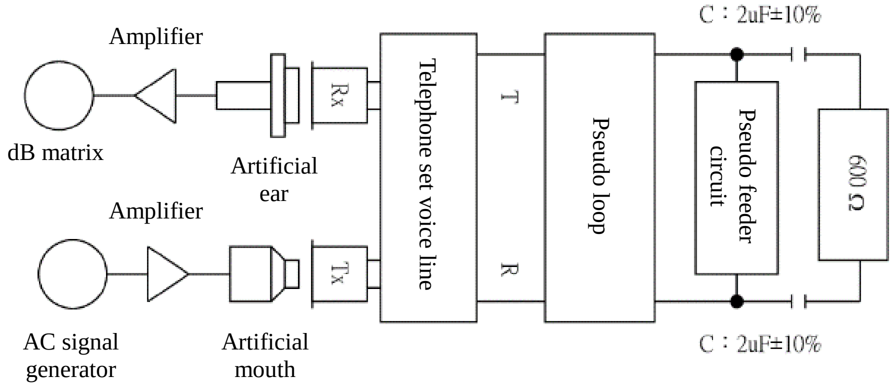


Figure 25 Sidetone equivalence test setup

4.2.4 Distortion

4.2.4.1 Distortion – transmission

Specifications: with the pseudo loop at 0 km, the total distortion injected from the transmitter to the telephone line output signals shall not exceed 5%.

Purpose: the telecommunications terminal equipment shall not generate such distortion of transmission signals that compromises the appropriate call function.

Test method:

1. The transmission distortion test setup is shown in Figure 26.
2. Transmission distortion test method:
   (1) Fit the handset to the artificial ear and mouth according to the OREM-A method.
   (2) Set the pseudo loop at 0 km.
   (3) The nominal sound pressure level for the artificial mouth at the MRP position is 0 dBPa / 1000 Hz.
   (4) Perform the test from the distortion meter and record the transmission distortion values.

Test equipment:

1. AC signal generator
2. Amplifier
3. Artificial mouth
4. Ear cover
5. Telephone set voice line
6. Pseudo loop
7. Pseudo feeder circuit
8. Distortion meter

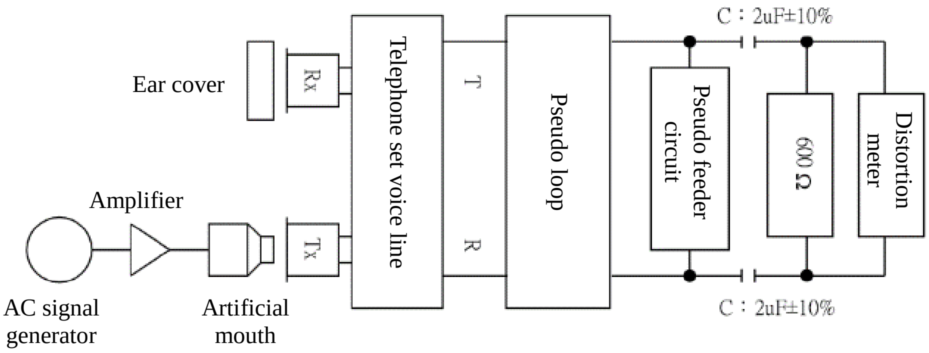


Figure 26　Transmission distortion test setup

4.2.4.2　Distortion – receiving

Specifications: with the pseudo loop at 0 km, the total distortion of receiver shall not exceed 7%. In case that the handset is provided with adjustable receiver gain, the total distortion of receiver shall not exceed 10% when the test is performed at the maximum output level

In case that the handset is provided with adjustable receiver gain for hearing aid, it may be set at the nominal output level for testing and this requirement shall be met.

Purpose: the telecommunications terminal equipment shall not generate such distortion of receiving signals that compromises the appropriate call function.

Test method:

1. The receiving distortion test setup is shown in Figure 27.
2. Receiving distortion test method:
   (1) Fit the handset to the artificial ear and mouth according to the OREM-A method.
   (2) Set the pseudo loop at 0 km.
   (3) Generate a 1000 Hz / –12dB sine wave signal with the signal generator to the object to be tested.
   (4) Perform the test from the distortion meter and record the receiving distortion values.
   (5) When the object to be tested is provided with receiver gain, set the receiving volume at the maximum output level and repeat test step (4).

Test equipment:

1. AC signal generator
2. Amplifier
3. Artificial ear
4. Mouth cover
5. Telephone set voice line
6. Pseudo loop
7. Pseudo feeder circuit
8. Distortion meter

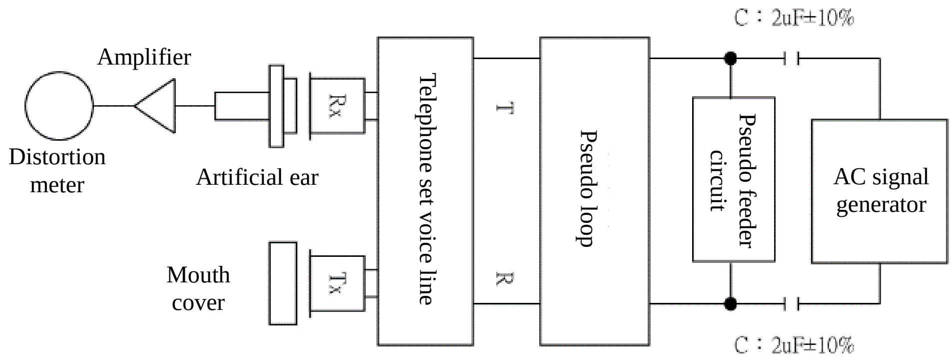


Figure 27 Receiving distortion test setup

4.2.5 Volume control – receiving (applicable without hearing aid)

Specifications: In case that the handset is provided with adjustable receiver gain, the receiving volume gain reaches 3dB to 6dB.

In case that the receiving volume returns to its initial value automatically after the telecommunications terminal equipment returns to open circuit, the gain may exceed 6dB.

Purpose: appropriate receiving voice characteristics are provided when connected with other telecommunications terminal equipment.

Test method:

1. The receiving volume control test setup is shown in Figure 22.
2. Receiving volume control test method:
   (1) Set the pseudo loop at 0 km.
   (2) Regulate the receiving volume to the minimum level.
   (3) Test the receiving equivalence, SORE1, according to 4.2.1.2.
   (4) Regulate the receiving volume to the maximum level. Repeat test step (3) to measure SORE2.
   (5) Determine the receiving gain = SORE2 – SORE1.
   (6) Set the pseudo loop at 5 km. Repeat test steps (2) through (5).

Test equipment:

1. AC signal generator
2. Amplifier
3. Artificial ear
4. Mouth cover
5. Telephone set voice line
6. Pseudo loop
7. Pseudo feeder circuit
8. dB matrix: objective reference equivalence matrix (OREM) or level logger

4.2.6 Continuous sound pressure level of receiver

Specifications: at closed circuit, the root-mean-square sound pressure of the receiver shall be smaller than 125 dB(A).

In case that the handset is provided with adjustable receiver gain, this requirement shall be met when the volume control is set at the maximum output level.

In case that the handset is provided with adjustable receiver gain for hearing aid, the test may be performed at the nominal output level and this requirement shall be met.

Purpose: to protect the hearing of the user from damaging.

Test method:

1. The test setup for continuous sound pressure level of receiver is shown in Figure 28.
2. Test method for continuous sound pressure level of receiver:
   (1) Set the sound level amplifier at “A” weighting and “slow” for response conditions.
   (2) Set the object to be tested at closed circuit and regulate the variable resistor until the loop current is 30mA.
   (3) Set the signal generator at 1000 Hz and enter the output that will produce 4.0Vrms at closed circuit.
   (4) Scan the signal generator frequency from 180 Hz to 4 kHz.
   (5) Test the record the maximum sound output reading at the receiver during the frequency scan.

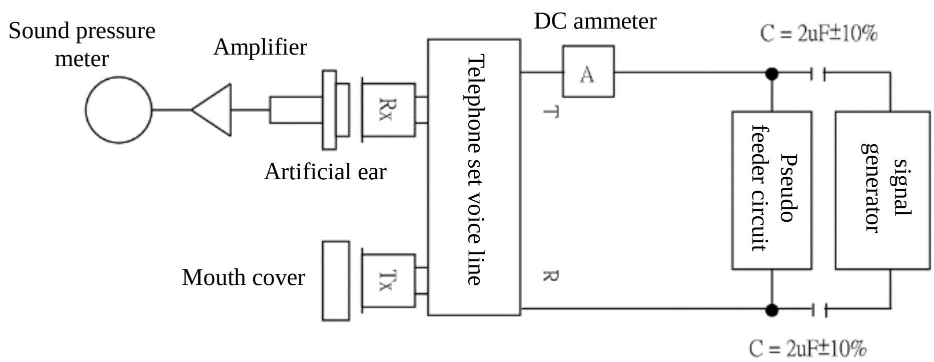


Figure 28 The test setup for continuous sound pressure level of receiver

Test equipment:

1. Sound pressure meter
2. Artificial ear
3. Mouth cover
4. Telephone set voice line
5. DC ammeter (A)
6. Pseudo feeder circuit
7. Signal generator

4.2.7 Magnetic flux test for receiver (with hearing aid)

Specifications: the following two specifications shall be met for the telecommunications terminal equipment to be tested with handset.

1. With axial field at 1000Hz, input at -10dBv for 1A/m, the test shall be > -22 dB.

   If the test value of axial field is > -19 dB, the conductive voltage frequency response curve of axial field shall comply with Figure A.

   If the test value of axial field is > -22 dB, the conductive voltage frequency response curve of axial field shall comply with Figure B.

2. With the radial magnetic field at 1000Hz, input at -10dBv for 1A/m, the values measured at 0°, 90°, 180° and 270° shall be > -27 dB.

Purpose: to allow those who use hearing aid to hear sounds normally.

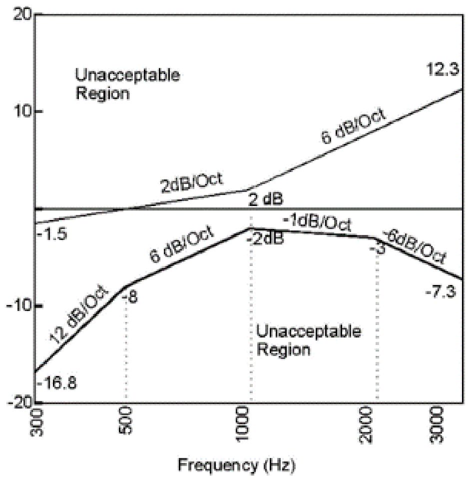


Figure A

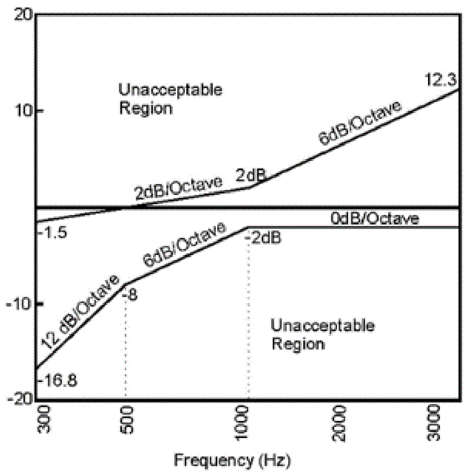
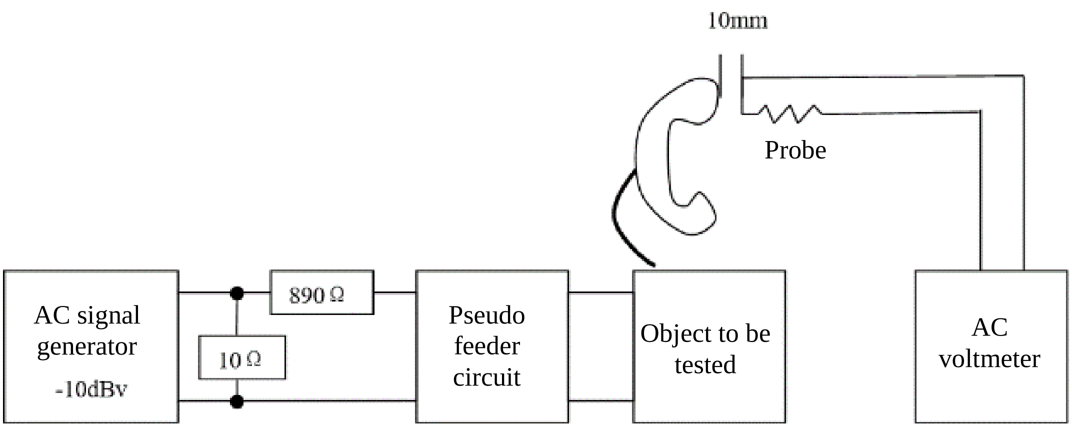


Figure B

Test method:

1. The test setup for the magnetic flux of receiver is shown below:



2. Test method for the magnetic flux of receiver:

(1) As shown above, connect and set the object to be tested at open circuit (off hook). Regulate the volume to the nominal value.

(2) Set the AC signal generator at 1kHz and -10dBV (316 mV).

(3) Test the axial field strength and record the readings.

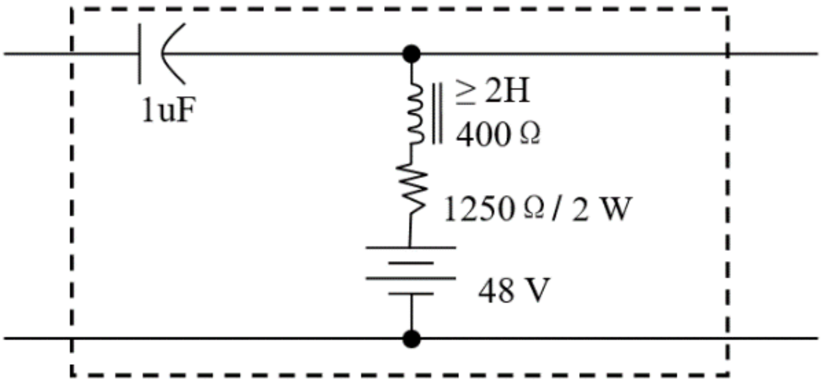
(4) Plot the conductive voltage frequency response curve of axial field from 300 Hz to 3300 Hz.

(5) Rearrange the test probe for the testing of radial field strength.

(6) Test and record the radial field strength values at 0°, 90° 180° and 270°.

Test equipment:

1. AC signal generator
2. AC voltmeter
3. Plotting equipment
4. Pseudo feeder circuit; see Figure C



Pseudo feeder circuit; Figure C

4.2.8 Volume control – receiver (applicable with hearing aid)

Specifications: the following shall be met for the telecommunications terminal equipment to be tested with handset.

In case that the handset is provided with adjustable receiver gain, the receiving transmission equivalence tested shall be kept between 12dB and 18dB (nominal volume and maximum volume).

The following shall be met if 18 dB is exceeded:

(1) The object to be tested will restore the volume to normal (< 18 dB) after it is on hook;

(2) A Mark shall be attached next to the switch of speakerphone;

(3) A distinct indicator shall be provided at the front of telephone set which lights up when the speakerphone is on;

(4) A Mark shall be attached next to the indicator indicating the speakerphone function;

(5) The warning “Caution! Loud Volume!” in Braille shall be provided on the back of the telephone handset to indicate that the speakerphone

switch may have been turned on; in case that the telephone set is of a hand-held type, the Braille warning shall be printed on the keyboard of the telephone.

(6) The applicant shall provide the instructions for the hearing aid.

Purpose: to allow those who use the handset to regulate the volume level freely as needed.

Test method:

1. The receiver volume control test setup is shown in Figure 22.
2. Receiver volume control test method:
   (1) Set the pseudo loop at 0 km.
   (2) Generate a 570mV open-circuit voltage signal with the AC signal generator and send the signal to the pseudo feeder circuit.
   (3) Regulate the receiver volume control until the handset volume is normal (not necessarily minimum).
   (4) Test the receiving equivalence, SORE1, according to 4.2.1.2.
   (5) Regulate the receiver volume control to the maximum level. Repeat test step (3) to measure SORE2.
   (6) Determine the receiving gain = SORE2 – SORE1.
   (7) Set the handset volume at maximum and pseudo loop at 2.5 km and 5 km. Repeat test steps (2) through (6).

4.3 PSTN-connected wireless telephone functions

4.3.1 Radio frequency requirements

Specifications: the wireless master and slave units of low-power duplexing wired telephone set operating under 80MHz shall meet the frequencies announced by Directorate General of Telecommunications (see Table 4 and Table 5).

Table 4 List of frequencies used for wireless master and slave units of 1.6 / 49MHz wired telephone set

Channel	Master unit frequency (MHz)		Slave unit frequency (MHz)	
	Receiving	Transmission	Transmission	Receiving
1	49.830	1.665	49.830	1.665
2	49.830	1.695	49.830	1.695
3	49.830	1.725	49.830	1.725
4	49.830	1.755	49.830	1.755
5	49.830	1.785	49.830	1.785
6	49.845	1.665	49.845	1.665
7	49.845	1.695	49.845	1.695
8	49.845	1.725	49.845	1.725
9	49.845	1.755	49.845	1.755
10	49.845	1.785	49.845	1.785

Table 5 List of frequencies used for wireless master and slave units of 46 / 49MHz wired telephone set

Channel	Slave unit (transmission frequency)	Master unit (transmission frequency)
1	49.670 MHz	46.610 MHz
2	49.845 MHz	46.630 MHz
3	49.860 MHz	46.670 MHz
4	49.770 MHz	46.710 MHz
5	49.875 MHz	46.730 MHz
6	49.830 MHz	46.770 MHz
7	49.890 MHz	46.830 MHz
8	49.930 MHz	46.870 MHz
9	49.990 MHz	46.930 MHz
10	49.970 MHz	46.970 MHz

4.3.2 Password requirements

Specifications: the probability that the password of master / slave unit is compromised before authorized shall be smaller than 1 / 1000.

The supplier shall provide the declaration of compliance.

4.3.3 Transmitter requirements

4.3.3.1 Carrier frequency

Specifications: the carrier frequency is the ability of transmitter to maintain the specified carrier frequency; the frequency deviation shall be smaller than ±500Hz.

Purpose: to test the carrier frequency of the transmitter to prevent excessive frequency deviation and, therefore, poor reception.

Test method:

1. The carrier frequency test setup is shown in Figure 29.
2. Carrier frequency test method:
   (1) Set the object to be tested to transmission.
   (2) Test and record the carrier frequency transmitted.
   (3) Determine the carrier frequency error = specified carrier frequency – carrier frequency test value.

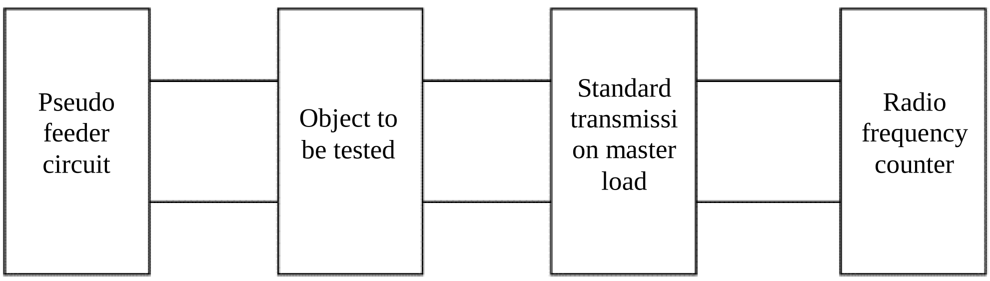


Figure 29 Carrier frequency test setup

Test equipment:

1. Pseudo feeder circuit
2. Standard transmission master load
3. Radio frequency counter

4.3.3.2 Modulation sensitivity (only for masters)

Specifications: an audio signal is fed to the telecommunications terminal equipment via pseudo feeder circuit to generate a standard test modulation signal with a strength -12 ±3dBm (the automatic control of any microphone in the telecommunications terminal equipment shall be deactivated during the test).

Purpose: to measure the signal level of audio frequency as an audio signal is fed and a deviation of ±3KHz is generated.

Test method:

1. The modulation sensitivity test setup is shown in Figure 30.

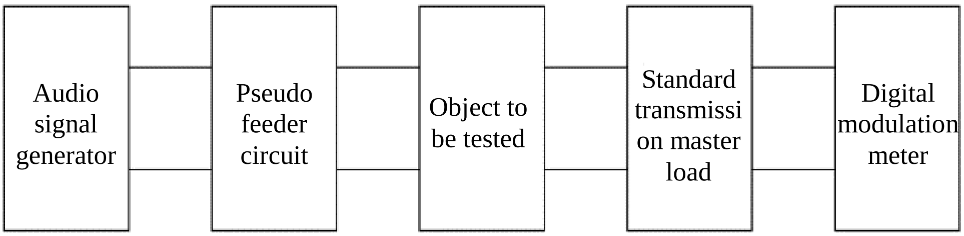


Figure 30 Modulation sensitivity test setup

2. Modulation sensitivity test method:
   (1) Set the audio signal generator at 1000Hz. Regulate the output level until 60% of system deviation is reached.
   (2) Record the output level of audio signal generator, which is the modulation sensitivity.

Test equipment:

1. Pseudo feeder circuit
2. Standard transmission master load
3. Audio signal generator
4. Digital modulation meter

4.3.3.3 Audio distortion

Specifications: the audio distortion is the root-mean-square of unwanted signal modulated by the transmitter at transmission to the complete signal, which shall be < 5%.

Purpose: to measure the audio distortion to ensure transmission quality when an audio signal is fed and a deviation of ±3KHz is generated.

Test method:

1. The audio distortion test setup is shown in Figure 31.
2. Audio distortion test method:
   (1) Set the audio signal generator at 1000Hz. Regulate the output level until 60% of system deviation is reached.
   (2) Test and record the audio distortion values.

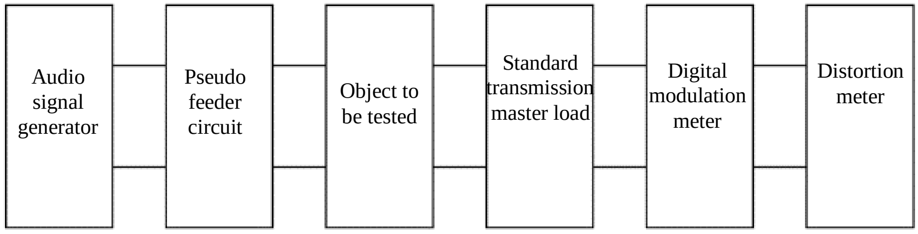


Figure 31 Audio distortion test setup

Test equipment:

1. Pseudo feeder circuit
2. Standard transmission master load
3. Audio signal generator
4. Digital modulation meter
5. Distortion meter

4.3.4 Receiver requirements

4.3.4.1 Available sensitivity

Specifications: the level of input signals of receiver when the receiver modulates at the specified frequency to obtain standard SINAD at the output end shall be $< 2.0\mu V$.

Purpose: to measure the ability of the telecommunications terminal equipment to receive radio signals.

Test method:

1. The available sensitivity test setup is shown in Figure 32.
2. Available sensitivity test method:
   (1) Set the radio frequency (RF) signal generator to transmit standard input signals to the input of receiver.
   (2) Regulate the output level of RF signal generator until the receiver reaches the standard 12dB SINAD.
   (3) The output level of RF signal generator is the available sensitivity level.

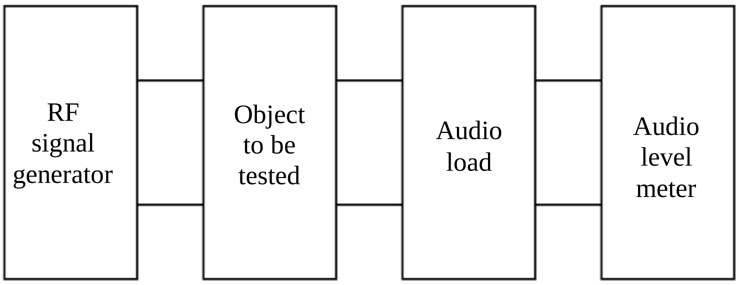


Figure 32 Available sensitivity test setup

Test equipment:

1. RF signal generator
2. Audio load
3. Audio level meter

4.3.4.2 Available bandwidth

Specifications: the frequency deviation shall be within ±500 Hz when the telecommunications terminal equipment modulates RF signal frequency deviation to reach the available sensitivity after a signal of available sensitivity plus 6dB is received.

Purpose: to measure the ability of receiver to receive frequency deviation when a signal at 6dB lower than the available sensitivity is received.

Test method:

1. The available bandwidth test setup is shown in Figure 33.

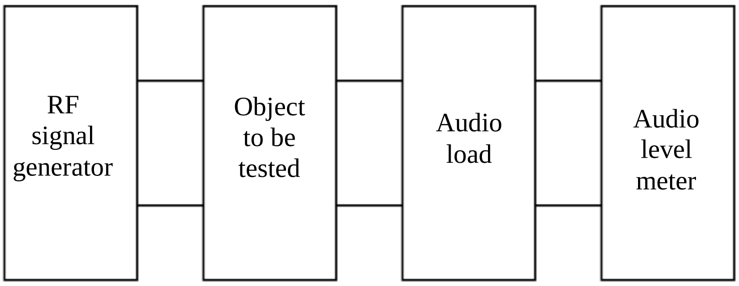


Figure 33 Available bandwidth test setup

2. Available bandwidth test method:
   (1) Set the RF signal generator to transmit standard input signals to the input of receiver.
   (2) Regulate the output level of RF signal generator until the receiver reaches the standard 12dB SINAD.
   (3) The output level of RF signal generator is the available sensitivity level (the reference sensitivity).
   (4) Set the RF signal generator at the signal level of reference sensitivity plus

6 dB.

(5) Increase the RF signal frequency until the reference sensitivity of 12dB SINAD is reached. Record the radio frequency, FH, at this moment.

(6) Decrease the RF signal frequency until the reference sensitivity of 12dB SINAD is reached. Record the radio frequency, FL, at this moment.

(7) Determine the available bandwidth: FH – receiving bandwidth or receiving frequency – FL, whichever is smaller.

Test equipment:

1. RF signal generator
2. Audio load
3. Audio level meter

4.3.4.3 Audio distortion

Specifications: the voltage ratio of the root mean square of unwanted signal generated by the receiver over the root means square of the complete signal shall be < 5%.

Purpose: to measure the receiving distortion of receiver to ensure transmission quality.

Test method:

1. The audio distortion test setup is shown in Figure 34.
2. Audio distortion test method:
   (1) Set the RF signal generator to transmit standard input signals to the input of receiver.
   (2) Test and record the audio distortion values.

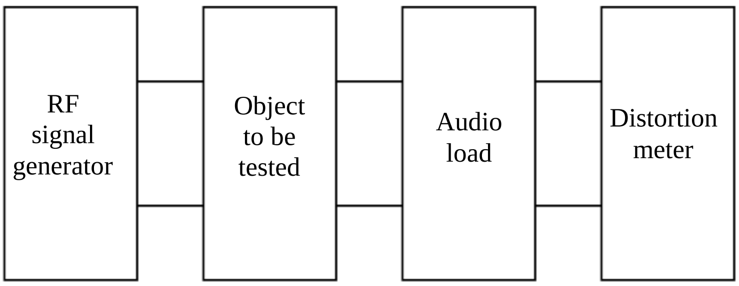


Figure 34 Audio distortion test setup

Test equipment:

1. RF signal generator
2. Audio load
3. Distortion meter

4.3.4.4 Signal to noise ratio

Specifications: the ratio of the remaining output power without modulation after the receiver receives a standard input signal over the output power when a standard input signal is received shall be > 40dB.

Purpose: to test the remaining output power ratio for the rated output power without modulation.

Test method:

1. The signal-to-noise ratio test setup is shown in Figure 35.
2. Signal-to-noise ratio test method:
   (1) Set the RF signal generator to transmit standard input signals to the input of receiver.
   (2) Record the audio output level, V1.
   (3) Turn the modulation of RF signal generator off. Record the audio output level, V2.
   (4) Determine the signal-to-noise ratio =20log(V1/V2).

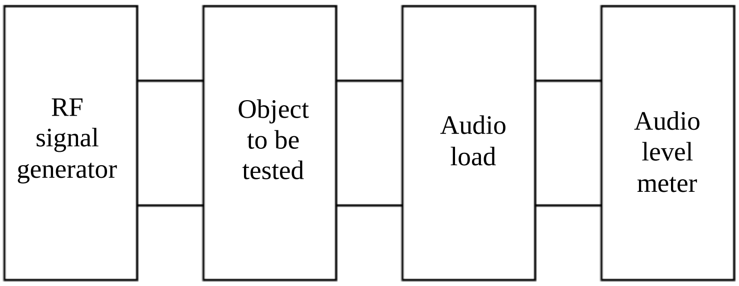


Figure 35 Signal-to-noise ratio test setup

Test equipment:

1. RF signal generator
2. Audio load
3. Audio level meter

4.3.4.5 Adjacent channel rejection

Specifications: the adjacent channel rejection is the receiving signal at the reference sensitivity (12 dB SINAD) plus 3 dB over the input signal at an adjacent channel as it is reduced to reach the reference sensitivity of 12dB SINAD, which shall be > 45dB.

Purpose: to measure the ability of telecommunications terminal equipment receiver to block adjacent channel signal interference.

Test method:

1. The adjacent channel rejection test setup is shown in Figure 36.
2. Adjacent channel rejection test method:
   (1) Turn the RF signal generator B OFF.
   (2) Send standard input signals from the RF signal generator A.
   (3) Record the signal level when the object to be tested receives the

reference sensitivity, P0.

(4) Increase the received input signal level by 3 dB.

(5) Turn the RF signal generator B ON and set the input signal of adjacent channel with 400Hz modulation and 60% of system deviation.

(6) Regulate signal level of the two adjacent channels to the reference sensitivity defined for the receiving signal frequency and record the level of the two adjacent channels, P1 and P2.

(7) Determine the adjacent channel rejection:

High adjacent channel rejection = P1 － P0

Low adjacent channel rejection = P2 － P0

Test equipment:

1. RF signal generator ×2
2. Mixer
3. Audio level meter
4. Audio load

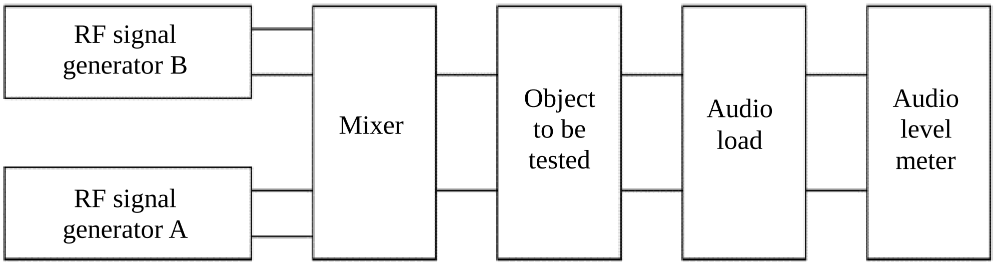


Figure 36 Adjacent channel rejection test setup

4.3.4.6 Spurious response rejection

Specifications: the spurious response rejection is the input signal level ratio of the receiver to prevent the spurious response signal to drop to the receiving signal, which shall be > 35 dB.

Purpose: to test the resistance of the telecommunications terminal equipment receiver to block the interference cause by an interfering signal at the output end.

Test method:

1. The spurious response rejection setup is shown in Figure 37.

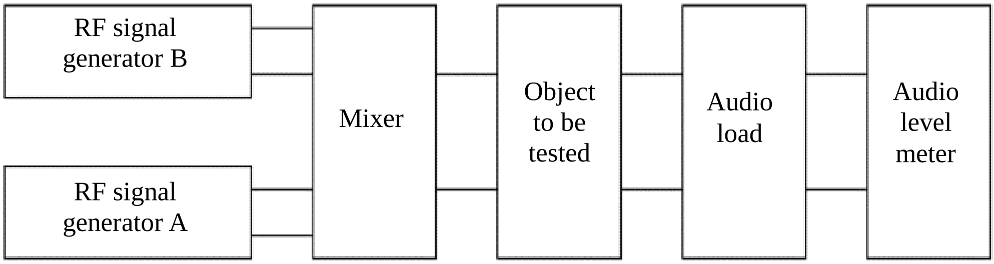


Figure 37 Spurious response rejection setup

2. Spurious response rejection test method:
   (1) Turn the RF signal generator B OFF.
   (2) Send standard input signals from the RF signal generator A.
   (3) Record the signal level when the object to be tested receives the reference sensitivity, P0.
   (4) Increase the received input signal level by 3 dB.
   (5) Turn the RF signal generator B ON and set the input signal of spurious response with 400Hz modulation and 60% of system deviation.
   (6) Change the spurious response signal frequency from 1/2 of the receiver's medium frequency to 2 times of the receiving frequency (except within receiver frequency ±100kHz). Regulate the spurious response signal frequency to maximum influence on the received signal.
   (7) Regulate the level of spurious response input signal until the reference sensitivity is obtained and record the signal level of spurious response, P1.
   (8) Determine the spurious response rejection = P1 – P0.

Test equipment:

1. RF signal generator × 2
2. Mixer
3. Audio level meter
4. Audio load

4.3.5 Radiated electric field strength and radiated interference test

Specifications: the radiated electric field strength of fundamental carrier frequency measured 3m from the master and slave units when the master and slave units of a wired telephone set are used shall be less than 10000uV/m; the electric field strength of harmonics and clutters generated by transmission and receiving shall comply with Table 6.

Table 6 Required values of radiated electric field strength and radiated interference

Frequency (MHz)	Maximum allowable radiated electric field strength of harmonics from 3 m away (uV/m)	Maximum allowable radiated electric field strength of clutter interference from 3 m away (uV/m)
25 ~ 88	100	100
88 ~ 216	150	150
216 ~ 1000	200	200

Purpose: to measure the electric field strength of the harmonics generated by the wireless master and slave units of wired telephone set during transmission and receiving and the clutter interference, as to prevent interference.

Test method: per CNS 13438.

Test equipment: per CNS 13438.

4.4 Functional characteristics of switchboard

4.4.1 General characteristics

4.4.1.1 Power interruption

Specifications:

1. At least one trunk shall be provided for emergency calls in the case of switch power interruption.
2. When the power on the power cable is restored, the switch shall maintain the trunk that was connected before the power restored
3. The manual for the switch shall provide the instructions for dealing with power interruption.

Purpose: to ensure that the switch telecommunications terminal equipment operating on the power fed from a power cable is capable of emergency calls over PSTN and maintaining the normal functioning of PSTN in the case of power supply failure or similar factors.

Test method:

1. The power interruption test setup is shown in Figure 38.
2. Power interruption test method:
   (1) Disconnect the object to be tested from the live power cable.
   (2) Operate one of the trunks in the switch to form an open circuit according to the instruction manual provided by the supplier.
   (3) Connect the object to be tested to the live power cable.
   (4) The slave unit in test step (2) shall remain closed while operating the original trunk.

Test equipment:

1. Pseudo feeder circuit

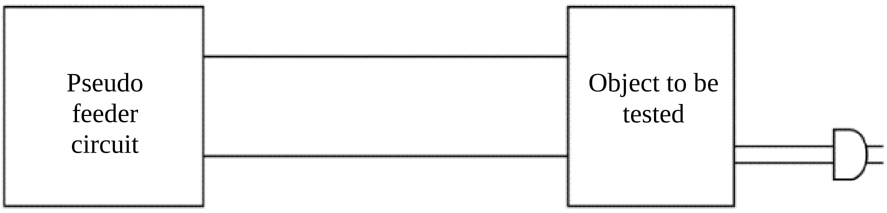


Figure 38 Power interruption test setup

4.4.1.2 Trunk cut-off

Specifications: an open circuit shall be formed in 3 seconds after the user hangs up the slave unit or the operator operates the cuts off the trunk.

Purpose: to prevent trunk collision in the switch telecommunications terminal equipment.

Test method:

1. The cut-off trunk test setup is shown in Figure 39.

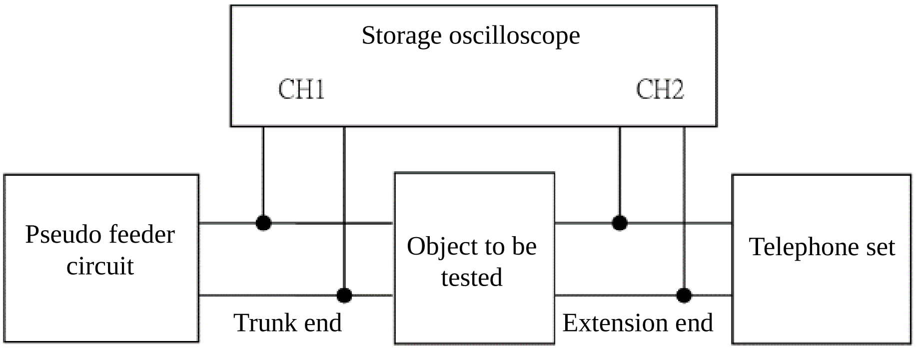


Figure 39 Cut-off trunk test setup

2. Cut-off trunk test method:
   (1) Set one of the trunks of the object to be tested to form a closed circuit using an extension telephone set.
   (2) Make the extension telephone set an open circuit, and then the trunk of the object to be tested becomes an open circuit as well.
   (3) Test and record the time difference in the DC voltage drop for both the extension and trunk.

Test equipment:

1. Pseudo feeder circuit
2. Storage oscilloscope
3. Telephone set

4.4.2 Static noises

Specifications: the static noise voltage in the call lines of a switch shall be < 1.5mVp (36dBrnc).

Purpose: to ensure the call quality of PSTN.

Test method:

1. The static noise test setup is shown in Figure 40.
2. Static noise test method:

(1) Set one of the trunks in the object to be tested to closed circuit using the 600Ω reference load.

(2) Set the frequency of band-pass filter between 200Hz and 4000 Hz.

(3) Test and record the peak noise voltage at the trunk.

Note: the band-pass filter and AC voltmeter may be replaced with a spectrum analyzer.

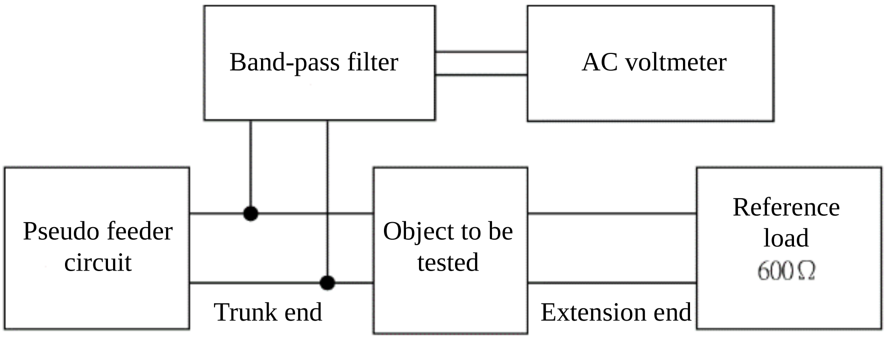


Figure 40 Static noise test setup

Test equipment:

1. Pseudo feeder circuit
2. band-pass filter
3. AC voltmeter
4. 600Ω reference load

4.4.3 Transmission loss

Specifications: the transmission loss at the trunk end and extension end shall not be greater than 2 dB when tested with 1kHz.

Purpose: to ensure the call quality of transmission ports.

Test method:

1. The transmission loss test setup is shown in Figure 41.
2. Transmission loss test method:
   (1) Set one of the trunks of the object to be tested to closed circuit using the 600Ω reference load.
   (2) Connect the AC signal generator to the pseudo feeder circuit.
   (3) Set the AC signal generator at 1000Hz and regulate the output until the AC voltage is measured at 0dBV at the trunk end.
   (4) Test and record the AC voltage at the extension end, V1 (in dBV).
   (5) Determined the transmission loss = 0 – V1.
   (6) Connect the AC signal generator to the 600Ω reference load.
   (7) Set the AC signal generator at 1000Hz and regulate the output until the AC voltage is measured at 0dBV at the extension end.
   (8) Test and record the AC voltage at the trunk end, V2 (in dBV).
   (9) Determined the transmission loss = 0 – V2。
   (10) Select the larger value of test steps (5) and (9).
   (11) With the combination of any trunk and any extension in the switch, repeat test steps (1) through (10).
   (12) The largest value from test steps (1) through (11) is the test value for transmission loss.

Test equipment:

1. AC signal generator
2. Pseudo feeder circuit
3. AC voltmeter
4. 600Ω reference load

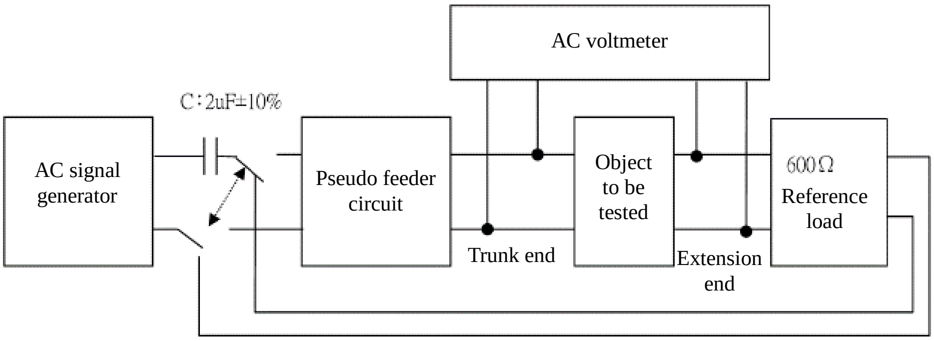


Figure 41 Transmission loss test setup

4.4.4 Crosstalk loss

Specifications: the crosstalk loss between speaker circuits shall be greater than 65 dB when tested with 1kHz.

The telecommunications terminal equipment with two or more trunks shall comply with this requirement.

Purpose: to ensure that the call quality of telecommunications terminal equipment is not compromised by the calling on another trunk in the telecommunications terminal equipment when in closed circuit.

Test method:

1. The crosstalk loss test setup is shown in Figure 42.
2. Crosstalk loss test method:
   (1) Set both trunks of the object to be tested to closed circuit using two 600Ω reference loads.
   (2) Connect the AC signal generator to the pseudo feeder circuit.
   (3) Set the AC signal generator at 1000Hz and regulate the output until the AC voltage is measured at 0dBV at both ends of trunk.
   (4) Do not feed any signal to the loop containing trunk 1 and extension 1.
   (5) Set the spectrum analyzer between 200 Hz and 4000 Hz.
   (6) Test and record the maximum noise signal peak level of trunk 1 and extension 1, Vp1 (in dBV).
   (7) Determine the crosstalk loss = 0 – Vp1.
   (8) Connect the 600Ω reference load end and repeat test step (3) through (7).
   (9) With the combination of any two trunks and extensions in the object to be tested, repeat test steps (1) through (8).
   (10) The smallest value from test steps (1) through (9) is the test value for the crosstalk loss.

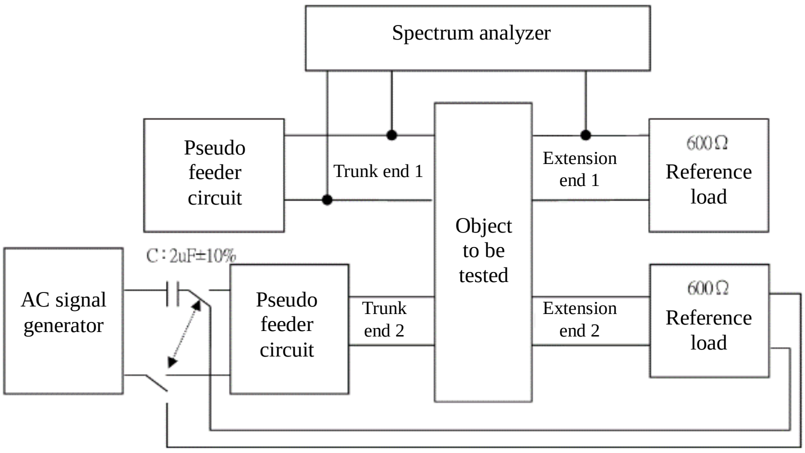


Figure 42　Crosstalk loss test setup

Test equipment:

1. AC signal generator
2. Pseudo feeder circuit ×2
3. Spectrum analyzer
4. 600Ω reference load ×2

4.5　Communication protocol requirements

Products using communications protocols, such as data equipment, shall comply with the applicable ITU-T requirements.

The supplier shall provide the declaration of compliance.

4.6　Caller ID

4.6.1　FSK signal test criteria

The following test conditions and data are defined in Appendix Ⅰ.

4.6.1.1　AC and DC boundaries

4.6.1.1.1 DC boundary

Specifications: the test instrument is set to transmit the telecommunications terminal equipment an effective wakeup signal to put the telecommunications terminal equipment in signal state. At the signal state, the current drawn by the telecommunications terminal equipment is determined by measuring the voltage across resistor R1.

The current drawn by the telecommunications terminal equipment shall not 0.5 mA.

Purpose: to ensure that the DC current drawn by the telecommunications terminal equipment with caller ID does not put PSTN in the loop connection state.

Test method:

1. The DC boundary test setup is shown in Figure 43.
2. DC boundary test method:
   (1) Set the simulation signal generator to transmit a wakeup signal.
   (2) Check that the object to be tested is in the signal state.
   (3) Test and record the maximum DC voltage across 1 kΩ, V.
   (4) Determine the DC current = V / 1000.

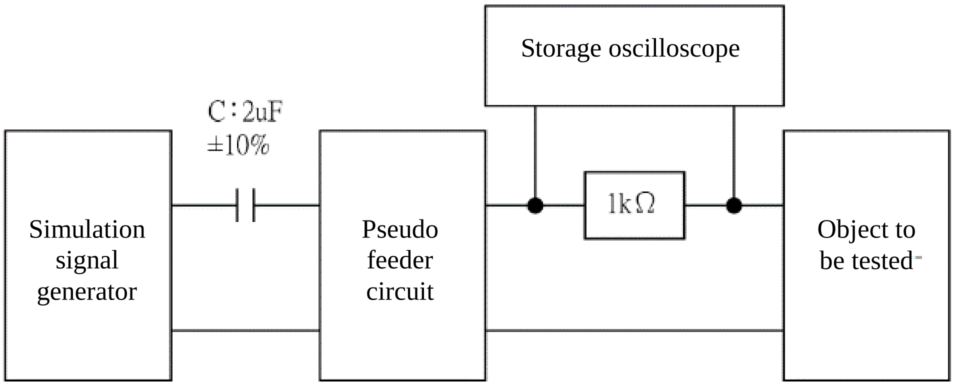


Figure 43 DC boundary test setup

Test equipment:

1. Simulation signal generator
2. Pseudo feeder circuit
3. Storage oscilloscope

4.6.1.1.2 AC boundary

Specifications: at signal state, the telecommunications terminal equipment shall present the following DC conditions:

Between 200Hz and 4000Hz, the impedance shall not be smaller than 8 kΩ and the phase angle shall not exceed +5°.

The supplier shall provide the declaration of compliance.

Purpose: to ensure that the input impedance of the telecommunications terminal equipment with caller ID at signal state complies with the PSTN requirements.

Test method:

1. The AC boundary test setup is shown in Figure 44.
2. AC boundary test method:

(1) Set the object to be tested at the signal state.

(2) Set the AC signal generator at 200Hz and regulate the output level until AC voltage across the object to be tested, V1, = 3Vrms.

(3) Test and record AC voltage, V2.

(4) Determine the AC impedance, Z = V1 / (V2 × 1000).

(5) Monitor and record the waveforms of V1 and V2 using a storage oscilloscope.

(6) Determine the phase difference, θ, as follows:

θ= △t ÷50ms × 360°

△ t: time difference between V1 and V2 waveforms

(7) Set the AC signal generator at 200Hz~4000Hz and repeat test steps (3) through (6).

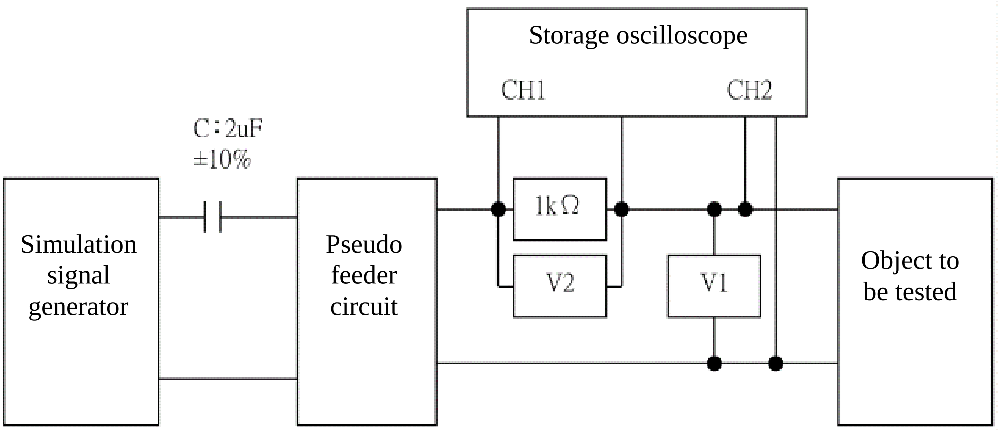


Figure 44 AC boundary test setup

Test equipment:

1. AC signal generator
2. Pseudo feeder circuit
3. Storage oscilloscope
4. AC voltmeters V1 and V 2

4.6.1.2 Timing

4.6.1.2.1 Wake-up state

Specifications: the test instrument is set to transmit test packet TP1 to the telecommunications terminal equipment to be tested to test the conditions in Table 7.

Purpose: to ensure that the telecommunications terminal equipment with caller ID is capable of operating the wake-up function correctly at all signal conditions.

Test method:

1. The wake-up state test setup is shown in Figure 45.
2. Wake-up state test method:
   (1) Set the object to be tested at idle.
   (2) Set the simulation signal generator for the simulation signals for TAS conditions and modulation conditions according to the timing requirements in Table 7, and transmit test packet TP1.
   (3) Check that the result of the object to be tested after receiving the signals complies with Table 7.

Table 7 Timing requirement, DT-AS

TAS condition	Modulation	Result
DT1	FSK1	Correct reception of FSK data
DT2	FSK1	Correct reception of FSK data
DT4; the first ringing starts one second after the TAS single ringing pulse ends.	FSK1	At the start of first ringing, the telecommunications terminal equipment to be tested returns to idle. No display of message or error
DT4	No data packet	The telecommunications terminal equipment to be tested returns to idle.
DT4	FSK1	Correct reception of FSK data
DT5	FSK1	Correct reception of FSK data

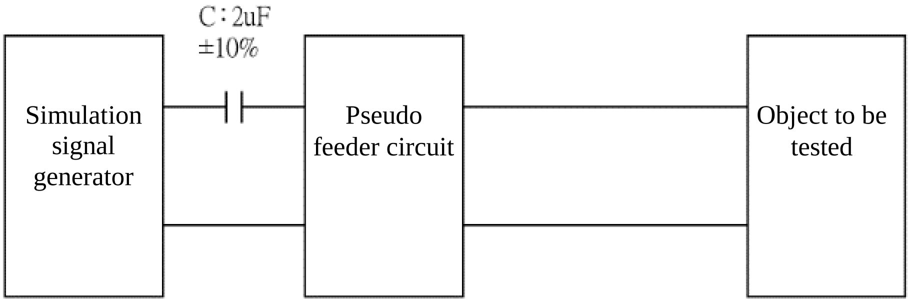


Figure 45 Wake-up state test setup

Test equipment:

1. Simulation signal generator
2. Pseudo feeder circuit

4.6.1.2.2 Initial time

Specifications: the telecommunications terminal equipment shall enter the signal state 45 milliseconds after the DT-AS ends.

The supplier shall provide the declaration of compliance.

Purpose: to ensure that the telecommunications terminal equipment with caller ID is capable of receiving FSK data correctly after the end of DT-AS receiving.

Test method:

1. The initial time test setup is shown in Figure 45.
2. Initial time test method:
   (1) Set the object to be tested at idle.
   (2) Set the simulation signal generator to transmit FSK data signal 45 ms after the transmission of DT-AS (dual tone alert signal).
   (3) Check that the object to be tested receives the FSK data signal set in step (2) correctly.

Test equipment:

1. Simulation signal generator
2. Pseudo feeder circuit

4.6.1.2.3 End time

Specifications: the telecommunications terminal equipment shall return to idle from signal state 150 milliseconds after the transmission of caller ID message.

The supplier shall provide the declaration of compliance.

Purpose: to ensure that the telecommunications terminal equipment with caller ID is capable of returning to idle correctly after receiving FSK signals.

Test method:

1. The end time test setup is shown in Figure 45.
2. End time test method:
   (1) Set the simulation signal generator to transmit FSK2 data signal 150 ms after the transmission of FSK1 data signals.
   (2) Check that the object to be tested only receives FSK1 data signals correctly.

Test equipment:

1. Simulation signal generator
2. Pseudo feeder circuit

4.6.1.3 Signal status

4.6.1.3.1 Frequency, level, deviation and interference tolerance

Specifications: the test instrument is set to transmit test packet TP1 to the telecommunications terminal equipment to be tested to test the conditions in Table 8.

Table 8 Signal requirements

TAS condition	Modulation	Result
DT5	FSK1	Correct reception of FSK data
DT5	FSK2	Correct reception of FSK data
DT5	FSK3	Correct reception of FSK data

Purpose: to ensure that the telecommunications terminal equipment with caller ID is capable of receiving FSK signals correctly.

Test method:

1. The frequency, level, deviation and interference tolerance test setup is shown in Figure 45.
2. Frequency, level, deviation and interference tolerance test method:
   (1) Set the object to be tested at idle.
   (2) Set the simulation signal generator for the simulation signals for TAS conditions and modulation conditions according to the timing requirements in Table 8, and transmit test packet TP1.
   (3) Check that the result of the object to be tested after receiving the signals complies with Table 8.

Test equipment:

1. Simulation signal generator
2. Pseudo feeder circuit

4.6.1.4 Packet status

4.6.1.4.1 Call capture

Specifications: the test instrument is set to transmit test message DT5:FSK1:TP1 to the telecommunications terminal equipment to be tested.

Check that the telecommunications terminal equipment to be tested displays the message correctly.

Purpose: to ensure that the telecommunications terminal equipment with caller ID is capable of receiving FSK messages correctly.

Test method:

1. The call capture test setup is shown in Figure 45.
2. Call capture test method:
   (1) Set the object to be tested at idle.
   (2) Set the simulation signal generator to transmit test message DT5:FSK1:TP1.
   (3) Check that the object to be tested receives and displays messages correctly.

Test equipment:

1. Simulation signal generator
2. Pseudo feeder circuit

4.6.1.4.2 Mark

Specifications: the test instrument is set to transmit test message DT5:FSK1:TP1 to the telecommunications terminal equipment to be tested.

Check that the telecommunications terminal equipment to be tested displays messages correctly.

Purpose: to ensure that the telecommunications terminal equipment with caller ID receives messages correctly.

Test method:

1. The mark test setup is shown in Figure 45.
2. Mark test method:
   (1) Set the object to be tested at idle.
   (2) Set the simulation signal generator to transmit test message DT5:FSK1:TP1.
   (3) Check that the object to be tested receives and displays messages correctly.

Test equipment:

1. Simulation signal generator
2. Pseudo feeder circuit

4.6.1.4.3 Message type

Specifications: the test instrument is set to transmit test messages in Table 9 to the telecommunications terminal equipment to be tested。

Check that the telecommunications terminal equipment to be tested displays every message correctly.

Table 9 Message types

Test data	Test condition	Result
DT5:FSK1:TP1	Call establishment type message	Correct reception of FSK data
DT5:FSK1:TP2 (optional)	Message waiting for instruction type message (test on / off in turns)	Correct reception of FSK data
DT5:FSK1:TP5	Non-call establishment type message	Discard or display error message

Note: the (optional) in the table indicates that the function is optional for the telecommunications terminal equipment.

Purpose: to ensure that the telecommunications terminal equipment with caller ID receives messages correctly.

Test method:

1. The message type test setup is shown in Figure 45.
2. Message type test method:
   (1) Set the object to be tested at idle.
   (2) Set the simulation signal generator for transmission of all message types according to Table 9.
   (3) Check that the results of the object to be tested comply with Table 9.

Test equipment:

1. Simulation signal generator

2. Pseudo feeder circuit

4.6.1.4.4 Checksum

Specifications: the test instrument is set to transmit test message DT5:FSK1:TP6 to the telecommunications terminal equipment to be tested (not the correct checksum).

Check that the telecommunications terminal equipment to be tested discard or display error messages correctly.

Purpose: to ensure that the telecommunications terminal equipment with caller ID is capable of detecting error messages correctly.

Test method:

1. The checksum test setup is shown in Figure 45.
2. Checksum test method:
   (1) Set the object to be tested at idle.
   (2) Set the simulation signal generator to transmit test message DT5:FSK1:TP6.
   (3) Check that the object to be tested receives and displays messages correctly.

Test equipment:

1. Simulation signal generator
2. Pseudo feeder circuit

4.6.1.5 Presentation layer message status

Specifications: the test instrument is set to transmit test messages in Table 10 to the telecommunications terminal equipment to be tested.

Check that the telecommunications terminal equipment to be tested displays every message correctly.

Table 10 Presentation layer messages

Test data	Test condition	Result
DT5:FSK1:TP7	Call type: ring back on idle (effective CLI message)	Message ignored or correct reception of FSK data
DT5:FSK1:TP8	Call type: none (effective CLI message)	Correct reception of FSK data
DT5:FSK1:TP9	Call type: voice (effective CLI message)	Correct reception of FSK data
DT5:FSK1:TP10	Call type: voice (effective CLI message)	Correct reception of FSK data
DT5:FSK1:TP11	Call type: wait message (effective CLI message)	Message is either ignored or displayed correctly.
DT5:FSK1:TP13	Call type: voice (effective CLI message)	Correct reception of FSK data
DT5:FSK1:TP14 (optional)	Call type: voice (effective CLI message)	Correct reception of FSK data
DT5:FSK1:TP15 (optional)	Call type: voice (effective CLI message)	Correct reception of FSK data

Note: the (optional) in the table indicates that the function is optional for the telecommunications terminal equipment.

Purpose: to ensure that to ensure that the telecommunications terminal equipment with caller ID is capable of receiving and displaying messages.

Test method:

1. The presentation layer message status test setup is shown in Figure 45.
2. Presentation layer status test method:
   (1) Set the object to be tested at idle.
   (2) Set the simulation signal generator for all presentation layer messages according to Table 10.
   (3) Check that the result of the object to be tested complies with Table 10.

Test equipment:

1. Simulation signal generator
2. Pseudo feeder circuit

4.6.2 DTMF signal test criteria

The following test conditions and data are defined in Appendix Ⅱ.

4.6.2.1 NIT status DC resistance

Specifications: at NIT (number information transfer) state, the DC resistance between both ends of line shall be greater than 90 kΩ.

Purpose: to ensure that the impedance characteristics of the telecommunications terminal equipment with caller ID do not compromise PSTN.

Test method:

1. The NIT state DC resistance test setup is shown in Figure 46.
2. NIT state DC resistance test method:
   (1) Set the object to be tested at NIT state.
   (2) Test and record DC current, Idc.
   (3) Determine the DC resistance = 48V ÷ Idc.

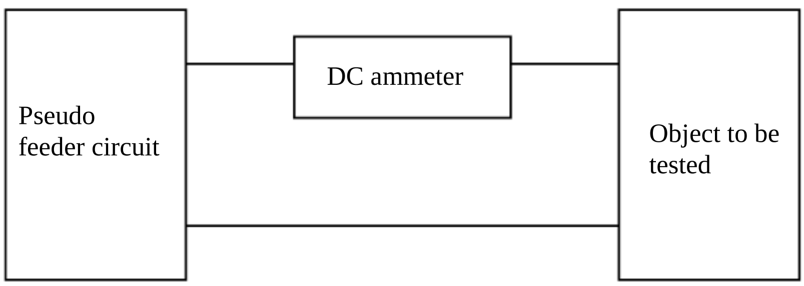


Figure 46 NIT state DC resistance test setup

Test equipment:

1. Pseudo feeder circuit
2. DC ammeter

4.6.2.2 NIT state disengagement

Specifications: when the number data is transmitted, the telecommunications terminal equipment shall disengage from the NIT state and return to idle dur to ringing.

Criteria for disengaging from NIT state: the transmission of number data is considered completed in one of the following circumstances:

1. The DTMF "C" code (end code) is received;
2. A ringing signal is received; or
3. A pause of more than 1 second is detected after the DTMF code is received.

At least criterion 2 and 3 shall be supported by the telecommunications terminal equipment. The criteria above are to guarantee that the NIT state is disengaged before or at the same as much as possible when the line enters the loop state for normal or abnormal number data transmission procedure.

Purpose: to ensure that the telecommunications terminal equipment with caller ID is capable of returning to idle after receiving DTMF message.

Test method:

1. The NIT disengagement test setup is shown in Figure 45.
2. NIT disengagement test method:
   (1) Set the object to be tested at idle.
   (2) Set the simulation signal generator to transmit DTMF “1” message / end code / DTMF “2” message in that sequence.
   (3) Check that the object to be tested displays only the DTMF “1” message.
   (4) Set the simulation signal generator to transmit DTMF “1” message / ringing signal / DTMF “2” message in that sequence.
   (5) Check that the object to be tested displays only the DTMF “1” message.
   (6) Set the simulation signal generator to transmit DTMF “1” message, pause for 1 second and transmit DTMF “2” message.
   (7) Check that the object to be tested displays only the DTMF “1” message.

Test equipment:

1. Simulation signal generator
2. Pseudo feeder circuit

4.6.2.3 DTMF signal

Specifications: the frequency, timing, level and deviation characteristics tolerance for the DTMF codes received between both ends of line are executed as shown in Table 11.

The receiving of the telecommunications terminal equipment to be tested shall meet the following:

1. Receiving level (high and low): -3 to -24 dBm
2. Maximum level difference between frequencies: 5 dB
3. Frequency tolerance: within ±1.5%

Table 11 DTMF signals

Signal status	Code / number	Result
DS1	TC2	Correct reception of number
DS2	TC2	Correct reception of number
DS3	TC2	Correct reception of number
DS4	TC2	Correct reception of number
DS5	TC2	Correct reception of number

Purpose: to ensure that the telecommunications terminal equipment with caller ID is capable of receiving DTMF messages correctly.

Test method:

1. The DTMF signal test setup is shown in Figure 45.
2. DTMF signal test method:
   (1) Set the object to be tested at idle.
   (2) Set the simulation signal generator for transmission of signals and numbers according to the requirements for receiving level, maximum level difference between frequencies and frequency tolerance and those in Table 11.
   (3) Check that the object to be tested receives numbers correctly.

Test equipment:

1. Simulation signal generator
2. Pseudo feeder circuit

4.6.2.4 DTMF code / number

Specifications: see Table 12, DTMF codes ／ numbers

Purpose: to ensure that the telecommunications terminal equipment with caller ID is capable of receiving DTMF messages.

Test method:

1. The DTMF code/number test setup is shown in Figure 45.
2. DTMF code/number test method:
   (1) Set the object to be tested at idle.
   (2) Set the simulation signal generator for transmission of signals and numbers according to Table 12.
   (3) Check that the object to be tested complies with the test results in Table 12.

Test equipment:

1. Simulation signal generator

2. Pseudo feeder circuit

Table 12 DTMF codes／numbers

Signal status	Code / number	Result
DS1	TC1	Correct reception of number
DS1	TC3	Caller ID restriction
DS1	TC4	Caller ID restriction

4.6.2.5 Anti-interference test for series equipment

Specifications: when a piece of telecommunications terminal equipment connected in series to the telecommunications terminal equipment with caller ID is used for calling, the telecommunications terminal equipment with caller ID shall not be subject to any interference.

Purpose: to ensure that the telecommunications terminal equipment with caller ID is not interfered when the connected telecommunications terminal equipment is on hook.

Test method:

1. The test setup for the anti-interference test for series equipment is shown in Figure 47.
2. Test method for anti-interference test for series equipment:
   (1) Set the object to be tested at idle.
   (2) Set the telecommunications terminal equipment in series at closed circuit (on hook).
   (3) Set the simulation signal generator to transmit DTMF signal status and numbers.
   (4) Check that the monitor of the object to be tested shows no display error.

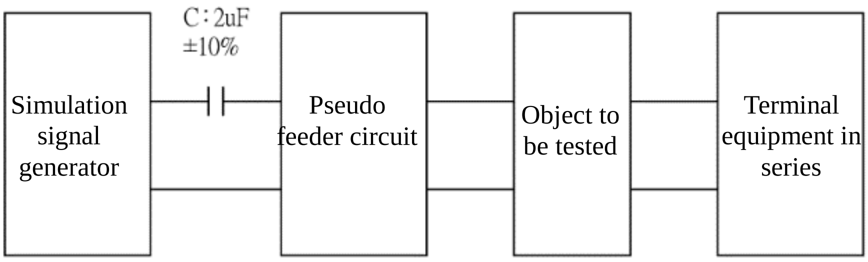


Figure 47 Test setup for the anti-interference test for series equipment

Test equipment:

1. Simulation signal generator
2. Pseudo feeder circuit
3. Telecommunications terminal equipment in series

4.7 Automatic redial

4.7.1 Automatic redial

4.7.1.1 Number of automatic redials and time limit

Specifications:

1. The telecommunications terminal equipment shall not send any dial signal until 2 seconds after the loop is closed.
   This does not apply to the telecommunications terminal equipment that is capable of transmission of dial signals after automatic detection of dial tone.
2. 2 or more automatic redials are allowed if the redial interval is one minute or longer;
3. The number of automatic redials is unlimited if the redial interval is three minutes or longer;
4. The number of automatic redials is unlimited for emergency communication equipment for reporting fires, theft or other emergencies.

Purpose: to ensure that the PSTN detects the state of the telecommunications terminal equipment correctly and prevents wasting of PSTN resources if the automatic redial application is not appropriate for the telecommunications terminal equipment.

Test method:

1. The test setup for number of automatic redials and time limit is shown in Figure 48.
2. Test method for number of automatic redials and time limit:
   (1) Set the pseudo feeder circuit so that it does not transmit dial tone when the object to be tested enters the closed-circuit state, and that it transmits busy tone when the object to be tested has transmitted the DTMF signals.
   (2) Set the object to be tested to operate the automatic redial function.
   (3) Test and record the AC and DC signals during the entire test process.
   (4) Determine the time from the object to be tested entering closed-circuit state to transmission of dial signal.
   (5) Determine the redial interval, which is the time from the object to be tested entering closed-circuit state to the next time when it enters the closed-circuit state.
   (6) Count the number of automatic redials (the first dial is not counted as a redial).

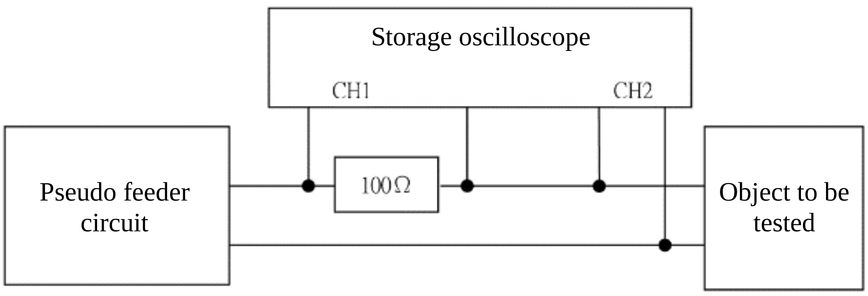


Figure 48 Test setup for number of automatic redials and time limit

Test equipment:

1. Pseudo feeder circuit: shall be provided with the ability to transmit dial tone, busy tone, ringing signal and ring back tone;
2. Storage oscilloscope

4.7.1.2 Disconnect time limit for automatic redial

Specifications:

1. The call shall be disconnected in 20 seconds if a busy tone is detected.
2. The call shall be disconnected in 2 minutes if the ring back tone is detected after the call is made.

Purpose: to prevent wasting of PSTN resources if the automatic redial application is not appropriate for the telecommunications terminal equipment.

Test method:

1. The test setup for disconnect time limit for automatic redial is shown in Figure 48.
2. Test method for disconnect time limit for automatic redial:
   (1) Set the pseudo feeder circuit to transmit busy tone after the object to be tested has transmitted the DTMF signals.
   (2) Set the object to be tested to operate the automatic redial function.
   (3) Test and record the AC and DC signals during the entire test process.
   (4) Determine the time from the object to be tested transmitting the dial signal to it entering the open-circuit state.
   (5) Set the pseudo feeder circuit so that it transmits a ring back tone after the object to be tested has transmitted the DTMF signals.
   (6) Repeat test steps (2) through (4).

Test equipment:

1. Pseudo feeder circuit
2. Storage oscilloscope

4.7.2 Automatic answering

Specifications: the telecommunications terminal equipment provided with automatic answering function shall comply with the following:

1. The automatic connection shall be done in 3 or fewer ring tones;
2. The DC loop shall be disconnected in 3 seconds or less after the caller hangs up.

Note: Item 2 above applies only to the telecommunications terminal equipment with modem.

Purpose: to prevent wasting of PSTN resources if the automatic answering application is not appropriate for the telecommunications terminal equipment.

Test method:

1. The automatic answering test setup is shown in Figure 49.
2. Automatic answering test method:
   (1) Set the object to be tested at open circuit.
   (2) Send the dial signal from the calling terminal.
   (3) Set the pseudo feeder circuit so that it transmits a ringing signal to the object to be tested after the DTMF signal is received from the telecommunications terminal equipment.
   (4) The object to be tested automatically enters the closed-circuit state after

receiving a ringing signal, and starts counting the number of rings.

(5) The calling terminal enters the open-circuit state.

(6) The object to be tested automatically enters the open-circuit state.

(7) Test and record the DC voltage signals during the entire process from test step (5) to (6).

(8) Determine the time difference from the calling terminal entering the open-circuit state to the object to be tested entering in the close-circuit state.

Test equipment:

1. Calling terminal
2. Storage oscilloscope
3. Pseudo feeder circuit: shall be capable of sending ringing signals.

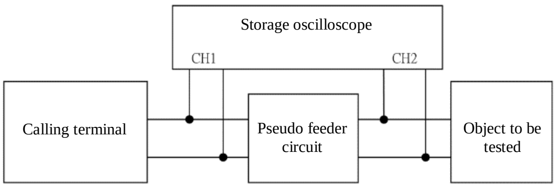


Figure 49 Automatic answering test setup

Appendix I:

FSK test status and data

Table I.1: DT-AS detection

Status	DT1	DT2	DT4	DT5
Frequency (Hz)	2120 and 2737	2140 and 2763	2140 and 2763	2130 and 2750
Level (dBm)	-10	-10	-30	-20
Deviation (dB)	6	6	6	0
Duration (ms)	90	110	110	100
Effectiveness	Yes	Yes	Yes	Yes

Table I.2: FSK signal status

Parameter	FSK1	FSK2	FSK3
Mark frequency (Hz) (logic 1)	1300	1280.5	1319.5
Space frequency (Hz) (logic 0)	2100	2068.5	2131.5
Mark level (dBm) (between A-wire and B-wire)	-20	-36	-4
Space level (dBm) (between A-wire and B-wire)	-20	-30	-10
Interference signal power level (dB)	none	-25	-25

Table I.3: Data link packet architecture

Test packet type	TP1	TP2	TP4	TP5	TP6	TP7	TP8	TP9	TP10	TP11	TP13	TP14	TP15
Circuit connection	SZ2	SZ2	SZ2	SZ2	SZ2	SZ2	SZ2	SZ2	SZ2	SZ2	SZ2	SZ2	SZ2
Mark period	MK1	MK1	MK1	MK1	MK1	MK1	MK1	MK1	MK1	MK1	MK1	MK1	MK1
Message type	MT1	MT3	MT1	MT2	MT1	MT1	MT1	MT1	MT1	MT1	MT1	MT1	MT1
Presentation message	PM1	PM9	PM1	PM1	PM1	PM2	PM3	PM4	PM5	PM6	PM8	PM10	PM11
Checksum	CH1	CH1	CH1	CH1	CH2	CH1	CH1	CH1	CH1	CH1	CH1	CH1	CH1

Table I.4: Presentation layer test messages

Presentation layer message type	PM1	PM2	PM3	PM4	PM5	PM6	PM8	PM9	PM10	PM11
Message length (byte)	ML1 (37)	ML1 (37)	ML2 (34)	ML3 (28)	ML3 (28)	ML4 (3)	ML6 (75)	ML3 (28)	ML3 (28)	ML3 (28)
Call type	CT1	CT2	-	CT1	CT1	CT3	CT1	CT3	CT1	CT1
Time and date	TD1	TD1	TD1	TD1	TD1	-	TD1	TD1	TD1	TD1
Caller ID	CL1	CL1	CL1	-	-	-	CL3	CL1	-	-
Called ID	CL2	CL2	CL2	CL2	CL2	-	CL4	-	CL2	CL2
Cause of no caller ID	-	-	-	RA1	RA2	-	-	-	RA3	RA4
Visible instruction	-	-	-	-	-	-	-	VI1	-	-
1st called ID	-	-	-	-	-	-	FC1	-	-	-
Network message system status	-	-	-	-	-	-	NS1	-	-	-
Transfer call type	-	-	-	-	-	-	FT1	-	-	-
Calling subscriber type	-	-	-	-	-	-	CU1	-	-	-
Transfer number	-	-	-	-	-	-	RN1	-	-	-

Table I.5: Test data

Test	Data	Note
SZ1	96 alternate mark and space bits	
SZ2	300 alternate mark and space bits (starting with space and ending with mark)	ETSI circuit connection cycle
MK1	80 consecutive mark bits	Network supplier's selection
MK2	25 consecutive mark bits	Invalid mark cycle
MK3	180 consecutive mark bits	Mark cycle proposed by ETSI
CH1	Correct checksum	Calculate every message
CH2	Incorrect checksum	Calculate every message
MT1	1000 0000 80 H	Call establishment message type
MT2	1000 0001 81 H	Non-call establishment message type
MT3	1000 0010 82 H	Message waiting instruction message type
ML1	0010 0101 25 H	37-byte message
ML2	0010 0010 22 H	34-byte message
ML3	0001 1100 1c H	28-byte message
ML4	0000 0011 03 H	3-byte message
ML6	0100 1011 4B H	75-byte message

Table I.6: CT1 test

CT1 test	Data	Meaning
Parameter type	0001 0001 11 H	Call type
Parameter length	0000 0001 01 H	1-byte parameter data
Parameter data	0000 0001 01 H	Voice call

Table I.7: CT2 test

CT2 test	Data	Meaning
Parameter type	0001 0001 11 H	Call type
Parameter length	0000 0001 01 H	1-byte parameter data
Parameter data	0000 0010 02 H	Ring back on idle

Table I.8: CT3 test

CT3 test	Data	Meaning
Parameter type	0001 0001 11 H	Call type
Parameter length	0000 0001 01 H	1-byte parameter data
Parameter data	1000 0001 81 H	Message waiting call

Table I.9: RA1 test

RA1 test	Data	Meaning
Parameter type	0000 0100 04 H	Cause of no calling number
Parameter length	0000 0001 01 H	1-byte parameter data
Parameter data	0100 1111 4F H	Without calling number

Table I.10: RA2 test

RA2 test	Data	Meaning
Parameter type	0000 0100 04 H	Cause of no calling number
Parameter length	0000 0001 01 H	1-byte parameter data
Parameter data	0101 0000 50 H	Calling number not given

Table I.11: RA3 test

RA3 test	Data	Meaning
Parameter type	0000 0100 04 H	Cause of no calling number
Parameter length	0000 0001 01 H	1-byte parameter data
Parameter data	0100 0011 43 H	Call from coin-operated telephone without number

Table I.12: RA4 test

RA4 test	Data	Meaning
Parameter type	0000 0100 04 H	Cause of no calling number
Parameter length	0000 0001 01 H	1-byte parameter data
Parameter data	0100 1001 49 H	International call without number

Table I.13: NM1 test

NM1 test	Data	Meaning
Parameter type	0001 0011 13 H	Network message system status
Parameter length	0000 0001 01 H	1-byte parameter data
Parameter data	0000 0011 03 H	3 messages waiting

Table I.14: TD1 test

TD1 test	Data	Meaning (14:30, 13 August)
Parameter type	0000 0001 01 H	Time and date
Parameter length	0000 1000 08 H	8-byte parameter data
Parameter data	0011 0000 30 H	0
Parameter data	0011 1000 38 H	8
Parameter data	0011 0001 31 H	1
Parameter data	0011 0011 33 H	3
Parameter data	0011 0001 31 H	1
Parameter data	0011 0100 34 H	4
Parameter data	0011 0011 33 H	3
Parameter data	0011 0000 30 H	0

Table I.15:CL1 test

CL1 test	Data	Meaning (0936275234)
Parameter type	0000 0010 02 H	Calling number
Parameter length	0000 1010 0A H	10-byte parameter data
Parameter data	0011 0000 30 H	0
Parameter data	0011 1001 39 H	9
Parameter data	0011 0011 33 H	3
Parameter data	0011 0110 36 H	6
Parameter data	0011 0010 32 H	2
Parameter data	0011 0111 37 H	7
Parameter data	0011 0101 35 H	5
Parameter data	0011 0010 32 H	2
Parameter data	0011 0011 33 H	3

Parameter data	0011 0100 34 H	4

Table I.16: CL2 test

CL2 test	Data	Meaning (0223433657)
Parameter type	0000 0011 03 H	Called number
Parameter length	0000 1010 0A H	10-byte parameter data
Parameter data	0011 0000 30 H	0
Parameter data	0011 0010 32 H	2
Parameter data	0011 0010 32 H	2
Parameter data	0011 0011 33 H	3
Parameter data	0011 0100 34 H	4
Parameter data	0011 0011 33 H	3
Parameter data	0011 0011 33 H	3
Parameter data	0011 0110 36 H	6
Parameter data	0011 0101 35 H	5
Parameter data	0011 0111 37 H	7

Table I.17: CL3 test

CL3 test	Data	Meaning (maximum length number)
Parameter type	0000 0010 02 H	Calling number
Parameter length	0001 0000 10 H	16-byte parameter data
Parameter data	0011 0000 30 H	0
Parameter data	0011 0000 30 H	0
Parameter data	0011 0010 32 H	2
Parameter data	0011 0001 31 H	1
Parameter data	0011 0010 32 H	2
Parameter data	0011 0011 33 H	3
Parameter data	0011 0100 34 H	4
Parameter data	0011 0101 35 H	5
Parameter data	0011 0110 36 H	6
Parameter data	0011 0111 37 H	7
Parameter data	0011 0001 31 H	1
Parameter data	0011 0010 32 H	2
Parameter data	0011 0011 33 H	3
Parameter data	0011 0100 34 H	4
Parameter data	0011 0101 35 H	5
Parameter data	0011 0110 36 H	6

Table I.18: CL4 test

CL4 test	Data	Meaning (083625234)
Parameter type	0000 0011 03 H	Called number
Parameter length	0000 1001 09 H	09-byte parameter data
Parameter data	0011 0000 30 H	0
Parameter data	0011 1000 38 H	8
Parameter data	0011 0011 33 H	3
Parameter data	0011 0110 36 H	6
Parameter data	0011 0010 32 H	2
Parameter data	0011 0101 35 H	5
Parameter data	0011 0010 32 H	2
Parameter data	0011 0011 33 H	3
Parameter data	0011 0100 34 H	4

Table I.19: FC1 test

FC1 test	Data	Meaning (0936275234)
Parameter type	0001 0010 12 H	First called number
Parameter length	0000 1010 0A H	10-byte parameter data
Parameter data	0011 0000 30 H	0
Parameter data	0011 1001 39 H	9
Parameter data	0011 0011 33 H	3
Parameter data	0011 0110 36 H	6
Parameter data	0011 0010 32 H	2
Parameter data	0011 0111 37 H	7
Parameter data	0011 0101 35 H	5
Parameter data	0011 0010 32 H	2
Parameter data	0011 0011 33 H	3
Parameter data	0011 0100 34 H	4

Table I.20: RN1 test

RN1 test	Data	Meaning (0223433657)
Parameter type	0001 1010 1A H	Transfer number
Parameter length	0000 1010 0A H	10-byte parameter data
Parameter data	0011 0000 30 H	0
Parameter data	0011 0010 32 H	2
Parameter data	0011 0010 32 H	2
Parameter data	0011 0011 33 H	3
Parameter data	0011 0100 34 H	4
Parameter data	0011 0011 33 H	3
Parameter data	0011 0011 33 H	3
Parameter data	0011 0110 36 H	6
Parameter data	0011 0101 35 H	5
Parameter data	0011 0111 37 H	7

Table I.21: VI1 test

VI1 test	Data	Meaning
Parameter type	0000 1011 0B H	Visible instructions
Parameter length	0000 0001 01 H	1-byte parameter data
Parameter data	1111 1111 FF H	Activated cutting-in

Table I.22: NS1 test

NS1 test	Data	Meaning
Parameter type	0001 0011 13 H	Network message system status
Parameter length	0000 0001 01 H	1-byte parameter data
Parameter data	0000 0001 01 H	One message or unspecified number of messages

Table I.23: FT1 test

FT1 test	Data	Meaning
Parameter type	0001 0101 15 H	Transfer telephone type
Parameter length	0000 0001 01 H	1-byte parameter data
Parameter data	0000 0011 03 H	Unconditional transfer telephone

Table I.24: CU1 test

CU1 test	Data	Meaning
Parameter type	0001 0110 16 H	Calling subscriber type
Parameter length	0000 0001 01 H	1-byte parameter data
Parameter data	0000 1010 0A H	Ordinary calling subscriber

Appendix II:

DTMF test status and data

Table II.1 Test status

DTMF signal status

Status	DS1	DS2	DS3	DS4	DS5
Frequency departure	0%	+1.5%	0%	0%	+1.5%
Level (dBm)	-13	-24	-3	-3	-24
Deviation (dB)	0	5	5	5	5
Sound duration (ms)	70	90	90	50	50
Pause between numbers (ms)	70	90	90	50	50
Interfering signal power level (dB)	None	-20	-20	-20	-20
Effectiveness	Yes	Yes	No	Yes	Yes

Test code / number

Parameter	TC1	TC2	TC3	TC4
Starting code	D	D	D	D
Calling number	CN1	CN2	CN3	CN4
Stop code	C	C	C	C

Table II.2 Test data

Test	Data	Note
CN1	0021456789012345	International call
CN2	0223433657	Domestic call
CN3	0	International call limit
CN4	0	Domestic call limit

Appendix III Suggested test environment and instruments

Test environment

All test shall be performed in the following conditions:

- Ambient temperature between 15℃ and 35℃
- Relative humidity between 45% and 85%
- Atmospheric pressure between 86 kPa and 106 kPa

All tests shall be performed in the working environment mentioned above if the telecommunications terminal equipment is not designed to operate in a completely special environment.

Power state

The telecommunications terminal equipment shall be activated and operated in the normal environment during testing.

If the telecommunications terminal equipment is powered by power mains (completely or equivalently), the voltage range of the power supply is ±5%. If the telecommunications terminal equipment is powered in other way and not by instrument (e.g. battery, DC power supply and stabilized AC power supply), all tests shall be performed within the upper and lower limits of the power supply used. If the power supply is of an AC type, the AC voltage range is ±4% for all tests performed.

Grounding test

The definition of grounding test is that the supply instrument shall be grounded and that the following shall be connected to earth reasonably:

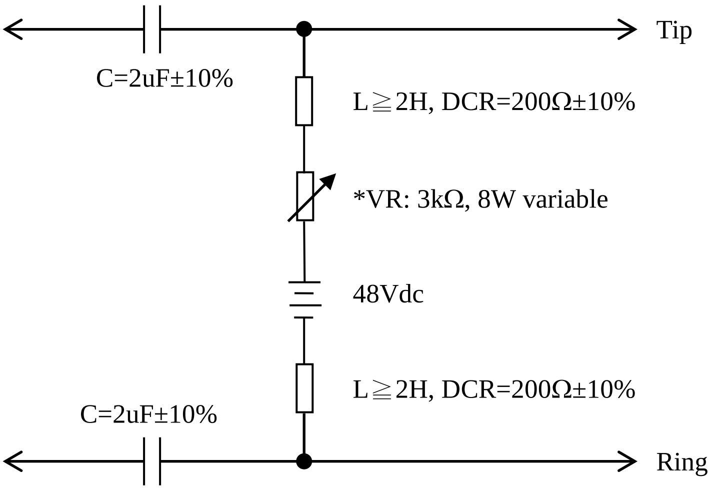
- The ground of the telecommunications terminal equipment shall be connected to earth (the power supply that powers the telecommunications terminal equipment shall be grounded as well during testing).
- When the telecommunications terminal equipment is operating normally, the ground shall be connected to earth. This test is not applicable if the ground of the telecommunications terminal equipment cannot be connected to earth as mentioned above.

List of suggested instruments

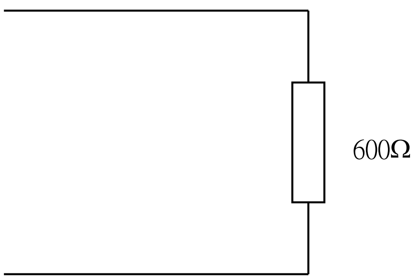
1. AC ammeter: the range shall be greater than 200mA, minimum frequency range between 15 Hz and 68 Hz and the bursting accuracy within ±3%.
2. AC voltage source: the output ranging from 0Vrms to 1500Vrms at 60 Hz, minimum allowable 10mA current and power insulation.
3. AC voltmeter: input impedance greater than 1MΩ, ranging from 0V to 150Vrms, minimum frequency ranging from 15.3 Hz to 68 Hz, accurate to ±3%.
4. Band-pass filter: input impedance greater than 100kΩ, pass band between 200 Hz and 4000 Hz, cutoff frequency at the attenuation point of 3dB, every octave greater than 24dB outside of frequency band.
5. Band-pass filter : input impedance greater than 100kΩ, pass band between 4000 Hz and 48kHz, cutoff frequency at the attenuation point of 3dB, every octave greater than 24dB outside of frequency band.
6. Current source: maximum output at 1 A.
7. DC ammeter: ranging from 0mA to 200mA and accurate to ±3%.
8. DC ammeter: ranging from 20 uA and accurate to ±3%.
9. DC power supply: output level ranging from 0 V to 200 V; the maximum current output shall be greater than 1A.
10. DC voltmeter: the output impedance greater than 1MΩ, ranging from 0V to 200V and accurate to ±3%.
11. Digital sampling storage oscilloscope: input impedance greater than 1MΩ, frequency range greater than 6 MHz, input sensitivity better than 3 mV, impulse sensitivity at least better than 10 mV and accurate to ±3%.
12. Digital sampling storage oscilloscope: input impedance greater than 1MΩ, frequency range greater than 100 MHz, input sensitivity better than 3 mV, impulse sensitivity at least better than 10 mV and accurate to ±3%.
13. DS1 transmission tester: capable of sending programmed bitstream.
14. Frequency counter: input impedance greater than 1MΩ, frequency range from 100 Hz to at least 10 MHz, input sensitivity better than 10 mV, resolution smaller than 1 Hz and accurate to ±3 Hz.
15. Frequency generator: output impedance at 600Ω, frequency range up to at least 4kHz, maximum output level greater than 40dBm with sine wave output.
16. Frequency selective voltmeter: frequency ranging from 2000 Hz to at least 4 kHz, input impedance greater than 10kΩ, balanced input ranging from 1μV to 1 V and accurate to ±3%; bandwidths 10Hz and 30Hz.
17. It is used mainly to keep tracks of oscilloscope and spectrum analyzer.
18. 1.544 Mb/s PCM wavelength multiplexer / demultiplexer and zero-level coder / decoder shall be provided with one or more function effectors.
19. Ringing amplifier: the output level shall be at least 150Vrms at 56.5 Vdc / 15.3 Hz to 68 Hz.
20. Spectrum analyzer: input impedance greater than 1MΩ, frequency ranging from 10 Hz to at least 6 MHz, sensitivity better than 0.1 mV, resolution smaller than 1 Hz and accurate to ±2 dB.
21. Summing Network: input and output impedance 600Ω.
22. Type A surge generator: peak output 800V; capable of generating 10μs of maximum front time and 560μs of minimum impact time; generation of minimum 100 A peak current allowed; capable of generating these impulses at both positive and negative polarities.
23. Type A surge generator: peak output 1500V, capable of generating 10μs of maximum front time, and 160μs of minimum impact time; generation of minimum 200 A peak current allowed; capable of generating these impulses at both positive and negative polarities.
24. Surge generator: peak output 2500V, capable of generating 2μs of maximum front time, and 10μs of minimum impact time; capable of generating these impulses at both positive and negative polarities; mainly for the supply of surge voltage input from the input of AC power network.
25. Track generator: input impedance smaller than 600Ω, frequency ranging from 10 Hz to at least 6 MHz, maximum output level 0dBm.
26. Correct root-mean-square AC voltmeter: input impedance greater than 100kΩ, frequency ranging from 10 Hz to at least 4 kHz, average time 0.1 second and 3.0 second, input sensitivity better than 0.7mV, capable of selecting peak indication and accurate to ±3%.
27. Correct root-mean-square AC voltmeter: input impedance greater than 100kΩ, frequency ranging from 1 kHz to at least 1 MHz, input sensitivity better than 35 mV (reference impedance 135Ω), provided with indication of peak voltage and root-square-mean and accurate to ±3%.
28. Correct root-mean-square AC ammeter: range between 0mA and 500mA, accurate to ±3%, and capable of testing both DC and AC root-square-mean values.
29. Voltage source: output of 120 Vrms and 10mA at 60 Hz
30. Voltage source: output of 300 Vrms and 10mA at 60 Hz
31. White noise generator: input impedance 600 Ω, frequency ranging from 200 Hz to at least 4 kHz, maximum output level at least 10dBm.

32. Zero-level coder / decoder: signals shall not be lost in the cording and decoding between analog and digital signals during testing.
33. Feeder bridge for analogue telephone: its fixture shall be provided with a 2uF±10% blocking capacitor and an inductor of at least 2H.
34. Test loop: any physically and commercially available artificial loop that is equivalent to 0 km and 5 km 0.4mm#26 AWG non-loaded cable.
35. Artificial ear: the artificial ear shall comply with the IEC ANSI S3.7-1973 (method for connection and calibration of artificial ear); the sound pressure response of microphone shall be used for the sound pressure of receiver.
36. Standard microphone: this type of microphone shall comply with ANSI S1.12-1967[3] to measure the artificial ear generating sound pressure; the microphone sensitivity frequency ranges from 100 Hz to 5000 Hz (continuous).
37. Microphone amplifier: for the frequency response characteristics of this amplifier, the frequency ranges from 100 Hz to 5000 Hz (continuous) and the input and output characteristics of amplifier shall be amplified linearly within sound pressure range.
38. 100 Hz to 5000 Hz sine wave frequency generator: the change of extension rate shall not compromise the inaccuracy of measurement. The frequency of this generator ranges from 100 Hz to 5000 Hz (continuous).
39. AC voltmeter: ranging from 0.01V to 10V (full-scale reading); input impedance greater than 100kΩ in bridge test or 600Ω terminal test.
40. Simulated transmission line is #26AWG 5km non-loaded cable (0.4mm, 280Ω/km, 50nf/km).

Pseudo feeder circuit:

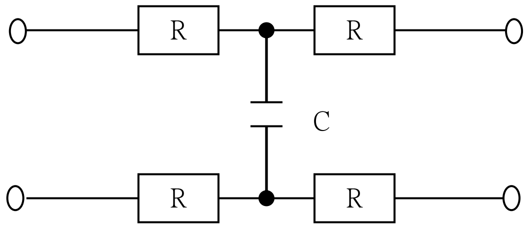


Reference load impedance: 600Ω



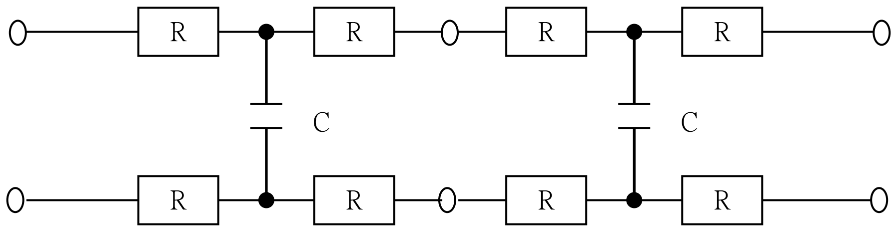
Simulated transmission line:

1. 0.4mm #26AWG transmission line: simulated line of 1 km



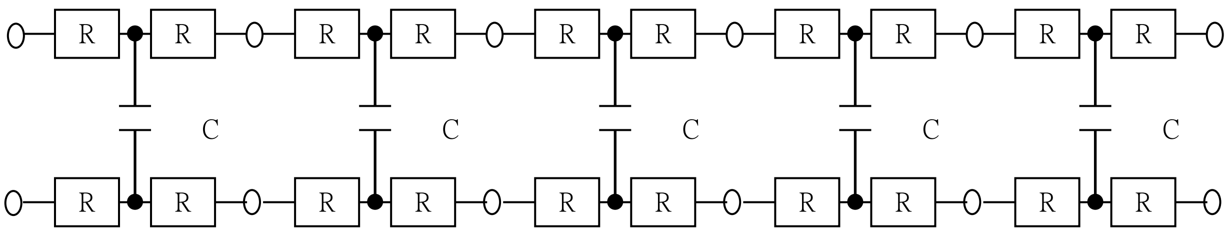
R: 70Ω
C: 50nF

2. 0.4mm #26AWG transmission line: simulated line of 2 km (2 1km simulated lines connected in series)



R: 70Ω
C: 50nF

3. 0.4mm #26AWG transmission line: simulated line of 5 km (5 1km simulated lines connected in series)



R: 70Ω
C: 50nF