NETWORK CONNECTION SPECIFICATION
FOR CONNECTION OF CUSTOMER PREMISES
EQUIPMENT (CPE)
TO THE LEASED LINE OR PRIVATE CIRCUIT
PROVIDED BY THE FIXED TELECOMMUNICATIONS
NETWORK SERVICES (FTNS) OPERATORS
IN HONG KONG
FOR VOICEBAND OPERATION
FOREWORD

1. This specification is issued pursuant to Section 32D of the Telecommunications Ordinance (Cap. 106). This specification sets out the technical requirements for connection of customer premises equipment (CPE) to the leased line(s) / private circuit(s) provided by the Fixed Telecommunications Network Services (FTNS) operators in Hong Kong for voiceband operation.

2. Voiceband leased line or private circuit may be provided by any one of the FTNS operators in Hong Kong. CPE should comply with this specification for connection to the voiceband leased line or private circuit provided by the FTNS operators. The general technical characteristics of the FTNS networks are given in HKTA 2201. Supplementary information on network characteristics and services of the FTNS networks may be obtained direct from the operators. Contact information of the FTNS operators can be found in the information note OFTA I 412.

3. At present, the Office of the Telecommunications Authority (OFTA) operates a Hong Kong Telecommunications Equipment Evaluation and Certification (“HKTEC”) scheme. Details of the scheme can be found in the information note OFTA I 421. Under the scheme, suppliers or manufacturers may apply for certification of their customer premises equipment against this specification. The application procedures for certification of customer premises equipment can be found in the information note OFTA I 412. A label prescribed by the Telecommunications Authority (TA) may be affixed to the certified equipment. Details of the labelling arrangement can be found in the Standardisation Guide HKTA 3211.

4. The TA may amend any part of this specification as and when he deems necessary.

5. In case of doubt about the interpretation of this specification, the methods of carrying out the test and the validity of statements made by the manufacturers of the equipment, the decision of the TA shall be final.

6. The TA accepts no responsibility for the satisfactory performance of the CPE connected to the public telecommunications networks. The CPE is not normally evaluated against performance, reliability or quality-of-service parameters.

7. The HKTA specifications and information notes issued by the TA can be downloaded from OFTA’s website at http://www.ofta.gov.hk. Enquiries about this specification may be directed to -

   Senior Telecommunications Engineer
   Standards Section
   Office of the Telecommunications Authority
   29/F Wu Chung House
   213 Queen’s Road East
   Wanchai
   Hong Kong

   Fax: +852 2838 5004
   Email: standards@ofta.gov.hk
AMENDMENT TABLE

<table>
<thead>
<tr>
<th>Item</th>
<th>Issue No.</th>
<th>Paragraph</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Issue 2</td>
<td>Foreword</td>
<td>Certification and labelling requirements are updated.</td>
</tr>
<tr>
<td>2.</td>
<td>Issue 2</td>
<td>2.2</td>
<td>The safety requirement is referred to HKTA 2001.</td>
</tr>
<tr>
<td>3.</td>
<td>Issue 3</td>
<td>1.1</td>
<td>The number of FTNS operators is not to be specified as it may change from time to time</td>
</tr>
<tr>
<td>4.</td>
<td>Issue 3</td>
<td>2.1, 3.1.1</td>
<td>Editorial update</td>
</tr>
<tr>
<td>5.</td>
<td>Issue 3</td>
<td>5.1</td>
<td>Add RJ plug and socket requirement</td>
</tr>
<tr>
<td>6.</td>
<td>Issue 4</td>
<td>Foreword</td>
<td>Update information on certification and labelling as a result of the accreditation of Certification Bodies (CBs).</td>
</tr>
<tr>
<td>7.</td>
<td>Issue 4</td>
<td>Para. 2.2 &amp; 6</td>
<td>The title of HKTA 2001 is updated</td>
</tr>
<tr>
<td>8.</td>
<td>Issue 4</td>
<td>Para. 5.2</td>
<td>Reference to the standard on mechanical requirements of RJ plugs is changed from FCC Part 68 to TIA-968-A or TIA-1096-A. TIA-1096-A is added as a reference standard on the contact requirements of RJ plugs in addition to TIA TSB 31-B.</td>
</tr>
</tbody>
</table>
CONTENT

1. SCOPE
2. ELECTRICAL SAFETY
3. PRIVATE CIRCUIT APPLICATIONS
4. TRANSMISSION REQUIREMENTS
5. INTERCONNECTION
6. REFERENCE
1. SCOPE

1.1 This network connection specification covers the minimum technical requirements of a CPE to be connected to private circuit(s) / leased line(s) provided by any one of the Fixed Telecommunications Network Services (FTNS) operators in Hong Kong for voiceband operation (300 to 3400 Hz). The scope of the specification covers -

a. protection of the leased line(s) / private circuits network;
b. safety hazard to the personnel using or working on the network; and
c. interoperability and interconnectivity of the leased line(s) / private circuit(s) provided by any one of the FTNS operators.

2. ELECTRICAL SAFETY

2.1 Principle of Protection

In order to safeguard operating personnel, users, and plant, it is essential to prevent the transmission of excessive voltages from the CPE into the telecommunications networks of FTNS operators in Hong Kong.

2.2 Safety Requirements

The CPE shall comply with the following specification -

- HKTA 2001 - Compliance Test Specification - Safety and Electrical Protection Requirements for Subscriber Telecommunications Equipment
3.  PRIVATE CIRCUIT APPLICATIONS

3.1  General

3.1.1  Various kinds of private circuit applications for connection of CPE to the voiceband private circuits are available in the local fixed telecommunications network. As the individual FTNS operator may offer applications such as the following, it is necessary to obtain further information from the FTNS operators with contact address as shown in paragraph 2 of Foreword in this specification.

(i)  PABX Bothway Tie

(ii) 2-Wire/4-Wire E&M Tie

(iii) Hot Line Service

(iv) PABX Long-Line Extension

Note:  No other DC line signalling schemes will be transported over the private circuits. Where there is an application for tie line operation other than the types mentioned above, the provision of the circuit should be evaluated and agreed between the parties involved on case by case basis.

3.1.2  This is the CPE supplier/agent’s responsibility to ensure that the application of tie line circuit, external extension or trunk-to-trunk connection (e.g. call forward, conference call, call transfer, etc.) will not cause degradation of transmission performance. In some cases, amplification may be required to compensate the line attenuation.

3.2  PABX Bothway Tie Line

3.2.1  This type of private circuit services for connection of two PABX systems at different ends employing 2-Wire bothway tie trunk. The PABX at either side may originate an outgoing call to the PABX at the other end.

3.2.2  In idle state, the tie trunk interface shall provide a nominal -48 V battery feed with the positive side connected to earth.

3.2.3  The tie trunk interface conforming the technical requirements for connection to the PSTN (both DEL and DDI line) will be considered to be compatible for the private circuit connection. The relevant technical requirements (e.g. seizure state, answer condition, DTMF/Loop-disconnect signalling) are stipulated in HKTA 2011 and HKTA 2013.
3.3 2-Wire/4-Wire E&M Tie Line

3.3.1 This private circuit supports transmission of voiceband analogue signals over 1 pair or 2 pairs of speech paths; while the control signals are carried by the E&M leads.

The block diagram of connection arrangement is depicted in figures 1 & 2 below -

Figure 1 2-Wire E&M Tie Line Circuit

Figure 2 4-Wire E&M Tie Line Circuit
3.3.2 E&M Signalling

Type I & V E&M signalling (see figures 3 & 4 respectively) are employed for CPE-to-Network operation.

CPE Equipment:
- On-Hook (Idle): Ground on M lead
- Off-Hook (Seizure/Answer): Battery on M lead

Exchange Equipment:
- On-Hook (Idle): Open on E lead
- Off-Hook (Seizure/Answer): Ground on E lead

Figure 3 Type I E&M Signalling Configuration
CPE Equipment : On-Hook (Idle) : Open on M lead
Off-Hook (Seizure/Answer) : Ground on M lead

Exchange Equipment : On-Hook (Idle) : Open on E lead
Off-Hook (Seizure/Answer) : Ground on E lead

Figure 4  Type V E&M Signalling Configuration
3.3.3 The E&M leads electrical parameters of exchange equipment are listed below -

- Operating voltage : -48 Vdc nominal
- Insulation resistance at E lead in idle state : > 150 kΩ, w.r.t. Earth
- Resistance at E lead in seizure/answer state : < 50 Ω, exclusive of external cable resistance
- Detector Limit (Line limit) : 500 Ω per lead maximum

3.3.4 E&M Leads electrical requirements of CPE are listed below -

- The operating voltage : -48 Vdc nominal
- Insulation resistance at M lead in type V in idle state : > 150 kΩ, w.r.t. Earth
- Line current Limit : < 110 mA, with a test load of 50 Ω
- Detector Limit (Line limit) : > 500 Ω per lead
- Terminating impedance : 600 Ω nominal
- Address signalling : a. Tone dialling (DTMF signalling) over the speech path
  b. Pulse dialling over the E&M leads
  c. The technical requirements of DTMF signalling and pulse dialling are referred to the relevant paragraphs in HKTA 2011.

3.4 Hot-Line Service

This type of private circuit provides automatic ringing signal (nominal 75 Vrms, 25 Hz) to the called party when the calling party goes off-hook state or vice versa. Speech path is set up once the called party goes off hook.

In idle state, the private circuit supplies a nominal feeding voltage of -48 Vdc to the CPE at both ends. Its operation can be triggered by a close-loop circuit at either side of CPE.

CPE conforming the technical requirements for connection to the public exchange line will be considered to be compatible for the private circuit connection. Relevant technical requirements (e.g. the on-hook and off-hook state conditions) are stipulated in HKTA 2011.
3.5 PABX Long Line Extension

This private circuit is used to connect between a PABX extension interface at the local end and a CPE at remote end via FTNS’s transmission facilities. The PABX extension is a 2-Wire analogue interface.

The CPE shall conform to the following technical requirements -

a. The battery feeding voltage of CPE presenting to the private circuit shall be -48 Vdc nominal, and the line current of the circuit shall not exceed 110 mA.

b. The ringing voltage of CPE presented to the private circuit shall be 75 Vrms ± 20%, with ringing frequency of 25 Hz nominal.

c. All other relevant signalling and transmission aspects such as on-hook state, off-hook state, DTMF/Loop-disconnect signalling, return loss, and etc. shall be identical to technical requirements stipulated in HKTA 2011.

4. TRANSMISSION REQUIREMENTS

4.1 General

The private circuits have a nominal pass-band of 300 to 3400 Hz, with 600 ohm nominal terminating impedance. No D.C. potential shall be transmitted from the CPE to the private circuit.

4.2 In-Band Power Limit of Tone Signals

The total power level of all transmitted signals in any 10 Hz band within the frequency range 0 to 4 kHz shall not exceed the limit shown in Figure 5 below, when measured at the private circuit interface of the CPE which is connected to a test circuit of a 600 ohm non-reactive load.

![Figure 5 In-Band Maximum Power Limit](image-url)

**Figure 5 In-Band Maximum Power Limit**
4.3 In-Band Power Limit of Speech or Music Signals

The power level of all transmitted speech or music signals, when averaged over any 3-second intervals, shall not exceed -9 dBm within the frequency range 300 to 4000 Hz, when measured at the private circuit interface of the CPE which is connected to a test circuit of a 600 ohm non-reactive load.

4.4 Out-Band Power Limit

For frequencies above 4 kHz, the root-mean-square (RMS) voltage averaged over 100 ms and measured at the private circuit interface of the CPE shall not exceed the limits shown below -

<table>
<thead>
<tr>
<th>Centre Frequency of 8 kHz Band (kHz)</th>
<th>Maximum Voltage in All 8 kHz Bands (dBV)</th>
<th>Terminating Impedance (ohms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 to 12</td>
<td>-(6.4 + 12.6 log f)</td>
<td>300</td>
</tr>
<tr>
<td>12 to 90</td>
<td>23 - 40 log f</td>
<td>135</td>
</tr>
<tr>
<td>90 to 266</td>
<td>-55</td>
<td>135</td>
</tr>
</tbody>
</table>

Where \( f \) = centre frequency in kHz of each of the possible 8 kHz bands beginning at 8 kHz, and

\[
\text{dBV} = 20 \log \text{(voltage in volts)}.
\]

4.5 Impedance

Voiceband private circuits are designed at a nominal balanced impedance of 600 ohms. The CPE shall present a terminating impedance of 400 to 1200 ohms over the operating frequency range to the private circuit.

4.6 Amplifier Gain

In order to limit the level of crosstalk reproduction, any amplifier gain of the CPE shall be limited such that a signal level of -57 dBm or below appearing at the private circuit interface of the CPE will not be reproduced to an intelligible level.

4.7 Impulse Noise

The level of impulse noise transmitted to the private circuit by the CPE shall not exceed 2 V peak-to-peak.
5. INTERCONNECTION

5.1 Single-line CPE connection

Private circuits are presented in either 2-wire or 4-wire format. The FTNS operator will provide a modular socket as the Interconnect Point (IP) between the CPE and the private circuit; the CPE shall be provided with a standard plug to facilitate connection to or disconnection from the socket. The standard types of socket provided in Hong Kong are as follows -

(a) Standard UK type socket

Details of the standard modular plug and socket for single-line interface are shown in Figure 6. For a 2-wire private circuit, the connection points shall be on Terminal No. 2 and 5 of the plug. For a 4-wire private circuit, the “send” pair of the CPE shall be on Terminal No. 2 and 5 of the plug, while the “receive” pair shall be on Terminal No. 3 and 4.

Note: The network operator has ceased installing the UK type sockets since 1 February 2004.

(b) Standard RJ socket

The standard RJ socket provides an RJ-45 jack. Details of the socket are illustrated in Figures 7a and 7b. The RJ-45 jack is compatible with CPE equipped with either RJ-11 plug (6-position) or RJ-45 plug (8-position).

Note: The network operators may supply other optional types of telephone sockets, such as sockets with more than one RJ-45 jack to meet the service demand of customers.

The CPE shall provide modular plug for connection and disconnection to the socket provided by the network operator.

Note: Hong Kong has implemented a plan for transition of the plug and socket system from UK type to RJ type. Both RJ and UK sockets will certainly co-exist during the transition as operators take time for the socket replacement. Suppliers may offer single-line CPE using DEL with UK plug or RJ plug to cater for the market need and demand during the transition. To help reduce the potential connection problem, CPE suppliers are encouraged to provide their customers with appropriate UK-RJ adaptors or other means for plug conversion. However, in order to promote the use of the RJ system, the CPE seeking the certification after 1 February 2004 has been required to meet the RJ plug requirement.

5.2 Multi-Line Interconnection

Where multiple number of private circuits are terminated at the same location, hard-wired termination may be employed as the IP in lieu of modular sockets. All wiring within the IP (e.g. Interface Disconnection Box with Krone strips) will be connected and disconnected by the corresponding FTNS operator. The supplier / agent of the CPE will provide the cabling to the CPE side of the IP.
Terminal Spades or Plug Unit as appropriate

Modular Line Cord

UK Type Modular Line Cord

Standard Socket

Modular Plug

Pin No.

Details X

Standard UK Type Jack

Note: Plugs should conform to specification BS6312:1982. In addition, the following requirements must be complied with:

a. Minimum plating on all contacts of plugs to be 2.5 micron of gold over 3 micron of nickel, over base metal.

b. Ductility of the nickel undercoat plating should be well controlled so that there should be no cracking on the plating surfaces which could cause exposure of the substrate with sequential corrosion problems under extremely adverse environmental conditions.

Figure 6 Standard UK modular plug and socket
RJ-11/RJ-45 Plug with Cord

Standard RJ Socket

Note:  
1. For connection to the RJ-45 jack, the CPE should be provided with either RJ-11 (6-position) plug for 2-wire operation or RJ-45 (8-position) plug for 4-wire operation.

2. The RJ plugs should conform to the mechanical requirements as specified in TIA-968-A or TIA-1096-A. The hard gold contacts or contacts using alternative materials shall conform to the requirements of TIA TSB-31-B or TIA-1096-A.

Figure 7a: RJ Plug and Standard RJ Socket

Note:  
1. The diode-resistor test circuits are only incorporated in the master line socket.
2. The IDC connectors are labelled by numbers (1, 2, 3, 4) and colours (W=White, BL=Blue, O=Orange, G=Green, BR=Brown) for pair and polarity identification.
3. For sequential extension of unshielded twisted pair (UTP) wires from one socket to another.
4. The jack pin/pair assignment of a RJ socket is referred to designation T568A defined in TIA/EIA-568-B.1.
5. For Plain Old Telephone Service (POTS), L1 should be used.
6. For broadband services such as Ethernet, L2/L3 should be used.

Figure 7b: Details of Standard RJ Socket
6. **REFERENCE**

6.1 HKTA 2001 - “Compliance Test Specification - Safety and Electrical Protection Requirements for Subscriber Telecommunications Equipment” issued by the Telecommunications Authority


6.3 BS 6312: 1982 - “Specification for Plugs for Use with British Telecommunications Line Jack Units” issued by British Standards Institution

6.4 TIA-968-A “Telecommunication - Telephone Terminal Equipment - Technical Requirements for Connection of Terminal Equipment to the Telephone Network” issued by the Telecommunications Industry Association

6.5 TIA TSB-31-B - “Part 68 Rationale and Measurement Guidelines” issued by the Telecommunications Industry Association

6.6 TIA-1096-A “Connector Requirements for Connection of Terminal Equipment to the Telephone Network” issued by the Telecommunications Industry Association

- End -