PRIVATE AUTOMATIC BRANCH EXCHANGE (PABX) SYSTEM FOR CONNECTION TO PUBLIC SWITCHED TELEPHONE NETWORK (PSTN) AND INTERNET PROTOCOL (IP) NETWORK (SECOND REVISION)

Developed by

Registered by

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Development of technical codes

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SIRIM QAS International Sdn Bhd
Telekom Malaysia Berhad
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Foreword

This technical code for Private Automatic Branch Exchange (PABX) System for Connection to Public Switched Telephone Network (PSTN) and Internet Protocol (IP) Network ('this Technical Code') pursuant to section 185 of the Act 588.

This Technical Code was developed for the purpose of certifying communications equipment under the Communications and Multimedia (Technical Standards) Regulations 2000.

Major modifications in this revision is inclusion of IP technology requirement for IP PABX.

This Technical Code cancels and replaces SKMM MTSFB TC T003:2013, Specification for Private Automatic Branch Exchange (PABX) System for Connection to Public Switched Telephone Network (PSTN) (First Revision).

This Technical Code shall continue to be valid and effective until reviewed or cancelled.
PRIVATE AUTOMATIC BRANCH EXCHANGE (PABX) SYSTEM FOR CONNECTION TO PUBLIC SWITCHED TELEPHONE NETWORK (PSTN) AND INTERNET PROTOCOL (IP) NETWORK

1. **Scope**

This Technical Code specifies the technical requirements for legacy Private Automatic Branch Exchange (PABX) and Internet Protocol (IP) PABX system for connection to Public Switched Telephone Network (PSTN) and IP network respectively.

2. **Normative reference**

The following normative references are indispensable for the application of this Technical Code. For dated references, only the edition cited applies. For undated references, the latest edition of the normative references (including any amendments) applies.

See Annex A.

3. **Abbreviations**

For this Technical Code, the following abbreviations and acronyms applies:

- **AC** Alternating Current
- **A-CLIP** Analogue Calling Line Identity Presentation
- **AT** Access and Terminal
- **ATA** Analogue Telephone Adapter
- **CAT-5** Category 5
- **DHCP** Dynamic Host Configuration Protocol
- **DTMF** Dual Tone Multi-Frequency
- **ETH** Ethernet
- **FXO** Foreign Exchange Office
- **FXS** Foreign Exchange Subscriber
- **GSM** Global System for Mobile Communication
- **IDD** International Direct Dial
- **IPv6** Internet Protocol version 6
- **LAN** Local Area Network
- **NU** Number Unobtainable
- **POS** Point of Sale
- **PVC** Polyvinyl Chloride
- **RFC** Request for Comment
- **SP** Service Provider
- **SIP** Session Initiation Protocol
- **SRTP** Secure Real – Time Protocol
- **TE** Terminal Equipment
- **TCP** Transmission Control Protocol
- **TNV** Telecommunication Network Voltage
4. **General requirement**

4.1 **Power supply requirements**

Requirements for power supply are as follows:

a) For Alternating Current (AC) powered Terminal Equipment (TE), the operating voltage shall be rated/marked at 230 V or 240 V in line with the country's nominal voltage and frequency in accordance to MS IEC 60038. If the product is rated with multiple or a range of voltages, voltage range between 230 V (+ 10 %, - 6 %) shall be included. Testing shall be conducted based on 230 V (+ 10 %, - 6 %) or 240 V and other relevant voltages, if the product is marked with multiple or a range of voltages.

b) Product shall be rated/marked at 50 Hz and testing shall be conducted at 50 Hz. If the product is marked at 50/60 Hz or 50 Hz - 60 Hz then testing shall be conducted either at 50 Hz or 60 Hz, whichever is more unfavourable.

c) The design of the TE shall be such that all essential items of equipment of the TE shall be powered from batteries on float charge such that the performance of the system shall not deteriorate in any way on failure of the electricity mains supply. Non-essential test equipment and other auxiliary devices may directly work off the electricity mains supply.

d) The system shall operate on 48 V (nominal) with positive earthing, and shall function satisfactorily within a voltage range of 42 V to 54 V for not less than 80 % of the calls and shall function satisfactorily within a voltage range of 44 V - 52 V for 100 % of the calls.

e) Where external power supply is used, e.g. AC adaptor or battery, it shall not affect the capability of the TE to meet this specification.

f) Adaptor shall be pre-approved by the relevant regulatory body before it can be used with the TE.

4.2 **Power supply cord and mains plug requirements**

TE shall be fitted with a suitable and appropriate approved power supply cord and mains plug. Both are regulated products and shall be pre-approved by the relevant regulatory body before it can be used with the TE.

4.2.1 **Power supply cord requirements**

The power supply cord shall be certified according to:

a) MS 2112-5 or BS EN 50525-2-11 or IEC 60227-5 (Polyvinyl Chloride (PVC) insulated - flexible cables/cords); or

b) MS 140 or MS 2127-4 or IEC 60245-1 & IEC 60245-4 (Rubber insulated flexible cables/cords).
4.2.2 **Mains plug requirements**
The mains plug shall be certified according to:

a) MS 589: Part 1 or BS 1363: Part 1 (13 A fused plugs); or

b) MS 1577 or BS 546 (15 A plugs); or

c) MS 1578 or BS EN 50075 (2.5 A, 250 V, flat non-rewirable two-pole plugs).

4.3 **Polarity**
The performance of the TE shall be independent of the PSTN line polarity i.e. the TE shall conform to both polarities of the line feeding (clause A.3 of ETSI ES 203021-1).

4.4 **Interoperability and connectivity requirements**
TE shall comply with the minimum requirement that is specified by the Service Provider (SP).

4.4.1 **Interoperability**
TE shall be able to exchange and/or use information between two or more systems or components.

4.4.2 **Connectivity**
TE shall be able to link with other programs and devices to allow interoperability.

4.5 **Marking requirements**
Marking requirements are as follows:

a) TE shall be marked with the following information:
   i) supplier/manufacturer’s name or identification mark;
   ii) supplier/manufacturer’s model or type reference; and
   iii) other markings as required by the relevant standards.

b) The markings shall be legible, indelible and readily visible.

4.6 **Language**
All markings, software and related documents shall be in Bahasa Malaysia or English language.

4.7 **Electromagnetic compatibility and electrical safety requirements**
Requirements for electromagnetic compatibility and electrical safety are as follows:

a) TE shall comply with the limits for conducted disturbance at the mains terminals and telecommunication ports, and the limits for radiated disturbance defined in the IEC CISPR 32.

b) TE shall comply with the MS IEC 60950-1 safety standard. The requirements in MS IEC 60950-1 that are applicable to the TE e.g. class of equipment, type of Telecommunication Network Voltage (TNV) circuit and types of components shall be identified and complied with.
5. Technical requirements

5.1 Generic network diagram setup for Terminal Equipment (TE)

The generic network diagram of TE is as illustrated in Figure 1.

![Figure 1. Terminal Equipment (TE) network diagram](image)

5.2 Extension telephones and exchange lines

Requirement for extension telephones and exchange lines are as follows:

a) The PABX supplied shall be able to accept the use of:
   i) Dual Tone Multi-Frequency (DTMF) push-button telephones.
   ii) Rotary dial telephones (decadic pulse).

b) TE that connected to PSTN shall be designed to meet the following requirements:
   i) In addition, where PABX system is connected to PSTN, it shall comply with the requirements for connection to PSTN in accordance to SKMM MTSFB TC T001.
   ii) In addition, where PABX system supported Analogue Calling Line Identity Presentation (A-CLIP), it shall comply with A-CLIP requirement in accordance to SKMM MTSFB TC T002.

c) TE which the target stations are analogue lines, shall be designed to meet the requirements 5.3 and 5.4 (refer Table 1).

d) The input/output of IP PABX, shall be complied with Voice over Internet Protocol (VoIP) requirements as follows:


iii) Codec: ITU-T G.711 (a-law and µ-law) with an option ITU-T G.726 or ITU-T G.729A.

iv) DTMF: Inband, RFC 2833.


vi) IP assignment: Dynamic Host Configuration Protocol (DHCP) and/or Static IP.

vii) Addressing: RFC 6157 (applicable for Internet Protocol version 6 (IPv6)).

5.3 Tones and cadences

Requirement for tone and cadences are as follows:

a) The frequency and cadence for the tones shall comply with the specification in Table 1. The allowable frequency deviation is ± 5 % of nominal value.

b) The ring back tone shall be returned to the calling party whenever an extension line in the system is being rung, irrespective of whether the call is internal or external.

c) TE with capacity above 100 extensions shall be incorporated with Number Unobtainable (NU) tone facilities and shall comply with Table 1.

5.4 Ringing current

Requirement for ringing current are as follows:

a) Cadence of ringing current shall comply with the specification in Table 1.

b) Ringing current generator shall have open circuit voltage of not less than 75 V_{rms} and not greater than 85 V_{rms} and a design nominal frequency within the range of 16 Hz to 25 Hz. The total harmonic distortion shall not exceed 30 %.

c) Terminal voltage on full load shall be at least 60 V_{rms}.

<table>
<thead>
<tr>
<th>No.</th>
<th>Type of tone</th>
<th>Cadence (second)</th>
<th>Frequency (Hz)</th>
<th>Level (dBm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ringing current</td>
<td>0.4 ON 0.2 OFF, 0.4 ON 2.0 OFF</td>
<td>16-25</td>
<td>75 V_{rms}</td>
</tr>
<tr>
<td>2</td>
<td>Dial tone</td>
<td>Continuous</td>
<td>425</td>
<td>-15 to -9</td>
</tr>
<tr>
<td>3</td>
<td>Ring tone</td>
<td>Internal call</td>
<td>1.0 ON 3.0 to 5.0 OFF</td>
<td>425</td>
</tr>
<tr>
<td></td>
<td></td>
<td>External call</td>
<td>0.4 ON, 0.2 OFF, 0.4 ON, 2.0 OFF</td>
<td>425</td>
</tr>
</tbody>
</table>

Table 1. Ringing signal and service tone

Table 1. Ringing signal and service tone (continue)
### 5.5 Numbering scheme

The generic numbering scheme for TE should be as per Table 2.

**Table 2. Numbering scheme and description**

<table>
<thead>
<tr>
<th>Numbering scheme</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2xxx</td>
<td>Extension numbers</td>
</tr>
<tr>
<td>3xxx</td>
<td></td>
</tr>
<tr>
<td>4xxx</td>
<td></td>
</tr>
<tr>
<td>5xxx</td>
<td></td>
</tr>
<tr>
<td>6xxx</td>
<td></td>
</tr>
<tr>
<td>7xxx</td>
<td>Extension number/abbreviated dialling</td>
</tr>
<tr>
<td>8x</td>
<td>Tie lines(^1)</td>
</tr>
<tr>
<td>9</td>
<td>Access to exchange lines</td>
</tr>
<tr>
<td>0</td>
<td>PABX operator</td>
</tr>
<tr>
<td>1xx</td>
<td>Services</td>
</tr>
</tbody>
</table>

### 5.5.1 Extension lines and Terminal Equipment (TE) capacity

Extension Line and TE capacity are as follows:

a) TE with up to 50 extension lines, two digits numbering is acceptable.

b) TE with more than 50 extension lines and up to 500 extension lines, three digits numbering shall be used.

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\(^1\) Tie lines is a leased/dedicated circuit linking two PABXs located in different premises
c) TE with more than 500 extension lines, four digits and above shall be used, depending on the capacity of the system.

5.5.2 Public exchange lines

Access digit for the public exchange lines shall be ‘9’.

5.5.3 Operator

Access digit for the operator shall be ‘0’.

5.5.4 Tie-lines

The first digit of tie-lines access code shall be ‘8’.

5.5.5 Services

The first digit of services access code shall be ‘1’.

5.6 Transmission requirements

Requirements for extension line circuit are as follows:

a) The TE with Foreign Exchange Subscriber (FXS) interface shall function satisfactorily with an extension line loop resistance of up to 1,500 Ω with a leakage resistance of down to 20,000 Ω.

b) The TE with Local Area Network (LAN) interface shall function satisfactorily with maximum length of 100 m of minimum CAT-5 ethernet cable.

5.7 Route restrictions

Requirements for route restrictions are as follows:

a) The route restriction equipment shall be of the type that counts the total number of digits dialled as well as analyse the number of pulses of the first two or three digits so as to render the route restriction facility as fool-proof as possible.

b) Alternatively, the digit analysis in the route restriction equipment shall commence analysis of the first digit dialled only after the route restriction equipment detects the public exchange dial tone.

c) The route restriction equipment shall reactivate the digit analysis function whenever the public exchange dial tone is detected.

d) First two digits “00” (International Direct Dial (IDD)) and first three digits “101”, “103” and “108” are barred.
Normative references

MS 140, Specification for insulated flexible cords and cables


MS 1577, Specification for 15A plugs and socket-outlets for domestic and similar purposes

MS 1578, Specification for flat non-rewirable two-pole plugs, 2.5 A, 250 V, with cord, for the connection of class II-Equipment for household and similar purposes

MS IEC 60038, IEC standard voltages

MS IEC 60950-1, Information technology equipment - Safety - Part 1: General requirements

SKMM MTSFB TC T001, Specification for terminal equipment connecting to the Public Switched Telephone Network (PSTN)

SKMM MTSFB TC T002, Specification for Analogue calling line Identity presentation (A-CLIP) facility for connection to Public Switched Telephone Network (PSTN)

ITU-T G.711, Pulse Code Modulation (PCM) of voice frequencies

ITU-T G.726, 40, 32, 24, 16 kbit/s Adaptive Differential Pulse Code Modulation (ADPCM)

ITU-T G.729A, Coding of Speech at 8 kbit/s using Conjugate-Structure Algebraic-Code-Excited Linear Prediction (CS-ACELP)

ITU-T H.323, Packet-based multimedia communications systems

ITU-T T.38, Procedures for real-time Group 3 facsimile communication over IP networks

IEC CISPR 32, Electromagnetic compatibility of multimedia equipment - Emission requirements

IEC 60227-5, Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V - Part 5: Flexible cables (cords)

IEC 60245-4, Rubber insulated cables - Rated voltages up to and including 450/750 V - Part 4: Cords and flexible cables

ETSI ES 203 021, Access and Terminals (AT): Harmonized basic attachment requirements for Terminals for connection to analogue interfaces of the Telephone Networks; Update of the technical contents of TBR 021, EN 301 437, TBR 015, TBR 017

BS 1363: Part 1, 13 A plugs, socket-outlets, adaptors and connection units - Part 1: Specification for rewirable and non-rewirable 13 A fused plugs

BS 546, Specification for AC power plugs and sockets

BS EN 50075, Specification for flat non-wirable two-pole plugs 2.5 A 250 V, with cord, for the connection of class II-equipment for household and similar purposes
BS 6500, *Electric cables Flexible cords rated up to 300/500 V, for use with appliances and equipment intended for domestic, office and similar environments*

RFC 2833, *RTP Payload for DTMF Digits, Telephony Tones and Telephony Signals*

RFC 3261, *SIP: Session Initiation Protocol*

RFC 6157, *IPv6 Transition in the Session Initiation Protocol (SIP)*
Acknowledgements

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