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Document	:	General Specification for Public Address Systems		
Title	:	Amendment Summary		
Issue No.	:	6	Date	: April 2022

Date	Clause	Latest Issue No.	Amendment Details
April 2022	All	5	Page numbers have been added to the document (except cover page).
April 2022	2.1	5	Revised “sub-clause 2.2” to “the Particular Specification”
April 2022	2.1 (a)	5	Revised “speaker zones” to “broadcast zones, each consist of a designated group of loudspeakers”
April 2022	2.1 (d)	5	Added clause ”and/or mobile devices for sound input”
April 2022	2.1 (e)	5	Added new clause
April 2022	2.2	5	Revised the requirement to include “digital audio players” and “computer controlled or even IP-enabled control mechanism as stipulated in the Particular Specification”
April 2022	4.4 (b)	5	Revised “Frequency response of <u>DVD/CD</u> players, and <u>Digital</u> MP3 players/recorders is measured...” to “Frequency response of <u>disc</u> players, <u>audio players</u> and <u>digital</u> MP3 players/recorders is measured...”
April 2022	5.1.4 to 5.1.17	5	Deleted clause 5.1.4 and added new clauses 5.1.4 to 5.1.17
April 2022	6.1.1.1 (b)	5	Deleted “The required length of cable is specified in the Particular Specification”
April 2022	6.1.1.3 (a)	5	Revised “presence of” to “The microphone shall powered by 1 or 2 nos. of rechargeable batteries, and supplied with a battery charger. It shall be provided with a built-in on-off switch and possess”
April 2022	6.1.1.3 (c)	5	Revised “use of” to “The wireless microphone and tuner receiver shall use...”
April 2022	6.1.1.3 (d)	5	Revised “The microphone shall be provided with a built-in on-off switch” to “Tuner receiver shall be equipped with detachable antenna”

Date	Clause	Latest Issue No.	Amendment Details
April 2022	6.1.1.3 (e)	5	Added new clause
April 2022	6.1.9 (b) (iii)	5	Added “or other facilities to allow visual monitoring of volume level”
April 2022	6.1.11	5	Revised “DVD/CD” to “Disc”
April 2022	6.1.11 (a)	5	Revised “DVD/CD” to “disc”
April 2022	6.1.11 (a) (i)	5	Added “on the front panel”
April 2022	6.1.11 (a) (ii)	5	Revised “headphone jack preferably with volume control” to “disc slot on the front panel”
April 2022	6.1.11 (a) (iii)	5	Revised “output level control” to “USB slot on the front panel for playback of media stored on USB storage media”
April 2022	6.1.11 (a) (iv)	5	Replaced “fluorescent information display” with “LCD or LED display”
April 2022	6.1.11 (a) (v)	5	Added “(on front panel or via remote control unit)”
April 2022	6.1.11 (a) (ix)	5	Deleted “24 bit DAC converter or better” and added “Blu-ray disc”
April 2022	6.1.11 (a) (xi)	5	Added new clause
April 2022	6.1.12	5	Revised Digital MP3 Player as Digital Audio Player. Added audio format M4A
April 2022	6.1.1.4, 6.1.4 (c), 6.1.5 (b), 6.1.6 (b), 6.3	5	Updates have been made to the textually commented clauses to align the text content in other clauses.
April 2022	6.3 (a)	5	Textual comment has been incorporated to the latest draft.
April 2022	7.1.1	5	Clauses rephrasing has been incorporated to the latest draft.
April 2022	7.2.6	5	Added new clause

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1. Scope

- 1.1 This specification lays down the technical specification, functional features and performance characteristics of basic equipment items, materials used and standard of workmanship, which are required for the provision of a general public address system.
  
- 1.2 This specification should be read in conjunction with the “General Requirements for Electronic Contracts, ESG01” and the Particular Specification. Unless otherwise stated in the Particular Specification and/or written instruction(s) of the Engineer, the requirements laid down in this document shall apply to all contracts/orders issued by the Electrical & Mechanical Services Department for the supply and installation of public address or sound systems.

## 2. Description of System

2.1 A public address system shall comprise items stipulated in the Particular Specification for the performance of the following functionalities:-

- (a) effect live broadcast or broadcast of pre-recorded materials (pre-recorded messages or background music) to one or more selected broadcast zones, each consist of a designated group of loudspeakers,
- (b) allow scheduled broadcast of pre-recorded materials at pre-determined times to pre-selected loudspeaker zone(s),
- (c) broadcast of signals from different audio sources to different groups of loudspeaker zones simultaneously,
- (d) allow connection to other line-level audio sources, to allow the flexibility for the users to use ad-hoc disc player and/or mobile devices for sound input;
- (e) prioritise different source of signals for broadcast in the selected broadcast zones

2.2 The system shall typically consist of:

- microphones,
- mixer(s), pre-amplifier(s) and/or power amplifier(s),
- digital audio players,
- loudspeaker(s) of various types to suit the local environment,
- control and monitoring panel(s)
- computer controlled or even IP-enabled control mechanism as stipulated in the Particular Specification etc.
- other ancillary equipment, e.g. attenuator.

Microphone inputs of different priority and groupings of loudspeakers to serve a number of broadcast zones may be required. Detailed tailoring of individual system shall be referred to the relevant requirements in Particular Specification.

### 3. Related Documents and Specification

#### 3.1 Statutory Obligations

Materials and equipment shall be built and installed complying with the following:

- (a) Electricity Ordinance, Chapter 406, and other subsidiary legislation made under the Ordinance;
- (b) Telecommunications Ordinance, Chapter 106, and other subsidiary legislation made under the Ordinance;
- (c) Environmental Impact Assessment Ordinance, Chapter 499 and other subsidiary legislation made under the Ordinance.

#### 3.2 Reference to User/Design/Installation Specification

The following references shall serve as normative guides for the contractor on design, installation and other requirements:-

- (a) the latest issue of “General Requirements for Electronic Contracts, ESG01” issued by Electrical and Mechanical Services Department of the Government,
- (b) the latest edition of “General Specification for Electrical Installation in Government Buildings” issued by the Architectural Services Department of the Government,
- (c) the latest edition of IEC 60386 “Method of Measurement of Speed Fluctuations in Sound Recording and Reproducing Equipment”,
- (d) the latest edition of IEC 60268-1 “Sound system equipment. Part 1: General”,
- (e) the latest edition of IEC 60268-2 “Sound system equipment. Part 2: Explanation of general terms and calculation methods”,
- (f) The latest edition of EIA/CEA-490 Standard Test Methods of Measurement for Audio Amplifiers.

#### 3.3 Other National or International Standards

Equipment complying with other national and international standards may be offered. Tenderers shall demonstrate clearly that these standards are equivalent to or better than those standards required by this Specification.

## 4. Definition

### 4.1 Terminology and Glossary of Terms

“Government” means the Government of the Hong Kong Special Administrative Region of the People’s Republic of China.

### 4.2 Abbreviations

- (a) “BS” means British Standards
- (b) “EIA” means Electronic Industries Alliance of USA
- (c) “IEC” means International Electrotechnical Commission
- (d) “r.m.s.” means root mean square
- (e) “LED” means light emitting diode
- (f) “EMSD” means Electrical and Mechanical Services Department
- (g) “OFCA” means Office of the Communications Authority

### 4.3 Measuring Systems

All units are SI units.

### 4.4 Measuring Criteria

- (a) Unless otherwise stated, all voltage, power levels, power or voltage ratios for amplifiers are r.m.s. measured at 1 kHz or relative to measurement made at 1 kHz.
- (b) Frequency response of disc players, digital audio players and recorders is measured on a record/playback basis at nominal record and playback signal levels. If a -20dB recording level is required for this parameter, it should be clearly stated.
- (c) Sensitivity of loudspeakers is measured at a distance of 1 metre with a random noise signal of 1 watt.

## 5. System Requirements

### 5.1 Design Criteria

- 5.1.1 Power amplifiers shall have power ratings with at least 10 % spare capacity to drive all the loudspeakers that they are respectively intended to serve.
- 5.1.2 The system shall be designed for 24x7 round-the-clock operation.
- 5.1.3 The system shall preferably be designed with energy saving features which allows the lower power consumption during standby / power failure.
- 5.1.4 The system shall be configured with time-synchronisation device to synchronise the system time with GPS time. If the system is connected to the Internet, it can instead be synchronised to the time server of the Hong Kong Observatory, subject to the requirement in the Particular Specification and approval by the Engineer.
- 5.1.5 The following schedule options shall be made available for scheduled announcement:-
- (i) broadcast day: specific dates and repeated monthly / weekly / daily; and
  - (ii) broadcast time: exact time and specified duration / repeated times.
- 5.1.6 A paging microphone shall be provided at the central equipment rack for announcement. Remote microphone(s) and / or mobile devices such as Android device or iPhone shall be available for playing audio outputs as indicated in the Particular Specification.
- 5.1.7 The paging devices in 5.1.6 shall be built-in / integrated with chime generators to generate a chime (configurable as a single-tone chime, a 2-tone chime and a 4-tone chime) when the remote microphone is activated.
- 5.1.8 Output to each loudspeaker line shall be protected with matching transformer of appropriate capacity.
- 5.1.9 The impedance of the loudspeakers shall be higher than or equal to that of the

channel.

- 5.1.10 The Contractor shall ensure that sound pressure level be evenly distributed in each broadcast zone and take into consideration the possible background noises, reflections, echoes, delays and reverberation in the environment during the design of the system and shall ensure that the system function properly and stably without acoustic feedback.
- 5.1.11 The sound pressure level of the output sound shall be at least 10dB higher than that of the background at the coverage area measured at around 1.5m high.
- 5.1.12 Monitor panel shall be provided for visual and aural monitoring of the output level of each broadcast zone.
- 5.1.13 Volume attenuator shall be installed at designated areas for user to locally control the output power of the loudspeakers installed at the same room / area. Such designated areas typically include but not limited to the following and those marked on the drawings:-
- (i) function rooms, meeting room and conference rooms;
  - (ii) office area including reception / enquiry counters which are not in open area;
  - (iii) places as stipulated in the Particular Specification.
- 5.1.14 System controlled by computer and/or connected by IP network switch shall be equipped with uninterruptible power supply unit.
- 5.1.15 Computers shall be provided for configuration of networking devices, including those equipment with networking function, e.g. for configuration of scheduled announcement. Software (with perpetual license) necessary for configuration and control of the equipment shall be supplied and be installed on the computer.
- 5.1.16 The system shall be able to operate normally at its basic functions when the computers for system configuration are not powered on.
- 5.1.17 Each equipment cabinet of the system shall be installed with a single on/off switch and power sequencer such that the following power on/off sequence

can be achieved automatically:-

- (i) when the system is switched on , the power amplifiers are the last items being turned on; and
- (ii) when the system is switched off, the power amplifiers are the first items being turned off and the other items be turned off after a period of delay time.

## 6. Equipment Functional Requirements and Performance Characteristics

### 6.1 General Equipment Requirement

#### 6.1.1 Microphone

##### 6.1.1.1 Unidirectional Handheld Microphone

- (a) It shall be of dynamic type provided with built-in blast and pop protection and microphone holder.
- (b) The microphone shall be provided with a built-in on-off switch and a suitable length of cable.
- (c) All cables for microphones shall be terminated with Cannon XLR-type connectors.
- (d) Where required, the microphones shall be provided with a tiltable mount and hardware adaptable to the floor stand or desk stand (Items 6.1.2 and 6.1.3 refer.)

##### 6.1.1.2 Miniature Omnidirectional Lavalier Microphone

- (a) It shall be lightweight and unobtrusive with smooth exterior and recessed grill screen minimizing clothing noise.
- (b) It shall be of rugged aluminum case construction and fitted with a flexible long-life cable. The lavalier cord shall be easily snapped onto or disengaged from a clasp of the lavalier holder.
- (c) A proper cable anchoring shall be provided and shall be terminated with the connector.

##### 6.1.1.3 Wireless Microphone with receiver

- (a) The microphone shall powered by 1 or 2 nos. of rechargeable batteries, and supplied with a battery charger. It shall be provided with a built-in on-off switch and possess LED or LCD indicator(s) for battery status and/or on-off status
- (b) RF carrier power shall be less than 50mW
- (c) The wireless microphone and tuner receiver shall use OFCA-approved

frequencies or frequencies which have been exempted from licensing and complying with CAP 106Z “Telecommunications (Telecommunications Apparatus) (Exemption from Licensing) Order, Telecommunications Ordinance”

- (d) Tuner receiver shall be equipped with detachable antenna.
- (e) The following performance shall be satisfied
  - (i) support auto-frequency selection;
  - (ii) operating range: 90 meters or more;
  - (iii) receiving sensitivity: -105dBm for 12 dB SINAD; and
  - (iv) image rejection: 50dB or less.

6.1.1.4 It shall satisfy the following performance characteristics:-

- (a) on-axis frequency response not to vary by more than +6 dB, -10 dB over the frequency range 100 to 10 000 Hz, relative to 1 kHz,
- (b) sensitivity not to be less than 1.0 mV/Pa (-77 dB ref. 1 V/ubar) at 1 kHz,
- (c) distortion to be less than 0.5% at 1 kHz at 30 Pa sound pressure level input,
- (d) front-to-back discrimination ratio to be greater than 15 dB for 300 to 5,000 Hz for unidirectional microphones,
- (e) balanced, low impedance in the range 200 to 600 ohm at 1 kHz.

6.1.2 Microphone Floor Stand & Boom Arm

- (a) The floor stand shall comprise a substantially constructed heavy cast black painted base supporting a satin chrome finished column with a self-locking device permitting the inner column to be raised or lowered with one hand within a range of adjustment from 900 to 1600 mm nominal.
- (b) Adaptor for microphone or adaptor for the boom arm shall be provided.
- (c) The boom arm shall comprise a satin chrome finished tubing with a suitable size of counter weight. The length shall not be less than 700 mm.
- (d) The boom arm shall be fitted with a locking device for snapping onto the adaptor of the microphone floor stand.
- (e) The boom adjustment range shall be 360° in any direction.

### 6.1.3 Microphone Desk Stand & Flexible Gooseneck Shaft

- (a) The desk stand shall be similarly constructed as the floor stand but with a short satin chrome pillar, with adjustment by means of a clamping ring designed to support the microphone 100 to 200 mm above desk top.
- (b) The flexible gooseneck shaft shall be a stainless steel flexible tubing of not less than 300 mm and permit easy bending in any direction of 45°.
- (c) The gooseneck shall be fitted with a thread insert and a XLR-type connector for easy mounting onto a desk stand on one end and a microphone on the other.

### 6.1.4 Mixer-Power Amplifier

- (a) The mix-power amplifier shall be fully solid-state, and provided with balanced floating outputs of 70 V and 100 V for loudspeaker connections.
- (b) As a minimum requirement, the mixer-power amplifier shall be provided with the following facilities: -
  - (i) power on/off switch,
  - (ii) mains 'on' indicator lamp,
  - (iii) independent mixing volume control for each input,
  - (iv) master volume, bass and treble tone controls,
  - (v) three-core flexible cord and correctly fused plug for mains supply and earth connection,
  - (vi) AC and DC fuse protection,
  - (vii) standard sockets complete with plugs and locking rings for each input and terminals for loudspeaker output.
- (c) It shall satisfy the following performance characteristics: -
  - (i) microphone input sensitivity not to be greater than 0.5 mV for rated output for source impedance of 200 to 600 ohm balanced,
  - (ii) high level input sensitivity not be greater than 400 mV for rated output for source impedance up to 50K ohm,
  - (iii) preamplifier provided at least 60 dB signal range from noise to clipping,
  - (iv) frequency response not to vary by more than + 3 dB over the frequency range 50 to 15 000 Hz, at rated output power,
  - (v) total harmonic distortion at rated output not to exceed 2% between 50 and 15 000 Hz, distortion shall not increase at lower power output,
  - (vi) noise level to be better than 65 dB below rated output with input shorted, over the frequency range 50 to 15 000 Hz, unweighted.

### 6.1.5 Mixer-Preamplifier

- (a) The mixer-preamplifier shall be fully solid-state and provided with the following facilities: -
  - (i) power on/off switch,
  - (ii) independent mixing volume for each input,
  - (iii) master volume, bass and treble tone controls,
  - (iv) flexible cord and correctly fused plug for mains supply connection,
  - (v) AC and DC fuse protection.
  
- (b) It shall satisfy the following performance characteristics: -
  - (i) microphone input sensitivity not to be greater than 0.5 mV for rated output for source impedance of 200 to 600 ohm,
  - (ii) high level input sensitivity not to be greater than 400 mV for rated output for source impedance up to 500K ohm,
  - (iii) r.m.s. output level not to be less than 0 dBm,
  - (iv) output impedance: 600 ohm balanced,
  - (v) preamplifier provides at least 60 dB signal range from noise to clipping,
  - (vi) frequency response not to vary by more than + 2 dB over the frequency range 50 to 15 000 Hz at rated output,
  - (vii) total harmonic distortion at rated output not to exceed 1% between 50 and 15 000 Hz, distortion shall not increase at lower power output,
  - (viii) base control  $\pm 10$  dB at 100 Hz,
  - (ix) treble control  $\pm 10$  dB at 10 000 Hz,
  - (x) noise level to be better than 80 dB below rated output with input shorted, over the frequency range 50 to 15 000 Hz, unweighted.
  - (xi) provision of at least one priority input for the connection of external signal device for scheduled or emergency notification. The priority input shall override all other inputs with muting.

### 6.1.6 Power Amplifier

- (a) The power amplifier shall be fully solid-state and provided with the following facilities: -
  - (i) power on/off switch,
  - (ii) mains 'on' indicator lamp,
  - (iii) input protection against overload,
  - (iv) volume control,
  - (v) balanced floating output of 70 V and 100 V for loudspeaker connections,
  - (vi) flexible cord and correctly fused plug for mains supply connection,
  - (vii) AC and preferably with DC fuse protection,
  - (viii) standard sockets complete with plugs and locking rings for each input and terminals for loudspeaker output.

- (b) It shall satisfy the following performance characteristics: -
  - (i) input sensitivity not to be greater than 0.77 V for rated output for source impedance of 600 ohm,
  - (ii) frequency response not to vary by more than  $\pm 3$  dB over the frequency range 50 to 15 000 Hz,
  - (iii) total harmonic distortion at rated output power not to exceed 1% between 50 and 15 000 Hz, distortion shall not increase at lower power output and/or less than full load,
  - (iv) noise level to be better than 70 dB below rated output with input shorted, over the frequency range 50 to 15 000 Hz unweighted,
  - (v) output regulation to be less than 2 dB from no load to full load, the amplifier shall be stable under no load conditions.

### 6.1.7 Loudspeaker

#### 6.1.7.1 Horn Speaker

- (a) The horn speaker shall be perfectly weatherproof and complete with built-in multiple tapping matching transformer and mounting bracket suitable for mounting onto any hard surfaces or masts.
- (b) It shall satisfy the following performance characteristics: -
  - (I) General Purpose Horn Speaker
    - (i) on-axis frequency response not to vary by more than  $\pm 10$  dB over the frequency range 250 to 6 000 Hz,
    - (ii) sensitivity not to be less than 103 dB/W.
  - (II) Wide Range Horn Speaker
    - (i) on-axis frequency response not to vary by more than  $\pm 10$  dB over the frequency range 200 to 15 000 Hz,
    - (ii) sensitivity not to be less than 95 dB/W.

#### 6.1.7.2 Speaker Column

- (a) The speaker column shall comprise at least four dynamic cone speaker units arranged in column on a baffle board. Multiple tapping matching transformers shall be provided.
- (b) The enclosure shall be acoustically designed to provide a unidirectional wide lateral beam spread of sound with limited cover in the longitudinal direction.
- (c) The wooden enclosure shall be rigid and complete with high quality front grille cloth, and fibre glass or BAF insulation lining of not less than 20 mm thick covering the interior column; speech coils and magnet air gaps shall be protected against ingress of dust and moisture.

- (d) The column shall be suitable for mounting on any hard surface and the mounting mechanism shall permit free rotation about the vertical axis and adjustable tilting angle. Mounting brackets shall be supplied.
- (e) The column shall be finished to harmonize with the wall or immediate background.
- (f) It shall satisfy the following performance characteristics: -
  - (i) on-axis frequency response not to vary by more than  $\pm 10$  dB over the frequency range 200 to 10 000 Hz,
  - (ii) sensitivity not to be less than 95 dB/W.

#### 6.1.7.3 Ceiling Mount Speaker

- (a) The speaker shall be either suitable for flush mounting to a false ceiling of any configuration, or for surface mounting if there is not false ceiling. It shall be equipped with a multiple tapping matching transformer to provided easy control of speaker sound volume. A dust proof bag or metal box shall be provided to protect the speaker. Supporting brackets to mount the speaker onto false ceilings of different configurations shall be provided.
- (b) It shall satisfy the following performance characteristics: -
  - (i) on-axis frequency response not to vary by more than  $\pm 10$  dB over the frequency range 200 to 8 000 Hz,
  - (ii) sensitivity not to be less than 90 dB/W.

#### 6.1.7.4 Box Speaker

- (a) The speaker shall be contained in a rigid wooden enclosure designed for surface mounting. Its inner rear section shall be fitted with sound absorption lining.
- (b) It shall satisfy the following performance characteristics: -
  - (i) on-axis frequency response not to vary by more than  $\pm 10$  dB over the frequency range 200 to 10 000 Hz,
  - (ii) sensitivity not to be less than 90 dB/W.

#### 6.1.8 Speaker Selector

- (a) The speaker selector shall allow speaker groups and all-call circuit to be selected individually, collectively or in any combinational manner.
- (b) Each speaker group and the all-call circuit shall be provided with lamp

indicators to show the conditions of use.

- (c) Each switch shall be capable of handling the power of its controlling circuit.

#### 6.1.9 Monitor Panel

- (a) The monitor panel shall be made of stainless steel or anodized aluminum. All labels shall be engraved if the panel is custom made.
- (b) As a minimum requirement, the panel shall be provided with the following facilities: -
  - (i) monitor speaker with volume control,
  - (ii) system power on/off switch,
  - (iii) VU meter or other facilities to allow visual monitoring of volume level,
  - (iv) channel selector switch,
  - (v) line voltage selector switch for monitoring 70 V or 100 V outputs.

#### 6.1.10 Relay Control Box

- (a) The relay control box shall be made of stainless steel or anodized aluminum.
- (b) The relay control box shall be equipped with adequate relays sets to provide inhibit circuits to microphone inputs. When requested by the Engineer, the tenderer/contractor shall submit a schematic diagram to show the operation of the circuit.

#### 6.1.11 Disc Player

- (a) The disc player shall be provided with the following facilities: -
  - (i) power on / off switch on the front panel with indicator,
  - (ii) disc slot on the front panel,
  - (iii) USB slot on the front panel for playback of media stored on USB storage media,
  - (iv) LCD or LED display,
  - (v) direct track selection buttons (on front panel or via remote control unit),
  - (vi) output level control,
  - (vii) random and disc/track repeat playback,
  - (viii) remote control unit,
  - (ix) Blu-ray disc, CD, CD-R, CD-RW, DVD-R, DVD+R, DVD-RW & MP3, M4A playback capability,
  - (x) optical digital outputs and RCA analog outputs.
  - (xi) two (2) female HDMI output connectors where one of the connector is for output of audio.

- (b) It shall satisfy the following performance characteristics: -
  - (i) frequency response not to vary by more than  $\pm 1$  dB over the frequency range 20 to 20 000 Hz,
  - (ii) signal-to-noise ratio to be better than 100 dB,
  - (iii) wow and flutter to be less than measurable limit,
  - (iv) total harmonic distortion to be less than 0.0025%,
  - (v) dynamic range to be better than 95 dB,
  - (vi) channel separation to be better than 90 dB,
  - (vii) analog output level to be at 2V r.m.s.,
  - (viii) sampling frequency to be at 44.1 kHz or above.

#### 6.1.12 Digital Audio Player

- (a) The device shall be a professional multi-format media player that capable of the following functions/features:-
  - (i) support playback of audio from audio CDs, data CDs (including CD, CD-R, CD-RW), USB memory devices;
  - (ii) support playback of audio files from Bluetooth® (version 4.2 or newer) connected devices, including but not limited to smartphones, tablets and portable music players;
  - (iii) support playback of external audio input via TRS or auxiliary (AUX) input connector;
  - (iv) support playback audio files of all the following formats: WAV, MP3, M4A, CD-DA, WMA, AAC;
  - (v) support solid-state storage device with capacity of up to at least 32 GB or more;
  - (vi) support the following playback mode: continuous, shuffle, single, repeat;
  - (vii) provide playback time display in terms of elapsed time of track, remained time of track, total elapsed time, total remained time;
  - (viii) support control by wireless remote controller;
- (b) The device shall have the following physical characteristics:-
  - (i) power on/off button on front panel;
  - (ii) backlit LCD display for displaying the track no. and elapsed time;
  - (iii) one (1) no. of CD drive complete with CD slot and eject button on front panel;
  - (iv) one (1) no. of USB slot on front panel;
  - (v) Bluetooth pairing button;
  - (vi) one (1) no. of 3.5mm stereo audio input connector on front panel (10kohm impedance);
  - (vii) one (1) no. of audio output with volume control on front panel for

- monitor headphone (if the connection interface is not 3.5mm audio jack, converter shall be provided for connection of 3.5mm audio plug);
  - (viii) playback control buttons (including but not limited to play;/pulse, stop, forward, backward, next, previous and playmode) on front panel;
  - (ix) audio output interface: RCA unbalanced and XLR balanced;
  - (x) rack-mountable;
  - (xi) provided with remote control with battery for remote control of the device.
- (c) It shall satisfy the following performance characteristics: -
- (i) frequency response: 20Hz – 20kHz, +/-1dB;
  - (ii) total harmonic distortion: less than 0.005% or less;
  - (iii) S/N ratio: 95dB or more;
  - (iv) dynamic range: 90dB or more; and
  - (v) channel separation: 90dB or more.

#### 6.1.13 Equipment Cabinet

- (a) The cabinet shall be sufficient strength and rigidity to house the equipment. It shall be complete with locking door and three-pin power sockets.
- (b) The cabinet shall be constructed from either teakwood of at least 15 mm thick or stainless steel of at least 1.2 mm thick, depending on individual system requirements.
- (c) Facilities shall be provided for good free ventilation and easy access of connecting cables from outside for maintenance.

## 6.2 Cable Requirement

### 6.2.1 General

- (a) All cables shall be of low smoke zero halogen (LSZH) type unless otherwise stated or explicitly approved by the Engineer or his representative(s).

### 6.2.2 Microphone Cable

- (a) The microphone cable shall be flexible twisted pair of insulated tinned annealed copper conductors, with tinned copper braided shield, and outer sheath. The colour of the sheath shall be either light grey or white.
- (b) The cable shall satisfy the following minimum characteristics: -
  - (i) at least 16 strands per conductor,

- (ii) strand diameter not to be less than 0.15 mm,
  - (iii) nominal outer diameter not to be greater than 5 mm,
  - (iv) capacitance between conductors not to be more than 110 pF/m,
  - (v) inner conductor d.c. resistance not to be more than 36 ohm/km at 20°C,
  - (vi) insulation thickness not to be less than 0.25 mm.
- (c) For lavalier microphone, the cable shall satisfy (iv) to (vi) above and
- (i) at least 10 strands per conductor,
  - (ii) strand diameter not to be less than 0.1 mm,
  - (iii) nominal outer diameter not to be greater than 3.4 mm.

### 6.2.3 Loudspeaker Cable

- (a) The loudspeaker cable shall consist of a pair of insulated stranded, oxygen-free tinned copper conductors, and shall be sheathed in approved colour.
- (b) The cable shall satisfy the following minimum characteristics: -
- (i) at least 19 strands per conductor,
  - (ii) strand diameter not to be less than 0.21 mm,
  - (iii) nominal outer diameter not to be greater than 8 mm,
  - (iv) insulation thickness not to be less than 0.5 mm.
- (c) Direct burial of underground cables without approvals is not allowed. Underground cables installed inside underground ducts shall be steel-wired armoured, and depending on the likelihood and extent of accumulation of water inside the ducting system, may use, subject to approvals, cables with non-LSZH sheath of increased water resistance.

### 6.3 Connector & Accessories Requirement

- (a) All audio connectors for wall panels, mixer inputs, microphones, etc., shall be Cannon XLR type.
- (b) Each indoor loudspeaker shall be terminated through a 2 A three-pin plug and socket complying with the latest edition of BS 546:1950 and supplements or its international equivalent standard to facilitate easy removal of the loudspeaker. Locally made plug and socket of equivalent standard is also acceptable. The Contractor shall be responsible for properly mounting the socket base plate onto any existing adaptable box provided by others as instructed by the Engineer. Outdoor loudspeakers shall be terminated through weatherproof type plugs and sockets provided with a push-on cap and cap retaining ring.

- (c) A sheet metal box with stainless steel cover shall be required to house one Cannon XLR male or female socket and a pilot LED indicator. The LED shall be 'screw-in' type for easy replacement. Both the socket and LED shall be provided.

## 7. Installation Requirements

### 7.1 General

7.1.1 The installation shall comply with the installation requirements stipulated in the “General Requirements for Electronics Contract”, ESG01.

### 7.2 System-specific requirement

7.2.1 Lines shall be run in separate conduits for microphone or line level circuits (up to +30 dBm), loudspeaker circuits (above +30 dBm), and power circuits. All other conduits shall be spaced not less than 50 mm from power conduits. Power conduits shall be grounded to the power system ground.

7.2.2 Microphone and 600 ohm lines shall be insulated from the conduit and from each other for the entire conduit length. Microphone and 600 ohm line conduits shall be mechanically and electrically connected to receptacle boxes and electrically grounded to the audio system ground point. Lines in conduit shall not be spliced.

7.2.3 Microphone line shields shall be grounded only at the microphone frame. Other shields shall be grounded only at the power amplifier inputs or at the control equipment outputs. Continuity of shields shall be preserved at connecting points. All audio grounds in the sound equipment rack(s) shall be connected to a common point on the rack(s). This point shall be connected to the building ground.

7.2.4 All audio lines, including microphone lines, line-level lines and loudspeaker lines, shall be floating with respect to the ground, either side of audio lines shall be grounded. If the equipment has a single ended input or output, it must be provided with isolation transformers to provide the floating conditions. Muting of microphones shall be done by shorting the microphone output, not by opening the circuit. Cut-off or transfer switches in line-level lines or loudspeaker lines shall be two-pole, switching both sides of the line simultaneously.

7.2.5 Outputs of power amplifiers shall not be inter-connected. Loudspeaker lines

leaving the equipment rack(s) shall be connected via barrier strip terminals.

- 7.2.6 Signal input cables shall be kept away from the signal output cables to avoid oscillation.

- End -