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CONTENTS

	Page
1. INTRODUCTION	6
2. SUPPORTING CLAUSES	6
2.1 SCOPE	6
2.1.1 Purpose	6
2.1.2 Applicability	6
2.2 NORMATIVE / INFORMATIVE REFERENCES	9
2.2.1 Normative	9
2.2.2 Informative	9
2.3 DEFINITIONS	9
2.3.1 Classification	11
2.4 ABBREVIATIONS	11
2.5 ROLES AND RESPONSIBILITIES	12
2.6 PROCESS FOR MONITORING	12
2.7 RELATED / SUPPORTING DOCUMENTS	12
3. TECHNICAL SPECIFICATIONS	12
3.1 PROJECT DEFINITION	12
3.2 CONTRACTOR'S SCOPE OF WORK	13
3.3 COMPLIANCE TO LEGISLATION, STANDARD AND PROCEDURES	13
3.3.1 Legislations	13
3.3.2 Standards	13
The Contractor shall comply with the following standards for All equipment shall comply with the following Standards.	13
3.3.2.1 HMI and Network	13
3.3.2.2 Electrical	13
3.3.2.3 Civils	14
3.3.2.4 Quality	14
3.3.2.5 Procedures	14
3.4 PUBLIC ADDRESS SYSTEM SPECIFICATIONS	14
3.4.1 Public Address System Cabinets and Housings	14
3.4.2 System Architecture	14
3.4.3 Zones	15
3.4.4 Background Music (BGM)	15
3.4.5 Tones and Pre-Recorded Messages	15
3.4.6 Control Panel	16
3.4.7 Critical Signal Path Monitoring and Fault Detection / Indication	16
3.4.8 Power Supplies and Standby Batteries	17
3.4.9	17
3.4.10 Redundancy	17
3.4.11 Reliability	18
3.4.12 Interfaces	19
3.4.13 System Event Log	19
3.4.14 Speakers and Associated Accessories	19
3.4.14.1 Ceiling Speakers (Single cone)	19
3.4.14.2 Ceiling Speakers (A-B Wiring)	19
3.4.14.3 Wall-Mount Box (Cabinet) Speakers	20
3.4.14.4 Horn Speakers	20
3.4.14.5 Bi-Directional Project Speakers	21
3.4.14.6 Attenuators and Attenuator Mountings	21
3.4.15 On-site Management Requirement	21
3.4.16 Remote Management Requirements	22
3.4.17 System Set-up, Configuration, and Commissioning	22
3.4.18 Factory Acceptance Test (FAT)	22
3.4.19 Installation and Site Acceptance Testing (SAT)	22

CONTROLLED DISCLOSURE

3.4.20 System Manuals(s) Documentation / Certificates.....	22
3.4.21 System Lifecycle	23
3.4.22 Warranty and Support.....	23
3.4.23 Cyber Security	23
3.4.23.1 Cyber Security Design Strategy	23
3.4.23.2 Network Segregation	23
3.4.23.3 Antivirus and Malware Protection	24
3.4.23.4 Software and Licencing	24
3.5 CIVILS AND STRUCTURAL SPECIFICATIONS.....	24
3.6 EQUIPMENT ENVIRONMENTAL CONDITION SPECIFICATION	24
3.7 QUALITY CONTROL AND QUALITY ASSURANCE SPECIFICATIONS	24
3.8 DETAILED SCOPE OF WORK.....	24
3.8.1 General Requirements.....	24
3.8.2 Project Specification Requirements.....	24
3.8.3 Location of the Works / Area to be covered.....	25
3.8.4 Drawings and Tables Applicable to the Project	26
3.8.5 Key Personnel Requirements	26
3.8.5.1 Project Manager	26
3.8.5.2 Project Site Supervisor	26
3.8.5.3 Accredited Access Equipment Personnel	26
3.8.5.4 Electrical Works Personnel.....	26
3.8.5.5 Accredited Technology / Product Specific Technical Personnel	26
3.8.5.6 Accredited Fibre Optic Technician.....	27
3.8.5.7 Additional Personnel Requirements	27
3.8.6 Technical Requirements	27
3.8.6.1 Equipment Housing / Rack	27
3.8.6.2 System Architecture.....	27
3.8.6.3 Zones, Zonal CCTs and CCT Loads	28
3.8.6.4 Back-Ground Music (BGM)	28
3.8.6.5 Tones – Pre-recorded Messages	28
3.8.6.6 Microphones	28
3.8.6.7 Power Supplies and Supply Protection	29
3.8.6.8 Component Power Supplies	30
3.8.6.9 Redundancy.....	30
3.8.6.10 Critical Signal Path monitoring / Surveillance and Fault Detection / Indication.....	31
3.8.6.11 Interfaces	31
3.8.6.12 System Event Log	31
3.8.6.13 On-site Management Requirements	31
3.8.6.14 Remote Management Requirements	31
3.8.6.15 Factory Acceptance Testing (FAT).....	31
3.8.6.16 Site Acceptance Testing.....	32
3.8.6.17 Warranty and Support	32
3.8.6.18 Distribution of Terminal Equipment	33
3.8.6.19 Specification Requirements for installation of Speakers and Associated Cabling and Hardware	35
3.8.6.20 Equipment Rack and Microphone Cabling	37
3.8.6.21 Existing Standalone PA System in National Control	37
3.8.6.22 Fibre Optic Cable, Terminations & Testing	37
3.8.6.23 Junction Boxes and Terminal Blocks.....	37
3.8.6.24 Additional Testing	38
3.8.6.25 Training.....	38
3.8.6.26 Human-Machine Interface (HMI) Training	38
3.8.6.27 Training on Re-initialization of the System	38
3.8.6.28 Optimisation.....	38
3.8.6.29 Commissioning	39
3.8.6.30 Partial Handover	39
3.8.6.31 Engineering and the Contractor’s Design.....	39
3.8.6.31.1 Employer’s Design.....	39
3.8.6.31.2 Part of the Works which the contractor is to design.....	39

CONTROLLED DISCLOSURE

3.8.6.32 Procedure for the substation and acceptance of the contractor's design	39
3.8.6.33 Equipment required to be included in the works	40
3.8.6.34 Configuration Management	40
3.8.6.35 As-built/ floor plan drawings	40
3.8.6.36 Documentation.....	40
3.8.6.37 Re-measurable items	40
3.8.6.38 Air-conditioning requirements.....	41
3.8.6.39 Electrical requirements	41
3.8.6.40 Tender returnable (technical)	41
3.8.6.40.1 Method Statements	41
3.8.6.40.2 Sample Inspection and Test Plans (ITPs) and Quality Acceptance Documents	41
3.8.6.40.3 Draft Schedule.....	41
3.8.6.40.4 Data / Specification sheets.....	41
3.8.6.40.5 Data Management.....	42
3.8.6.40.6 Product Certification / Conformity Documents	42
3.8.7 Architectural Schematics	42
3.8.7.1.1 Rack Layout.....	43
3.8.7.1.2 Left Over and Recovered Material	43
3.8.7.1.3 Guarantees	43
3.8.7.1.4 Training.....	43
4. AUTHORISATION	44
5. REVISIONS.....	44
6. DEVELOPMENT TEAM.....	44
7. ACKNOWLEDGEMENTS.....	44
APPENDIX A : TECHNICAL SPECIFICATION OUTPUT DOCUMENTS	45
APPENDIX B : TRADE STUDIES PERFORMED.....	46

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EXECUTIVE SUMMARY

The purpose of this document is to procure, installed, test and commission the public address voice announcement primarily be used for the purpose of broadcast information and guidance voice instructions during an emergency to ensure correct implementation of the emergency response plan. The System shall primarily use to provide clear one-way voice communication and audio alarm tones during an emergency to affect a rapid and orderly evacuation of everyone in response to the emergency. Some buildings are located across the main complex on Power Street as well as conference and accommodation facility located alongside Victoria Lake.

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1. INTRODUCTION

This specification is for phase two (2) of the overall public address solution. The PA system will primarily be used to broadcast informative and guidance voice instructions during an emergency to ensure correct implementation of the emergency response plan. The main function of the PA system is to ensure effective communication to all employees, *Contractor*, and visitors during emergency evaluation. System shall primarily use to provide clear one-way voice communication and audio alarm tones during an emergency to affect a rapid and orderly evacuation of everyone in response to the emergency. Some buildings are located across the main complex on Power Street as well as conference and accommodation facility located alongside Victoria Lake. The entire complex has been declared a National Key Point. The main complex houses two main Control Centre facilities with three control rooms that are operational throughout year on a 24-hour basis. Besides the control centres, the complex houses many workshops, storage facilities, laboratories, offices, and boardrooms.

2. SUPPORTING CLAUSES

2.1 SCOPE

This section of the specification describes and specifies Simmerpan requirements for the design, supply, delivery, installation, testing, commissioning, handing over in approved working order and maintenance during the defects liability period of the of site wide Public Address (PA) system as part of the emergency preparedness and response plan.

2.1.1 Purpose

The objective of this project is to provide a Voice Alarm (Public Address) to obtain the certificate of compliance to meet the building, test, and commissioning compliant with standard and specification as listed in this document for purpose for the purpose of managing safety on site. The scope forms the initial phase of several phases of the project and caters for the area as listed in the document.

2.1.2 Applicability

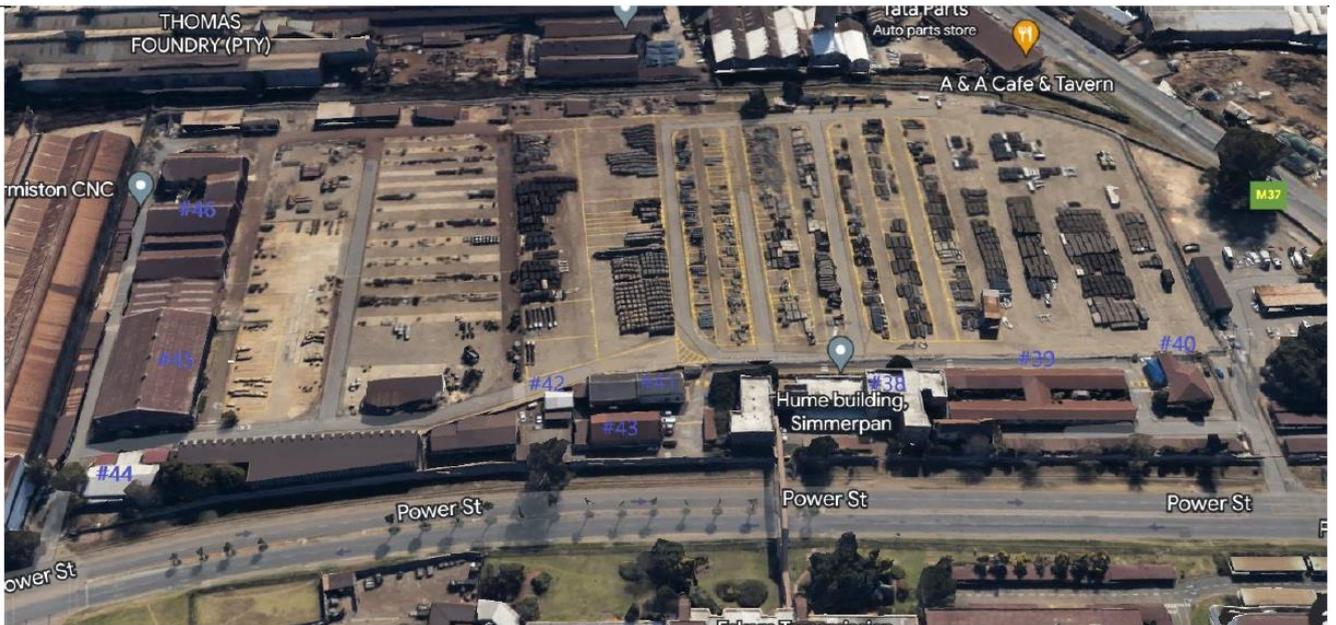
This specification is applicable to Eskom Simmerpan public address system phase (2) with specific reference to areas Medical Centre, Safety Risk Management, Transport Building (Distribution), Live Line Building, School of Technology, Psychometric (Transport Building), PTM&C, Switchgear, T System, Tom Store, Victor Lake Inn, Hume Building, Transit Building, Risk Management, Gymnasium, Transmission Stores, Metering Lab, West Gate Offices, WP&CS – Prefab, ET Stores, Telecoms, Central Grid Maintenance Workshop, Instrument Workshop, Panel Workshop (Eng. Ground Floor), BIPM (Eng. 1st Floor), Simmer Centre EPMD, Simmer Centre finance, Simmer Centre HR, Central Grid, HV Lab (Live work test facility), DC Lab.

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Table 1: List of Building Applicable

Phase 2			
#	BUILDING/ DEPARTMENT	#	BUILDING/ DEPARTMENT
1	Safety Risk Management	17	Switchgear
2	Transport Building (Distribution)	18	T System
3	Live Line Building	19	Tom Store
4	School of Technology	20	VLI
5	Psychometric (Transport Building)	21	Hume Building
6	PTM&C	22	Transit Building
7	Telecoms	23	Risk Management
8	ET Stores	24	Gymnasium
9	Metering Lab	25	Transmission Stores
10	Medical Centre	26	BIPM (Eng. 1st Floor)
11	Simmer Centre EPMD	27	Instrument Workshop
12	Simmer Centre Finance	28	Panel Workshop (Eng. Gr Floor)
13	Simmer Centre HR	29	BIPM (Eng. 1st Floor)
14	Central Grid maintenance Workshop	30	
15	HV Lab (Live work test facility)	31	
16	DC Lab		

2.2 NORMATIVE / INFORMATIVE REFERENCES

Parties using this document shall apply the most recent edition of the document listed in the applicable paragraphs. The list of applicable codes, standards and guidelines that need to be satisfied with this design are referenced under Section 3 of this specification.

2.2.1 Normative

- [1] ISO 9001 Quality Management Systems

2.2.2 Informative

- [2] None.

2.3 DEFINITIONS

Definition	Description
<i>Contractor</i>	The main principal <i>Contractor</i> that is responsible for the Works of this project
Microphone Station	A device which converts sound energy into electrical energy. The output voltage is very low and typically ranges between 0.0001 volts and 0.005 volts (100µV and 5.0mV).
Equipment Rack	A housing consisting of all amplifiers, power supplies, audio control units, batteries, management equipment, patch panels, Ethernet switches, multi-media units, audio recorders and any other component required in the management of a zone.

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Employer	The Client for this project being Eskom Holdings.
Controlled Disclosure	Controlled disclosure to external parties (either enforced by law, or discretionary)
<i>Employer</i>	The Client for this project being Eskom Holdings.
Amplifier	A device with raises the voltage or current generated by a low-level devices such as microphone to the level necessary to operate the loudspeaker(s). Amplifiers normally have an output voltage of 100 volts
Quiescent Condition	Functional condition characterised by the absence of the voice-alarm, fault-warning, disabled and test conditions.
Voice Alarm Condition	Alert signal, evacuated signal, recorded or live emergency signal broadcast in at least one emergency loudspeaker zone.
Zone	A demarcated area within an area that is covered by a system. A zone may include several sub-zones.
Background Music (Not allowed for this contract)	Refers to the playing of music at a low level to produce a comfortable working ambiance. The volume level of which BGM should be played is important to its effectiveness and should ideally be adjusted so that should the music stop it is not immediately noticeable.
Loudspeaker	A device which converts electrical energy produced by the amplifier into sound energy. For paging and evacuation purpose they mostly fall into two categories: <ul style="list-style-type: none"> ○ Ceiling type loudspeakers are usually built into wall mounting cabinets and baffles designed for ceiling mounting. This type of loudspeakers is typically used in indoor environments such as offices, passageways, shops and waiting rooms. ○ Horns type loudspeakers are typically used in industrial environments such as workshops, factories, warehouses, and for outdoor installations. ○ Bidirectional speakers ○ Cabinet Speakers – wall/surface mount speakers typically used escape stairs, storerooms and kitchens
Line Level	Depending on local practice, amplifiers usually amplify the audio signals to 50 V, 70 V, or 100 V speaker line level.
System	An integrated set of constituent pieces that are combined in an operational or support environment to accomplish a defined objective. These pieces include people, hardware, software, firmware, information, procedure, facilities, services, and other support facets.

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Definition	Description
Sound pressure Level	It is a measure of the ability to convert electrical energy into sound energy. The SPL generated by a loudspeaker varies over a wide range and there are many factors, which determine the SPL. Quoted SPL figures are usually referenced to an input power of 1 watt and measured at a distance of 1 metre. The RMS sound pressure expressed in dB re 20 microPa (The lowest threshold of hearing for 1 kHz). [As points of reference, zero dB-SPL equals the threshold of hearing, while 140dB-SPL equals irreparable hearing damage.

2.3.1 Classification

Controlled disclosure: controlled disclosure to external parties (either enforced by law, or discretionary).

2.4 ABBREVIATIONS

Abbreviation	Description
BGM	Background Music (Not allowed in this contract)
CCA	Copper-clad Aluminium
CCT	Circuit (Used in reference to speaker line)
CoC	Certified of Compliance
DEC	Data & Energy Compliance
Dx	Distribution (A division of Eskom Holdings)
EN	European Norm
TRE	Transmission Real Estate
FAT	Factory Acceptance Testing
FOA	Fibre Optic Association
GA	General Arrangement (In reference to drawings)
HDD	Heavy Duty Duct
HMI	Human-Machine Interface
IP	Internet Protocol
ISO	International Organisation for Standard
LAN	Local Area Network
MDF	Main Distribution Frame
MJB	Maintenance Junction Box
MCB	Main Circuit Breaker
NCC	National Control Centre
NMC	Network Management Centre
OEM	Original Equipment Manufacturer

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OTDR	Optical Time Domain Reflectometer
SABS	South African Bureau of Standards
SAQCC	South African Qualification and Certification Committee
SAT	Site Acceptance Testing
SME	Subject Matter Experts
Tx	Transmission (A division of Eskom Holdings)
VLAN	Virtual Local Area Network

2.5 ROLES AND RESPONSIBILITIES

Compiler: Responsible to compile the document and to ensure that the content is integrated to reflect the requirements of stakeholders forming part of this project.

Functional Responsibility: The Functional Responsible person is responsible to approve the content of the document and assure its correctness before the document is submitted for authorisation.

Authoriser: The document authoriser is responsible to ensure that the correct processes were followed in developing this document and that the relevant stakeholders have been involved. The Authoriser also reviews the document for alignment to business strategy, policy, objectives, and requirements. He/she will authorise the release and application of the document.

Maintenance: Transmission Real Estate (TRE) Facility Management to determine the maintenance regime of all its assets under its control, guided by application Eskom Standards and legal requirements.

2.6 PROCESS FOR MONITORING

This document will be internally reviewed by the Transmission Real Estate and Simmerpan facilities management team.

2.7 RELATED / SUPPORTING DOCUMENTS

Due to the sensitivity of the site, relevant supporting documentation and floor diagrams will be made available to the successful *Contractor* after agreeing to a Non-Disclosure clause.

3. TECHNICAL SPECIFICATIONS

3.1 PROJECT DEFINITION

The objective of this project is to provide a de-centralised EN-54 Voice Alarm (Public Address) Evaluation system compliant with the standard and specification as listed in this document for the purposes of managing safety on site. This scope forms the 2nd phase of the project and caters for the areas as listed in the document. The system shall be scalable to ultimately provide a single integrated system to cater for broadcasts to all or selected areas / zones of the entire Simmerpan complex. The detailed requirements for the 2nd phase are as specified in this document. The system shall be highly reliable and provide a certain degree of redundancy. The system shall be capable of self-monitoring in real time and capable of isolating system failures. The proposed system shall require minimum or limited maintenance.

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3.2 CONTRACTOR'S SCOPE OF WORK

The *Contractor* provides a de-centralised EN-54 Voice Alarm (Public Address) Evacuation system for the buildings listed in section 3.8 of this specification and is compliant with the standard and specification as listed in this document.

3.3 COMPLIANCE TO LEGISLATION, STANDARD AND PROCEDURES

The *Contractor* complies with the latest revisions of the legislations, standards and procedures listed in the subsection below. The *Employer* provides the Eskom standards and procedures to the *Contractor*.

All other legislations and standards will not be supplied by the Employer. It is the Contractor's responsibility to source all other standards for the purposes of this project.

3.3.1 Legislations

- Occupational Health and Safety Act, Act 85 of 1998.
- National Building Regulations And Building Standard Act No. 103 of 1977
- SANS 10400 The application of the National Building Regulations – All Parts.
- Engineering Professional Act, 2000 (Act No. 46 of 2000)
- Department of Employment and Labour (DOL) mandate to the South African Qualifications Certification Committee (SAQCC) Fire

3.3.2 Standards

The *Contractor* shall comply with the following standards for All equipment shall comply with the following Standards.

- EN54 Part 4 (EN54-4) – Voice Alarm Power Supply Equipment.
- EN54 Part 16 (EN54-16) – Voice Alarm and Indicating equipment.
- EN54 Part 24 (EN54-24) – Voice Alarm Loudspeakers.
- Speakers may also conform to ISO 7240-24 and / or BS-5839-8 standard.
- IEC 62236-4/ EN 50121- 4 - The electromagnetic standards which applies to a signalling and telecommunication apparatus installed in railways environment.
- ISO 7240 Part 19 (7240-19) – Design, Installation, Commissioning, and Maintenance of Sound Systems for Emergency purpose.
- Only equipment certified under EN54 Standard by an authorised certification body may be proposed.
- All modems, routers, switches, patch panels, and external media inputs shall be ICASA approved.
- EN 55032:2015 Class A, EN 55024:2010 and EN 61000-3-2:2014, EN 61000-3-3: 2013

3.3.2.1 HMI and Network

- 240 – 129014618 Generation Cyber Security Compliance Guidelines.
- 240- 64038621 Remote Device Communication Standard for Data Retrieval and Remote Access.

3.3.2.2 Electrical

- SANS 10142 The wiring of premises Part 1: Low-voltage installations.
- 240 – 56227443 Requirements for Control and Power Cables for Power Station Standard. (Also applicable to TRE premises).
- 240- 51999453 Valve Regulated Lead Acid Battery Standard.
- 240-56360086 Ni-Cad Battery Standard

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- 240-56364545 – Structural Design and Engineering Standard

3.3.2.4 Quality

- 240-105658000 Supplier Quality Management: Specification
- QM58 Quality Management Standard
- ISO 9001: 2015 Quality Management Standard

3.3.2.5 Procedures

- 240-53114026 Project Engineering Change Management Procedure
- 240-53113685 Design Review Procedure

3.4 PUBLIC ADDRESS SYSTEM SPECIFICATIONS

3.4.1 Public Address System Cabinets and Housings

- All system equipment shall be housed in 600mm (W) x 800mm (D) floor-standing cabinets.
- The height of each housing shall allow for at least 20% spare capacity excluding allowance for adequate ventilation.
- The housing shall be constructed of steel be powder coated.
- The housing shall include the option of castors with braking mechanisms on all wheels.
- Both, front and rear access doors must be lockable and be supplied with spare keys.
- The rack loading capacity shall be suitable to accommodate the total weight of all the components it is intended to house.
- Housing shall have a 4-WAY fan tray on the inside of the roof of the housing and include earthing point/s.
- All housings shall have cable entry points from the bottom as well as the top.
- The housing loading capacity shall be suitable to accommodate the total weight of all the components it is intended to house.
- Housing data sheets shall be supplied for technical evaluation.

3.4.2 System Architecture

- System shall be scalable allowing for de-centralised components in different locations under a centralised control over a packet-based network backbone.
- The system components shall provide network redundancy by doubling on the TCP/IP Ethernet interfaces, supplying two ports for audio and data control transmission on each decentralised device.
- The system shall support an additional analogue audio reserve path to allow for an all-call paging in case of a network failure or CPU failure, as well as signal path line faults anywhere between microphone(s) and amplifier(s).
- The de-centralised zones shall have their local audio output / inputs, battery surveillance capability, battery charging capability, and speaker line surveillance capabilities.
- The system manager system manager shall be capable of monitoring all de-centralised zones centrally and logging all events.
- All system components shall be modular and of the 19" rack-mount type.
- All components of the system except for multi-media inputs, recording/playback devices, batteries, and network connectivity switches shall be from any authorised registered manufacturer.
- Control of the entire system must be software-driven using the Microsoft Windows preferably the latest operating system with the latest security updates.

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- The system shall not be part any other system such as a fire control system but be capable for integration with other stand-alone system such as Fire control panels.
 - Operational tasks must be performed by menu buttons with visible LCD displays and LED statues.
 - The system shall cater for an initial of 2 microphone and / or external line-level inputs which can be expandable to a minimum of 16 such inputs.
 - The system shall cater for an initial minimum of 8 amplifier outputs which can be expandable up to 256 such outputs.
 - The system shall cater for a minimum of 8 audio channels for general broadcasts (paging, announcements, BGM, etc.) and 4 audio channels for emergency broadcasts which can be processed simultaneously.
 - The system shall provide for a minimum of 32 level of priority settings. This is to assign different levels of management of the system.
 - The system shall be capable of accommodating A-B speakers wiring configuration.
 - The system shall be capable of handling of emergency broadcasts, background music and paging announcements, simultaneously in different zones. However, emergency conditions “all-call” shall be prioritised over all broadcasts.
 - The system shall be capable of broadcasting up to four different emergency messages (alert and evacuation) simultaneously into individual zones or groups of zones, to avoid unnecessary evacuations in non-affected areas thereby avoiding a state of panic.
 - The system shall provide programming of four 3-phase alarm sequences.
 - The phases shall be triggered automatically by a programmable timer, or externally by the fire detection system or the emergency microphone panel.
 - The number of phases can be matched to the requirements.

3.4.3 Zones

- The system must be supplied with a minimum of 8 zones with the option to increase this to a maximum of 32 zones by a process of augmentation.
- The system must be programmable to select individual zones, or group zones, as well as all call paging

3.4.4 Background Music (BGM)

- The system shall be able to play back-ground music from any media player input.
- The background music shall be selectable to play on any designated zones, group of zones, or all zones.
- The BGM shall be programmable to select volume settings individual from the front control panel of the Audio Output module or by programmable software.
- The system shall be able to over-ride any Background Music broadcasts during emergency and general paging.

3.4.5 Tones and Pre-Recorded Messages

- The system shall accommodate for a minimum of 16 tones and / or pre-recorded messages or a combination thereof.
- The tones / pre-recording messages shall not be stored on a rotary disc.

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3.4.6 Control Panel

The contractor supplies the following for control panel:

- VX-3000 CT Control Panel with 9 function keys and 8 volume control knobs for easy operation.
- Function keys will be used for public address operation such as the activation of general broadcast.
- Volume controls allow volume level adjustment of the VX-3000 Frame’s audio input or audio output (assignable).
- Up to 2 units can be connected to a single CV-3000 Frame.



Figure 1: X-3000 Control Panel with volume control section cover

Applicable Model	VX-3000 CT
Power Sources	20 - 33 V DC, removable terminal block (4 pins)
Current Consumption	0,09 A at 33V DC input, 0.11 A at 24 V DC input
LAN A, B	Number of Connectors: 2 (LAN A, LAN B) Network I/F: 100BASE-TX Connection Device: VX-3004F, VX-3004F, VX-3008F, VX-300, VX-3000CT, VX-3000PM, Switching HUB Connector: RJ45 connector, Connection Cable: Category 5 twisted pair cable (CAT5) or greater Maximum cable distance: 100m
Panel Indicator	Power (Green) x 1, Run (Green) x 1, Link/ACT (Green) x 2, Signal (Green) x 8, Fault (Yellow) x 1, Status (Green/Yellow) x 9, Select (Green) x 9
Volume Control	8 Channels
Operation	Function key x 9, Reset Key x 1, IP address setting switch x 1
Dimensions (W x H x D)	482 x 44 x 315.2mm
Weight	3 kg

3.4.7 Critical Signal Path Monitoring and Fault Detection / Indication

- The system shall be capable of monitoring all speaker lines by means of impedance monitoring and indicating all faults.
- All faults shall be indicated via the microphone unit immediately upon occurrence of each fault.
- The surveillance shall include open CCTx, short CCTx, and earth leakage (ground) faults on speaker lines.
- The sensitivity of the speaker line monitoring shall be adjustable to prevent any false indications.
- The following faults are also to be indicated on the microphone unit(s) as General Faults:
 - CPU failure
 - Mains supply failure.
 - Stand-by batteries and charger.
 - Stand-by amplifiers.
 - All protective devices such as fuses

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- The fire-alarm broadcast initiation point(s)
 - Emergency messages
 - Interlinks between different components.
 - Battery faults
- The indication of faults should be announced within 100 seconds of occurrence of the fault.
 - Remote viewing and downloading of the data shall also be possible using native web-interface running on the monitoring modules, as this allows configuration of the devices through HTTP/S protocols.
 - Software shall remain the property of NTCSA and be located on an Eskom server. The licence shall also remain the property of Eskom and all upgrades within the first 5 years of installation, shall be at no cost to NTCSA.

3.4.8 Power Supplies and Standby Batteries

- The system shall be equipped with EN 54-4: 1997 + A2: 2006 compliant stand-by batteries to cater for a minimum stand-by period of 24 hours and a continuous broadcast of 30 minutes at full power.
- The power supply manager VX-3000DS shall also comply with EN 55032 Class A, CPR with EN 54-2 (see figure 2).
- The system shall be powered by applicable DC voltage via power supply modules working off 230V AC and must be capable of a seamless transition between AC and DC.
- Standby batteries shall be of the sealed Vent regulated Lead Acid (VRLA), flame retardant variety and maintenance free.
- Standby batteries shall comply with EN 50272 and EN6 0896-2 standards or the Eskom standard for VRLA batteries. 240-51999453. Alternative technology batteries may be proposed provided the charging circuit is suitable for the proposed batteries.
- The minimum lifespan of the batteries shall be 5-10 years.
- The system must be capable of discharging and re-charging each battery at a pre-determined interval for purposes of keeping each battery in optimal condition.



Figure 2: Power Supply VX-3000DS

3.4.9

3.4.10 Redundancy

The *Contractor* Shall ensure that the following requirements are complied with:

- The system shall allow for the redundancy on both, fibre, and copper concurrently.
- Redundant Network shall be configured with LAN connection for more reliability system as shown in figure 1.
- Redundancy for audio broadcasts shall be provided over copper via analogue link ports.
- The system shall allow for call broadcasts even during failure of the system manager CPU.
- A stand-by amplifier which is equal to or higher in capacity than the capacity of any other amplifier in the same rack, shall be installed to adequately serve any fault amplifier in a zone.

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- The standby amplifier must be able to take over the load of any amplifier that has failed, without the need for any human interface.
- The system must be powered with essential services power supply or from a UPS source of supply (excluding standby batteries).

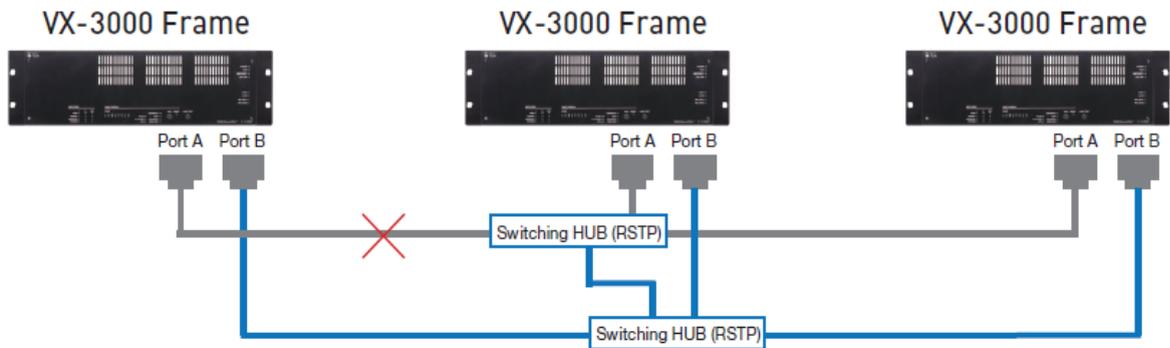


Figure 3: Redundant Network System

3.4.11 Reliability

The Contractor shall ensure that the following requirements are complied with:

- Redundant system configuration shall be supplied with network connection, standby amplifier setting and backup power supply.
- Advance failure detection
- Fault indications assignable to control outputs, remote microphone function keys, VX 3000 Frame's LEDs, buzzers, e-mail notification, etc.
- Redundant Amplifier can be shared among the multiple VX-3000 Frames such as depicted in here below:

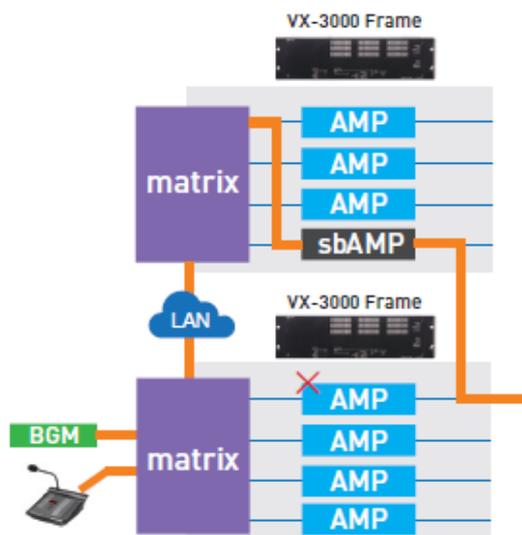


Figure 4: Standby amplifier with VX-3000 Frames

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3.4.12 Interfaces

- The system shall be capable of accommodating any external inputs from stand-alone panels such as fire detection and access control panels.
- The system shall be capable of accommodating any external inputs from stand-alone system such Building Management System (BMS).
- The system shall also be capable of providing outputs to trigger indicating equipment such as buzzers and lights.
- The system shall have an Ethernet port for the purposes of connecting a service terminal as well as connection to a LAN port for remote access.

3.4.13 System Event Log

- The system shall be capable of logging a minimum of 10 000 event logs on a storage drive in text format which can be accessed even after a total system failure.
- The system event log must be accessible remotely.
- The log format must be able to be exported into MS® Excel as well as PDF formats.

3.4.14 Speakers and Associated Accessories

3.4.14.1 Ceiling Speakers (Single cone)

- A product data sheet is to be supplied for purposes of technical evaluation.
- Speaker to be EN54-24/ISO 7240-24 and compliant with BS 5839-8: 2008 14.8.
- A Construction Product Directive certificate is to be supplied for the speaker.
- Maximum speaker output at 100V: 6W
- Speaker tap settings: The output of the speaker shall be adjustable to a minimum of 2 output wattages lower than its maximum wattage.
- Maximum sensitivity (SPL): 94dB (1W; 1M)
- Speaker shall include a ceramic terminal connector block and a thermal fuse.
- Maximum mounting hole diameter: 150mm Mounting of speakers in ceiling structures need to be done in such nature as not to compromise the structural integrity of the ceiling and not compromise the aesthetics of the installed infrastructure.
- The colour of the speakers should be such a nature to blend in with the installed ceilings.
- The speaker should not have a metal fire-dome but must include a protect jacket fitted over the cone unless otherwise specified.
- Speaker mounting: The speaker shall be mounted into the bracket via a clamping mechanism to maintain or replace the speaker as required for maintenance.

3.4.14.2 Ceiling Speakers (A-B Wiring)

- A product data sheet is to be supplied for purposes of technical evaluation.
- Speaker to be EN54-24/ISO7240-24 and compliant with BS 5839-8: 2008 14.8.
- A Construction Product Directive certificate is to be supplied for the speaker.
- Maximum speaker output at 100V: 6W (15 W for 15W version)
- Speaker tap settings: The output of the speaker shall be adjustable to a minimum of 2 output wattages lower than its maximum wattage.
- Maximum sensitivity (SPL): 94dB (1W; 1M); (98dB for 15W versions)
- Speaker shall have a ceramic terminal connector block and a thermal fuse.
- Speaker mounting: The speaker enclosure shall be a wooden box with the speaker mounted into the bracket via a clamping mechanism to maintain or replace the speaker as required for maintenance. (15W versions shall be supplied with a steel bracket for mounting).

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3.4.14.3 Wall-Mount Box (Cabinet) Speakers

- A product data sheet is to be supplied for purposes of technical evaluation.
- Speaker to be EN54-24/ISO7240-24 and compliant with BS 5839-8: 2008 14.8.
- A Construction Product Directive certificate is to be supplied for the speaker.
- Maximum speaker output at 100V: 6W (15 W for 15W version)
- Speaker tap settings: The output of the speaker shall be adjustable to a minimum of 2 output wattages lower than its maximum wattage.
- Maximum sensitivity (SPL): 94dB (1W; 1M); (98dB for 15W versions)
- Speaker shall have a ceramic terminal connector block and a thermal fuse.
- Speaker mounting: The speaker enclosure shall be a wooden box with the speaker mounted into the bracket via a clamping mechanism to maintain or replace the speaker as required for maintenance. (15W versions shall be supplied with a steel bracket for mounting).

3.4.14.4 Horn Speakers

The *Contractor* shall provide the following:

- A product data sheet is to be supplied for purposes of technical evaluation.
- Speaker to be EN54-24/ISO7240-24 and compliant with BS 5839-8: 2008 14.8.
- A Construction Product Directive certificate is to be supplied for the speaker.
- Maximum speaker output at 100V: 15W for 15W version; 30W for 30W version.
- Speaker tap settings: The output of the speaker shall be adjustable to a minimum of 2 output wattages lower than its maximum wattage.
- Maximum sensitivity (SPL): 109dB (1W; 1M) for 15W version; 113dB (1W; 1M) for 30W version
- Minimum IP rating: IP65 (Indoor & outdoor application)
- Speaker shall include a ceramic terminal connector block and a thermal fuse.
- Speaker mounting: Speaker shall be supplied with a surface-mount bracket that can be fitted horizontally or vertically and would allow the speaker to be panned as required.
- The speaker must be made of a suitable weather- and UV-resistant material whilst all brackets and securing hardware shall be made from lightweight corrosion resistant material.
- Cable entry: Speaker shall be supplied with 1 compression gland with the option of fitting a second compression gland via a knockout.



Figure 5: Horn Speaker

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Dimension (W x H x D)	285 x 227 x 277 mm
Dimensions (ø x D)	X 277 mm
Finish	Aluminium, powder coating, off-white (RAL 9010 or equivalent), Reflector horn, trans case and terminal cover: ABS resin, off-white (RAL 9010 or equivalent) Bracket, screws and bolts: Stainless steel

3.4.14.5 Bi-Directional Project Speakers

The *Contractor* shall provide the following:

- A product data sheet is to be supplied for purposes of technical evaluation.
- Speaker to be EN54-24/ISO7240-24 and compliant with BS 5839-8: 2008 14.8.
- A Construction Product Directive certificate is to be supplied for the speaker.
- Maximum speaker output at 100V: 20W
- Speaker tap settings: The output of the speaker shall be adjustable to a minimum of 2 output wattages lower than its maximum wattage.
- Maximum sensitivity (SPL): 89dB (1W; 1M)
- Minimum IP rating: IP66 (for indoor & outdoor application)
- Speaker shall have a ceramic terminal connector blocks and thermal fuses.
- Speaker mounting: The speaker shall include a bracket which can be used to install the speaker flush against a flat surface or another mounting structure.
- Both speakers in the enclosure shall be angled 180 degrees apart from each other.
- Speaker mounting: The speaker shall include a bracket which can be used to install the speaker flush against a flat surface or another mounting structure.

3.4.14.6 Attenuators and Attenuator Mountings

The following specification shall be adhered to:

- A product data sheet is to be supplied for purposes of technical evaluation.
- Attenuation: minimum of 5 step attenuation including "OFF".
- Colour should be aesthetically adaptable to the surroundings and practically maintainable.
- Input range: Optional ranges to accommodate the respective speaker line load.
- Attenuators shall be capable of handling an override command from the system.
- Surface-mount boxes for attenuators shall also be included.

3.4.15 On-site Management Requirement

- On-site management of the EP/PA system will be via human interface through a computerised system.
- Hardware for on-site management of the system shall be non-proprietary components.
- The Management / Administrative software and licensing shall execute maintenance routines of the entire system, monitor the operational status of all components of the system (including speakers), and changing the configuration parameters of the system both on site and remotely by way of Eskom LAN or Internet access.
- Event log database capable of recording all system faults as well as all controls effected through human interface.
- The system shall include an external voice activated recording device to record all announcements made via each of the microphones.
- The recorder should be a capable of recording in multiple formats onto compact disc/s and/or high-capacity SD card/s.

CONTROLLED DISCLOSURE

- All recorded data must contain date & time stamp information during recording & playback.
- Access to on-site management system service terminal must be password protected.

3.4.16 Remote Management Requirements

- The medium of access into the remote system and/or on-site management system shall be via the Eskom Intranet and / or the internet.
- The remote management must not require any specialised remote management platform to access the installed location/s remotely.
- The licensing terms and conditions applicable to the Remote Management Platform shall be stipulated.
- All the functionalities provided over remote access configuration shall be listed.
- The Remote Management System shall generate status reports concerning all aspects of the respective EP/PA system and its components. Such reports shall be capable of being exported and transmitted electronically.
- Remote access to any of the installed sites must be password protected.

3.4.17 System Set-up, Configuration, and Commissioning

- All components of the system must be installed and wired by the supplier in each equipment rack.
- The system shall also be configured as per end-user requirements and commissioned.
- The supplier shall have the capability of configuring the software interface to integrate the voice alarm system into a Building Management System (BMS).

3.4.18 Factory Acceptance Test (FAT)

- The supplier shall configure and rig the system in their premises for Factory Acceptance Testing by Eskom and the end-user prior to deployment to the installation site.
- The FAT exercise shall be in adherence with the requirements of parts the EN54 suite of standards applicable to Voice Evacuation systems.

3.4.19 Installation and Site Acceptance Testing (SAT)

- The supplier shall install the system on site (excluding speakers, speaker cabling, and backbone cabling) inclusive of all interconnections between the de-centralised zones.
- The SAT exercise shall be in adherence with the requirements of parts the EN54 suite of standards applicable to Voice Evacuation systems.

3.4.20 System Manuals(s) Documentation / Certificates

- Multiple copies of the system design & architecture, system components, User Manuals, and all other Data Sheets are to be supplied with the system.
- All components and equipment must be supplied with their CPD certification documents.
- Where requested, only CPD certificates issued by a registered "Notified Body" under ECC will be valid.
- The manuals, documentation, and certificates must be made available in both, hard and soft copy formats.
- The initial fingerprint of the system stored in the system post configuration shall be provided as a soft copy.
- A maintenance fingerprint of the installed base shall also be provided in an electronic format.

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3.4.21 System Lifecycle

- The minimum system life cycle of the proposed product must be 10 years.
- The life cycle of the product must be further supported in terms of spares availability for a minimum period of 7 years after discontinuation of the product.

3.4.22 Warranty and Support

- The system shall carry a minimum local (South African) warranty of 36 months with on-site as well as telephonic support from date of the system being commissioned. Eskom shall thereafter have the option to access on-going support in terms of a subsequent agreement.
- The supplier must have a technician on call on a 24-hour basis for purposes of telephonic support.
- Supplier spares holding should include minimum replacement spares to restore service of the system in its entirety within 8 working hours.
- All support shall also include all firmware upgrades of the initial system version installed over the operational life of the system.
- The support shall include First Line Level maintenance training including remote management. system training as well as periodic refresher training for Eskom's maintenance personnel.
- The supplier shall also provide Operator training on site to the End-User.
- Product support must include national as well as international support through the local branch should the product not be locally manufactured.
- The supplier shall be willing to enter into a SLA with Eskom for ad-hoc maintenance support.
- The supplier or the OEM representative of the supplier should have history of supplying products of this nature in South Africa for at least a minimum period of 10 years.
- Upon request, the supplier to provide list of reference sites with contact details where the product on offer has been successfully installed and the year of implementation.
- The supplier should have a local technician available not more than 500km from any Eskom site in South Africa for purposes of on-site support.

3.4.23 Cyber Security

3.4.23.1 Cyber Security Design Strategy

The *Contractor* conducts a cybersecurity risk assessment to identify the Cybersecurity risks and the vulnerabilities associated to the entire public address system. Based on the results of the risk assessment, the *Contractor* provides security measures as part of the public address system to mitigate the cyber and physical vulnerabilities or risks.

The *Contractor* secures the public address system to prevent unauthorised access to system that may compromise the safety of people and plant.

The *Contractor* adheres to the Eskom 240-129014618 Generation Cyber Security Compliance Guideline.

3.4.23.2 Network Segregation

Should the public address system require an external network link such as VPN or a connection to the Eskom LAN then the *Contractor* provides a demilitarised zone (DMZ) between the public address system network(s) and the external common network. The DMZ must be established through dedicated firewall(s) hardware that resides between the public address system network and the external common network.

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3.4.23.3 Antivirus and Malware Protection

The *Contractor* provides an antivirus solution and malware detection software on all computer equipment that is vulnerable to cyber-attack. The antivirus software must for part of the *Employer* approved list of software.

3.4.23.4 Software and Licencing

The *Contractor* provides fully licenced versions of all software required for the public address system. The system shall also be capable of being supported by all firmware upgrades.

3.5 CIVILS AND STRUCTURAL SPECIFICATIONS

If and where civil *works* is envisaged, such as speaker towers etc., the *Contractor* complies with the Eskom 240-56364545 Structural Design and Engineering Standard for civil *Works*.

3.6 EQUIPMENT ENVIRONMENTAL CONDITION SPECIFICATION

Contractor provides equipment that is rated for the environment that is suitable for the equipment and incorporates factors such as ambient temperature, relative humidity, dust ingress, water ingress, wind, oil, access for maintenance and theft when selecting the equipment and its siting. The operating conditions where equipment will be installed must not reduce the life expectancy of the equipment.

3.7 QUALITY CONTROL AND QUALITY ASSURANCE SPECIFICATIONS

The *Contractor* is required to comply with the Eskom 240-105658000 Supplier Quality Management Specification.

3.8 DETAILED SCOPE OF WORK

3.8.1 General Requirements

- The Scope of “Works” is an extension of the drawings, specifications and bills of quantities listed.
- The *Contractor* shall notify the Employer’s representative of any discrepancies before commencement of the Works.
- The *Contractor* supplies all material, labour, plant, equipment, loose tools, consumables and transport for the duration and completion of the project.
- The *Contractor* shall provide all costs for the execution of the Works of the complete project as indicated on the drawings, specifications and in the Bill of Quantities.
- The *Contractor* shall immediately notify the Employer’s representative in writing of scope and site variations.
- The *Contractor* shall report all obstacles on site that could impact negatively on time and cost in writing to the Employer.
- The *Contractor* shall clear and de-establish total site on completion of proposed *works*.

3.8.2 Project Specification Requirements

- Provide for an EN54 compliant Public Address and Alarm Voice Evacuation system for the specified areas inclusive of all amplifiers, power management systems, audio management systems, broadcast input devices, audio recorder units, multi-media units, Ethernet switches, interfaces, modules/cards, operating software & licenses, and human-machine interfaces.
- Provide all terminal equipment (audio & visual) inclusive of associated cabling & hardware.

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- The system shall be based on a 100V speaker line design as opposed to a 70V design.
- Provide management system and components for all areas specified by the *Employer*.

3.8.3 Location of the Works / Area to be covered.

This phase of the *Works* is limited to areas within the main Simmerpan Complex.

The entire Simmerpan Complex has been zones into 7 main zones with certain zones comprising of sub- zones within their respective zones. These zones are catered for via de-centralised equipment racks located in 7 different locations. The scope for this phase includes providing fully populated equipment racks for the following 3 of the 7 rack locations with the installation areas listed below each of the rack locations:

- Switchgear Building Rack
 - Simmer Centre
 - Metering Lab
 - Switchgear Building Ground Floor, 1st Floor and 2nd Floor and 3rd Floor
- Transmission Safety Risk
 - Safety Risk Building
 - Medical Centre Building
 - Transmission Old house
 - School of Technology
 - Live Line Building
- Engineering Building PTM&C Server Room Rack
 - PTM&C Room
 - Psychometric Building
 - Transmission Stores
 - ET Stores
 - Telecoms
 - BIPM (Engineering 1st Floor)
 - Panel Workshop (Eng. Ground Floor)
 - Central Grid Maintenance Works
 - Transit Building
 - Risk Management
 - Gymnasium
 - Metering Lab
- Simmer Centre Rack
 - H Block
 - Flexi-Form
 - Simmer Centre EPMD
 - Simmer Centre HR
 - Simmer Centre Finance
 - Central Grid
 - HV Lab (Live work test facility)
 - DC Lab
 - Instrument Workshop
- Victoria Lake Inn Racks
 - Victoria Lakes Board Room
 - Victoria Lakes Dinning and Kitchen Room
 - Victoria Lakes Accommodation Rooms
 - Victoria Lakes Office

CONTROLLED DISCLOSURE

The new equipment rack located in the Switchgear Power Distribution Equipment Room and Transmission Safety Risk Server Room shall also contain all components and capacity to cater for the speaker CCTs and speaker line loads (as provided) for the Switchgear Building (All floors) and the TOM Stores and adjoining building/s.

3.8.4 Drawings and Tables Applicable to the Project

The Contractor shall supply the PA system Zone As-built drawing clearly show the all the interfaces to Racks in their specific location zone.

- Tables are included into the *Works Information*
- Construction drawings will be issued to the successful contractor on contract award.

3.8.5 Key Personnel Requirements

3.8.5.1 Project Manager

- A *Project Manager* shall be allocated to the project for management of the project and providing regular feedback.
- The *Project Manager* shall also attend all required meetings and be responsible for all correspondence between the *Employer* and the *Contractor*.

3.8.5.2 Project Site Supervisor

- The *Project Manager* shall also attend all required meetings and be responsible for all correspondence between the *Employer* and the *Contractor*.
- This individual shall also serve as the on-site interface between the *Employer's* representative and the *Contractor*.

3.8.5.3 Accredited Access Equipment Personnel

- The *Contractor* shall indicate the method of accessing certain areas and the equipment to be used, especially for accessing work areas above ground level.
- Should scaffolding be used by the *Contractor*, the *Contractor* shall suitably qualified personnel for the erection, use, dismantling and inspection of access scaffolding.
- Use of all other access equipment shall be subject to approval from the *Employer* prior to such equipment being allowed on site.
- Personnel handling and inspecting all access equipment shall be in possession of the respective valid accredited training certificates for the respective equipment.

3.8.5.4 Electrical Works Personnel

- A qualified electrician shall be used for all electrical connections.
- The *Contractor* shall ensure that all electrical work is issued with Safety Clearance Certificates, Air-conditioning and Refrigeration Technician
- A qualified and SAQCC registered air conditioner technician shall be used for all air conditioning work.

3.8.5.5 Accredited Technology / Product Specific Technical Personnel

- The *Contractor* shall ensure that provision is made for OEM accredited installation and commissioning technicians for the duration of the project.
- All personnel shall be in possession of valid accreditation documents from the respective OEM in this regard.

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3.8.5.6 Accredited Fibre Optic Technician

- The *Contractor* is required to provide an organogram of the crew that they intend deploying on the project.
- All fibre optic splicing and OTDR testing shall be done by an accredited fibre optic technician.
- Fibre Optic Technicians are required to be accredited with FOA.

3.8.5.7 Additional Personnel Requirements

- The *Contractor* is required to provide an organogram of the crew that they intend deploying on the project.
- All other scope requiring accredited personnel in that field shall be provided for the respective portion of work.
- All specialist personnel shall have the valid accreditation / training certificates for their respective fields of work.

3.8.6 Technical Requirements

The following technical specifications must be read in conjunction with the Standards and specification as documented under Section 3. The information below indicates the specific requirements for this scope of the project. All speakers shall comply with relevant international standards for safety and performance such as SANS/ IEC 60268-5 for sound system equipment and SANS/IEC 60529 for Ingress Protection IP rating IP65.

3.8.6.1 Equipment Housing / Rack

- Equipment housing for all 3 rack locations shall be limited to a single rack not exceeding 47U.
- The equipment housing for the Psychometric (Transport Building) is required to be a wall-mount version due to the limited floor space in this location.
- All required components and equipment (excluding speakers and associated cabling & hardware) for Psychometric (Transport Building) shall therefore be in wall-mounted housing / racks.
- The equipment rack for the Switchgear Building shall require all cable entry from the top of the rack.
- The equipment rack for the PTM&C Room require all cable entry from the bottom of the rack as this room has a raised floor.
- Data sheets for all equipment housing (floor standing as well as wall-mounted) shall be supplied for technical evaluation purposes.

3.8.6.2 System Architecture

- The architecture of the system shall be a de-centralized system initially catering for 3 of the 7 zones of the system.
- Primary backbone of the system shall be a 24-core single mode HDD fibre optic cable configured in a STAR configuration for this phase.
- It is required for the system to have the capability of concurrently accommodating a Ethernet network to achieve backbone redundancy (this shall be implemented in future phases of the project).
- Management of the system will be from Switchgear Building hosting one rack.
- A Fireman's microphone shall be in Switchgear Building.
- The Voice Recorder and Multi-media functionality shall also be in the Switchgear Building equipment rack.

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3.8.6.3 Zones, Zonal CCTs and CCT Loads

- The entire site has been zones into 7 main zones.

3.8.6.4 Back-Ground Music (BGM)

- BGM functionality for daily use of the system has been removed for this project.
- A multi-media unit shall however be supplied and installed in the management system equipment rack.
- The purpose of the multi-media unit will be broadcast selected audio into different areas of zone / zones for the purposes of testing audio outputs during maintenance exercises.

3.8.6.5 Tones – Pre-recorded Messages

- The *Supplier* shall provide samples of differentiated tones for Fire, Medical, Evacuation, for evaluation by the *Employer*.
- The supplier shall also provide samples of pre-recorded voice messages as shall be indicated by the *Employer*.

3.8.6.6 Microphones

The *Contractor* shall all VX-300 series Remote Microphone RM-300X are installed in the following locations:

- The Fireman's microphone together with a VX-300 series Remote Microphone RM-300X shall be in the Transmission Safety Risk building.
- A VX-300 series Remote Microphone RM-300X shall be placed in the Switchgear Room housed in the Switchgear Building.
- A VX-300 series Remote Microphone RM-300X shall shall be installed at Victoria Lake Inn at the security desk reception.
- A Remote VX-300 series Remote Microphone RM-300X shall be installed in the ground floor security reception at Simmer Centre EPMD Building.
- One shall be in System Operator Control Room and the other on the desk of the National Control Security Reception desk.
- A VX-300 series Remote Microphone RM-300X will be installed at PTM&C security reception room at Engineering Building.
- All VX-300 series Remote Microphone RM-300X shall include adequate surge & lightning protection.
- All VX-300 series Remote Microphone RM-300X shall be equipped with adequate keys to accommodate a minimum of 12 zones in addition to alert tone / pre-recorded message keys and other basis keys.
- The VX-300 series Remote Microphone RM-300X at Transmission Safety Risk shall be assigned the highest priority after the Fireman's microphone.
- All main VX-300 series microphones shall be equipped with Ethernet cables terminated into termination boxes.
- Ethernet fly leads shall serve as interfaces between these termination boxes and the microphones.

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Figure 6: VX-300 RM-300X Desk Microphone

The Contractor shall comply with VX-300 series Remote Microphone RM-300X specification shall be followed:

Table 2: VX-300 Series RM-300X Remote Microphone Specification

Applicable Model	RM-300X
Power Sources	24V DC (operating range: 15-40 DC), supplied from the audio input until or DC input power supply connector
Current Consumption	Under 240mA
Audio Output	0 dBV, 600 Ω, balance
External Microphone Input	negative 40 dB, 2.2 kΩ, unbalanced, mini jack, phantom powering
Frequency Response	100Hz - 20kHz
Distortion	Under 1%
Signal-to-noise Ration	Over 60 dB
Volume Control	Microphone volume control, Monitor speaker volume control
Key Extension	Max. 7 RM-210F
Maximum Cable Distance	1200m
Finish	ABB resin, black
Dimension (W x H x D)	190 x 76.5 x 215mm (gooseneck microphone excluded)
Weight	850g

3.8.6.7 Power Supplies and Supply Protection

- The Fireman’s microphone together with a Remote microphone shall be in the Transmission Safety Risk building.
- A remote microphone shall be placed in the Live Line Building reception room housed in the Live Line Building
- One shall be in in the first floor Switchgear security reception room and the other on the desk of the Transmission Safety Risk Security desk.
- All microphones shall include adequate surge & lightning protection.
- All microphones shall be equipped with adequate keys to accommodate a minimum of 12 zones in addition to alert tone / pre-recorded message keys and other basis keys.
- The remote microphone at Switchgear Building Control shall be assigned the highest priority after the Fireman’s microphone.

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- All main microphones Ethernet cables are to be terminated into termination boxes.
- Ethernet fly leads shall serve as interfaces between these termination boxes and the microphones.

3.8.6.8 Component Power Supplies

The Contractor shall ensure comply with the VX-3000DS Power Supply Specification as follows:

- All components shall be powered by OEM specified power supplies capable of providing the recommended power to each component / module in the system.
- Supplies a VX-3000DS DC power supply to all system components with combination of two built-in power source units with a high-performance charger.
- Provides automatically switch to auxiliary battery power if the AC power supply is down.
- Supply VX-3000DS: EN 54-4 certified, Certificate No: 1143-CPR-137

Contractor shall design and supply the power supplies in accordance with the following specification:

Table 3: VX-3000DS Power Supply Specification

Applicable Model	RM-300X
Power Sources	220- 230V AC, 50Hz
Power Consumption	2800W max in total (at rated output with charging), 350 W max each (EN 60065)
DC Power Output (AC mode)	Rated output: 2300 W (31 V, 72.5 A, total DC outpower), Peak output: 2780W (29 V, 96 A, total DC power output)
DC Power Output	8 x 31V (19- 33V) 25A max each, M4 Screw termination, distance between barriers: 11mm
Charging Output Voltage	27.3V +/- 0.3 V (at 25 degree), temperature correction coefficient: - 40mV/C
Charger Method	Temperature compensated trickle charging
Battery Connection	One each positive and negative terminal, applicable cable diameter: AWG 6 - AWG 0 (AWG 1/10) (16mm ² - 50mm ²) Line Resistance within 4m ohm/total
Control Connector (DS LINK IN/OUT)	RJ45 female connector for connecting the system and cascade connection, shielded Twisted-pair straight cable (TIA/EIA - 568A standard)
Panel Indicator	AC power IN 1, IN 2 (Green), Charging (Green), Battery power (Green), Battery connects (Green), Battery condition (Green)
Finish	Panel: Surface-treated steel plate, black, 30% glossa, paint
Dimension (W x H x D)	482 x 132.6 x 400.5mm (19 degree, 3U)
Weight	11.8 kg

3.8.6.9 Redundancy

- Although the system shall not provide for back-bone redundancy in a star-configured fibre optic reticulation, the system shall be capable of providing a redundant backbone path over an Eskom VLAN reticulation.
- Seamless power redundancy shall be provided for all equipment racks.
- Seamless amplifier redundancy shall be provided for all amplifiers in the system.
- In addition to amplifier redundancy, the rack design shall ensure that speaker line CCT redundancy has been considered.
- All redundancy provisions shall not require any human intervention.

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- All system shall be capable of indicating as well as logging in real time when any redundant options have been engaged and when the situation has been normalised.

3.8.6.10 Critical Signal Path monitoring / Surveillance and Fault Detection / Indication

- The system shall be configured in a manner to accomplish complete real-time monitoring of all system components.
- The surveillance shall include monitoring of each component in the main equipment racks, Ethernet cabling, microphones, power supplies, speaker lines and amplifiers, and all other primary components.
- Any fault detected by the surveillance functionality shall result in all microphones indicating the existence of the fault by means of audible & visual indication.
- The fault shall also be immediately logged in the event log register.

3.8.6.11 Interfaces

- The Voice Evacuation system shall not be interfaced with any other system in this phase.
- The system shall however provide the functionality of being able to be interfaced when required to do so.

3.8.6.12 System Event Log

- The system shall be able to store adequate logs on the storage capacity provided with the system management.
- All event logs shall include time & date stamps.
- Training shall be provided on accessing and understanding the Event Log feature of the system.
- The system shall be able to store adequate logs on the storage capacity provided with the system management.

3.8.6.13 On-site Management Requirements

- On-site management requirements shall be located i=within the equipment rack located at ZERO Control.
- Management system shall include the latest version of MS® Windows as well as MS® Office package inclusive of MS® Outlook.
- Additional software to be included shall be Team Viewer.
- All loaded software shall be licensed for lifetime and should not require annual licensing.

3.8.6.14 Remote Management Requirements

- The system shall not be configured for remote access in this phase.
- The system shall however provide the functionality of being able to provide this functionality when required.

3.8.6.15 Factory Acceptance Testing (FAT)

- The *Contractor* shall fully rig the system and configure it at their premises for Factory Acceptance Testing by the *Employer*.
- The system must be rigged in a manner that would indicate how it appears once installed on site. Temporary power, speaker and microphone cables shall be acceptable during the FAT session.
- The *Contractor* shall submit the FAT criteria documents together with supporting drawings /schematics to the *Employer* 14 working days prior to the FAT exercise for review and acceptance.
- The *Employer* may request amendments to the criteria prior to it being approved.

CONTROLLED DISCLOSURE

- The *Contractor* shall use the pre-approved FAT criteria documentation and associated schematics / drawings to conduct the FAT exercise.
- All defects identified during the FAT exercise shall be corrected with 72 hours and feedback provided to the *Employer's* representative.
- The *Employer's* representative shall confirm whether the defects have been corrected before permission is granted to transport the system to site.
- FAT documents shall be signed by all relevant stakeholders and included in the Quality File of the project as part of the document records.
- The *Employer* may opt to engage with the *Contractor* in one or more pre-FAT sessions prior to the main FAT exercise to enable a smooth testing exercise.
- FAT documents are together with architectural schematics for all equipment racks are to be submitted to the *Employer's* representative within 21 working days of the contract being entered into.

3.8.6.16 Site Acceptance Testing

- SAT criteria documents together with supporting drawings / schematics documents are to be submitted to the Employer together with the FAT documents (14 days prior to FAT) for review and acceptance.
- The *Employer* may request amendments to the criteria prior to it being approved.
- The *Contractor* shall use the pre-approved SAT criteria documentation and associated schematics / drawings to conduct the SAT exercise.
- SAT shall involve permanent intended power supplies and permanent speaker lines.
- All defects identified during the SAT exercise shall be corrected with 72 hours and the system re-checked with the Employer's representative.
- SAT documents shall be signed by all relevant stakeholders and included in the Quality File of the project as part of the document records.

3.8.6.17 Warranty and Support

- The *Contractor* shall be the OEM or an accredited supplier of the OEM for the product being proposed.
- The *Contractor* shall be suitably accredited in all aspects for the product being proposed.
- A Letter of Accreditation is required to be submitted in this regard.
- The tenderer shall be able to offer all technical, spares, and firmware support for the product being proposed.
- The tenderer shall have a history of supplying products of this nature for a period of 3 years or have personnel experienced in this field for a period of no less than 5 years.
- The tenderer shall supply a minimum of 3 traceable reference sites with contact person details where the proposed product has been successfully installed by them.

CONTROLLED DISCLOSURE

3.8.6.18 Distribution of Terminal Equipment

Distribution of speakers is as per Table 1 below.

Table 1: Speaker Distribution

LINE	AREA	FLOOR	LOCATION	HORN SPEAKER	CEILING SPKR.	A-B CEILING SPKR.	BOX W/O ATT.	BI-DI PROJ. SPEAKER	15W WALL-MOUNT	SPEAKER COUNT
------	------	-------	----------	--------------	---------------	-------------------	--------------	---------------------	----------------	---------------

SWITCHGEAR BUILDING										
1	Ground Floor	GND	IN		2				4	6
2	Ground Floor	GND	OUT	2						2
3	First Floor	FIRST	IN		3			2	2	7
4	Second Floor	SECOND	IN		3			2	4	9
5	Third Floor	3 rd Floor	IN	2				2		4

TOTALS	→	4	8				6	10	28
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Engineering Building New Rack										
1	PTMC – Transmission Stores	GND	OUT	4						11
2	PTMC – Transmission Stores	First Floor	IN					4	3	11
3	Psychometric Building	GND	IN		4			2	2	8
4	ET Stores	FIRST	IN		4		1		3	8
5	Telecoms	GND	IN		5			2	2	9
6	BIPM (Engineering 1 st Floor)	FIRST	IN		5			1	2	8
7	Panel Workshop (Eng. Ground Floor)	GND	IN		3				2	5
8	Central Grid Maintenance Works	GND	IN	2	3			2	3	10
9	Transit Building	GND	IN		3			2	2	7
10	Risk Management	GND	IN		3			2	2	7
11	Gymnasium	GND	IN		8			3	2	13

TOTALS	→	6	32		1	18	23	105
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CONTROLLED DISCLOSURE

Simmerpan Public Address System Phase 2 Technical Specification

LINE	AREA	FLOOR	LOCATION	HORN SPEAKER	CEILING SPKR.	A-B CEILING SPKR.	BOX W/O ATT.	BI-DI PROJ. SPEAKER	15W WALL-MOUNT	SPEAKER COUNT
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Simmer Centre New Rack (ZONE)

1	Simmer Centre (Outside)	OUTSIDE	OUT	2						2
2	Simmer Centre EPMD	GND	IN	3				4	3	10
3	Simmer Centre HR	First Floor	IN		4			2		6
4	Simmer Centre Finance	GND	IN		4			2	2	8
5	Central Grid	FIRST	IN		4		3		3	10
6	HVLAB	OUTSIDE	OUT	1						1
7	HVLAB	GND	IN		5			2	2	9
8	Flexi-Form	FIRST	IN	2	5			1	2	10
9	Instrument Workshop	GND	IN	2	3				2	7
10	H Block	GND	IN	2	3			2	3	10

TOTALS	→	12	28		3	13	17	71
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Victoria Lake Inn New Rack (ZONE)

1	Victoria Lake Outside	OUTSID	OUT	5						5
2	Victoria Lake Board Room	FIRST FLOOR	IN		6			3		9
3	Victoria Lakes Dinning and Kitchen Room	GND	IN		4			2	2	8
4	Victoria Lakes Accommodation Rooms	FIRST FLOOR	IN		4		1		3	8
5	Victoria Lakes Offices	FIRST FLOOR	IN		5			8	8	21
6	Victoria Lakes Toilets	GND	IN		12					12
7	Victoria Lake Kitchen	FIRST	IN		5			1	2	8
8	Victoria Lake Security Desk	GND	IN		3				2	5

TOTALS	→	5	39		1	11	20	76
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CONTROLLED DISCLOSURE

LINE	AREA	FLOOR	LOCATION	HORN SPEAKER	CEILING SPKR.	A-B CEILING SPKR.	BOX W/O ATT.	BI-DI PROJ. SPEAKER	15W WALL-MOUNT	SPEAKER COUNT
Transmission Safety Risk New Rack (ZONE)										
1	Transmission Safety Risk	GND	OUT	2						2
2	Transmission Safety Risk	GND	IN		2				2	4
3	Medical Centre Building	OUTSIDE	OUT	1						1
4	Medical Centre Building	GND	IN		5				2	7
5	Old houses Building	GND	IN		4				2	6
6	School of Technology Building	OUTSIDE	OUT	3						3
7	School of Technology Building	GND	IN		24			1	2	27
8	Live Line Building	GND	OUT	3						3
9	Live Line Building	GND	IN	3	4			3	3	13

Grand Total

TOTALS	→	12	39			4	11	63
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3.8.6.19 Specification Requirements for installation of Speakers and Associated Cabling and Hardware

The contractor shall be responsible for the complete installation of the PA system, including testing and commissioning and offer comprehensive training for the operating staff on system use and maintenance.

- All external horn & bi-directional projection speakers on brick / concrete walls shall be mounted on 41mm x 41mm galvanized steel strut channels together with the termination boxes.
- All internal horn & bi-directional projection speakers on brick / concrete walls and metal structures in the plant shall be mounted on 41mm x 41mm galvanized steel strut channels together with the junction boxes.
- All terminals shall be of the disconnect (knife-edge) variety for the entire scope.
- Ceiling speakers are to be mounted on ceiling tiles via cut-outs in the tiles.
- Where there are existing cable trays in the ceilings, these shall be used for the installation of the Fire/Alarm cable as far as possible.
- For all other cable installations inside ceilings, the cable should be installed in a manner that it does not rest on the ceiling tiles.
- For Transmission Safety Risk and Data & Engineering Building PTM&C all cable in ceilings not installed on cable trays shall be installed inside galvanized steel tubing secured to the ceiling.
- Cable installations on raised floors inside the Transmission Safety Risk and Engineering Building PTM&C buildings shall also be installed in galvanized steel tubing.
- All speakers in the System Operator Control Room area shall be coupled with attenuators.
- Adequate cable allowance shall be considered for all installations for the purposes of maintenance.
- All main cable lengths shall be recorded and shall form part of the Maintenance Fingerprint.
- *Employer's* estimated cable distances are as per Table 3 below.

CONTROLLED DISCLOSURE

INSTALLATION AREA	FIBRE OPTIC SM 24-CORE	Cat5e STP Ethernet Cable	Cat6A Ethernet Cable	PH30 SWA 4-CORE 1.5mm	PH30 4-CORE 1.0mm	PH30 2-CORE 1.5mm	PH30 2-CORE 1.0mm
ZERO Control – Switchgear Building	800m						
Switchgear Building – Simmer Centre	250m						
Simmer Centre -Transmission Safety &Risk	300m						
ZERO Control – Engineering Building	500m			250			
Transmission Safety & Risk – Live Work	500m			2			
Transmission Old House				2	500		350
Transmission Satey & Risk – School of Tech	350m	80			350	300	300
Live Line Building		75		230	800	450	200
Psychometric Building		320			200		250
Transmission Stores Building		100		150	300		300
ET Stores Building		50		170	100		
Telecom Building		60		200	130		300
BIPM (Engineering 1 st Floor)		80			300		300
Panel Workshop (Eng. Ground Floor)		75			350		200
Central Grid Maintenance Works		320			100		350
Transit Building		100			200		200
Risk Management		50			300		200
Gymnasium		60			100		300
School of Technology – VLI (Building)	1000m	80			130		100
Flexi-Form		75			500		130
Simmer Centre EPMD					350	300	100
Simmer Centre Finance		100			200		350
Simmer Centre HR		50			200		400
Central Grid		100				400	200
HV Lab (Live work test facility)						250	300
DC Lab					130		100
Instrument Workshop		75			300		130
H Block		320			350		400
Victoria Lake In		100				400	350
Victoria Lake Board Room		50			200		400
Victoria Lake Accommodation		60			300		550
Victoria Lake Security Desk		100					300
Victoria Lake Dinning and Kitchen Room		200					150
Victoria Lake Office							330
Victoria Lake Toilets							300
Old Transport Building		150			300		250
PTMC Engineering Building – HUME Building	1000m						
TOTALS	1200	2830	1130	1630	6790	2100	8140

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3.8.6.20 Equipment Rack and Microphone Cabling

- All Ethernet cabling for microphones shall be of pure copper variety.
- Ethernet cabling inside the equipment racks as well as for the microphones in Transmission Safety Risk and Engineering Building PTM&C shall be minimum of Cat5e with cabling for all microphones being shielded.
- Ethernet cabling for all microphones in the Switchgear Building, Transmission Safety Risk and Live line Building shall be of the Cat6A shielded variety.
- Data / Specification sheets for all Ethernet cabling shall be supplied for the purposes of Technical Evaluation.
- The actual lengths of all installed cables shall be recorded.

3.8.6.21 Existing Standalone PA System in National Control

- There is an existing TOA VM-3360VA public address system with a TOA RM-200M microphone located in the vicinity of the Transmission Safety Risk reception which is not working and two existing small speakers at the boardroom.
- This unit is to be relocated and housed in the equipment rack of the new system which is to be located on the ground floor of the PTM&C Telecommunication server room.
- The microphone for this system shall remain in its current location with the Ethernet cable extended.
- All dual cone (A-B Ceiling speakers) shall be connected to this system.
- The existing bi-directional speakers and associated cabling for this system shall be removed.

3.8.6.22 Fibre Optic Cable, Terminations & Testing

- Fibre optic cables installed between the PA system equipment racks shall be a 24-CORE single mode heavy duty duct (HDD) fibre.
- Fibre cable length between Transmission Safety Risk and the Switchgear Building is approximated as being 500M in length and the length between the Transmission Safety Risk and Live line Building is approximated as 200M.
- The actual lengths of all installed cables shall be recorded.
- All fibre optic patch panels shall be fully populated and be terminated in SC-APC connectors.
- Data / Specification sheets for the fibre optic cable as well as the fibre optic patch panels shall be supplied for the purposes of Technical Evaluation.
- Fibre optic testing of all cores shall be performed on all 3 wavelengths in both directions.

3.8.6.23 Junction Boxes and Terminal Blocks

- Junction boxes accommodating audio cables shall be with the non-transparent lid.
- Junction boxes accommodating electrical cables for strobe lights shall be with the transparent lid.
- The above exercise is to differentiate between the junction boxes for audio & electrical.
- All junction boxes shall include an earthing point.
- All modular terminal blocks shall be of the knife-edge DIN rail mount variety with screw terminals and test points.
- Terminals shall be able to accommodate a minimum of 4 mm² cable cores.
- Separator plates and end stops shall be used together with terminal blocks to separate cable cores.
- Terminal blocks shall be able to accommodate terminal labels.
- All unused cable entry points shall be fitted with blanking plugs.

CONTROLLED DISCLOSURE

- A junction box will be installed to terminate any main incoming PH30 cables into any building and/or infrastructure.
- A junction box shall also be included at all levels of a multi-level building.
- There junction boxes shall serve as test points for the purposes of maintenance.

3.8.6.24 Additional Testing

- Apart from the required FAT & SAT Tests that are required, the *Contractor* shall also perform additional mandatory tests during the installation period.
- These tests as listed in the Inspection & Test Plan (ITP) shall follow the required Witness & Hold points.
- All check sheets and ITP documents shall be signed by all relevant stakeholders and included in the Quality File of the project as part of the document records.
- All material delivered to site shall also be subject to quality control procedures to ensure that the goods meet the required specifications.
- The *Employer* may request inspection of certain material at the *Contractor's* supplier premises for acceptance prior to it being delivered to site.

3.8.6.25 Training

Training on the use of microphones

- The *Contractor* shall provide for comprehensive training on the use of microphones.
- The operational and maintenance training shall cover the use of all types of microphones and any microphone augmentations that form part of the system.
- The training must include zonal and ALL-CALL broadcasts selection, alert tones & pre-recorded message broadcast selection, BGM control, reset, fault acknowledgement, etc. functionalities.
- A minimum of two *Employer's* representatives shall be provided with "Super-User" training to allow them to train new users on the use of the microphone.
- All training must be accompanied by training material notes.
- Training will include the use of the alert tone & pre-recorded messages functionality.

3.8.6.26 Human-Machine Interface (HMI) Training

- Training shall be provided on the use of the HMI.
- Training shall be specific to checking system status, accessing event logs, as well as resetting of the system.
- The training shall include the reading and acknowledgement of all statuses of the system via LCD screens / LEDs or whatever form in which such statuses or faults are displayed.

3.8.6.27 Training on Re-initialization of the System

- Training shall be provided on the re-initialization of the system to accept / acknowledge any changes made to the system.

3.8.6.28 Optimisation

- The *Contractor* shall conduct an optimization exercise to adjust all volume levels of all speakers as well as microphones.
- The optimization exercise shall be to achieve the most optimum speaker output setting.
- Optimization exercise may require the tap settings of certain speakers to be adjusted to a desired optimum level.

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- All changes in speaker tap settings shall be recorded and filed and form part of the Maintenance Fingerprint of the system.

3.8.6.29 Commissioning

- All speaker line CCTs shall be commissioned post installation and optimization processes.
- The exact loads and impedance measurements shall be recorded and form part of the Maintenance Fingerprint.
- Final commissioning of the system equipment racks shall take place post the partial commissioning of all speaker line CCTs.

3.8.6.30 Partial Handover

- All speaker line CCTs and or areas / zones shall be handed over to the *Employer's* representative once they have been commissioned.
- All relevant Quality and handover documentation needs to be handed over together with this exercise.

3.8.6.31 Engineering and the Contractor's Design

3.8.6.31.1 Employer's Design

- The *Employer's* Subject Matter Expert (SME) has made recommendation on the architecture of the system inclusive of the distribution & placement of the audio equipment in the various areas where such equipment is to be installed for this phase of the project.
- The *Contractor* shall however make proposals in this regard that will be subject to the *Employer's*.

3.8.6.31.2 Part of the Works which the contractor is to design.

The *Contractor* is required to provide the following designs:

- Architecture of the system – if different from that of the *Employer's* SME recommendations.
- Equipment Rack layout designs.
- Speaker lines CCTs - if different from that of the *Employer's* SME recommendations.
- Power consumption calculations.
- Heat Dissipation calculations.
- Provide differentiated alert tones and pre-recorded messages for which the text dialogue shall be provided by the *Employer*.

3.8.6.32 Procedure for the substation and acceptance of the contractor's design

All designs from the *Contractor* are to be accompanied by the following as a minimum requirement:

- Data / specification sheets of all components / material as proposed in the designs.
- Test certificates (where applicable) shall be supplied by the *Contractor*.
- Any other supporting documentation that is deemed as necessary.
- The *Contractor* is required to submit all proposed designs to the *Employer* with all required supporting documentation for the *Employer's* perusal at least 14 days in advance. All *Contractor* designs shall be subject to the *Employer's* assessment & approval.

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3.8.6.33 Equipment required to be included in the works

The *Contractor* shall include the supply of the following equipment as part of the *Works*:

- Analogue impedance meter (preferably one recommended by the OEM of the equipment being supplied).
- All items not itemized on the BoQ but forms part of the installation requirements shall be supplied and installed by the *Contractor*.
- This shall include, but is not limited to fasteners, adhesives, consumables, etc.

3.8.6.34 Configuration Management

- All KKS coding shall be supplied by the *Employer*.
- Labels shall be manufactured as per configured data by the *Contractor* and affixed.
- The *Employer* shall provide the *Contractor* with a Labelling Standard which provides a guideline on the manufacture of the labels.

3.8.6.35 As-built/ floor plan drawings

- As-built/Floor plan drawings shall be supplied to the successful *Contractor* for the areas in which installation is required.
- Terminal equipment locations and proposed cable routes shall be indicated on these drawings.
- The *Contractor* is to red-line these drawings depicted and clearly show the revision mark-up and latest revision as per Eskom convention depicting installed cable, junction boxes and terminal equipment.

3.8.6.36 Documentation

The following documents are to be supplied by the *Contractor* within the pre-determined schedule:

- Functional description of the system
- Electrical Schematic diagrams, including loop diagrams.
- General Arrangement drawings of the panels
- Component lists per panel and per section.
- Termination diagrams for each Enclosure, Junction box, Maintenance junction box.
- Operation and Maintenance Instruction manual.
- Original Manufacturers product documents
- FAT Procedure
- Commissioning procedure
- Handover certificates
- Inspection and Test Procedures
- System manuals (2 hard copies, 1 soft copy)
- Drawings (2 hard copies, 1 soft copy)
- Training material

3.8.6.37 Re-measurable items

- Notwithstanding that practical care was exercised in preparing the BOQ, but all quantities given herein shall be deemed to be estimated quantities of the work to be done but they are not to be taken as actual and correct quantities of the work to be executed and they are not to absolve the *Contractor* of his obligations under the *Contract*.
- All work shall be re-measurable.

CONTROLLED DISCLOSURE

3.8.6.38 Air-conditioning requirements

The three rooms identified for the installation of the equipment racks are all three air-conditioned rooms and therefore there is no requirement from this contract to do any work on air-conditioners in these rooms.

3.8.6.39 Electrical requirements

Contractor shall modify the Existing Distribution Board and issue CoC in accordance with the SANS 10142-1 ensure supply to the speakers. All equipment shall be rated for operation on a 240/415V, 3-phase, 4 wire, 50 Hz system with solidly earthed neutral system. Conductors size shall not be specified must be determined in accordance with the SANS 10142-1. *Contractor* shall use identified Distribution Boards for this project. Distribution Boards Circuit modifications for all identified DB's with additional breakers for HVAC.

3.8.6.40 Tender returnable (technical)

The following documents shall from part of the required documents to be submitted with the tender.

3.8.6.40.1 Method Statements

The *Contractor* shall provide detailed method statements on how he intends to carry out the *Works*; this shall apply to all, and any part of the *Works* as provided in the conditions of contract. The *Contractor's* comprehensive Method Statements shall demonstrate the following:

- Sound understanding of the whole of the *Works*,
- Understanding of the required competencies in executing all activities of the whole of the *Works*,
- The logical sequencing in which the *Works* are to be executed and,
- The Safety, Health, Environmental and Quality considerations in execution of the *Works*.

3.8.6.40.2 Sample Inspection and Test Plans (ITPs) and Quality Acceptance Documents

The *Contractor* shall provide sample ITPS & QA documents for all activities of the scope. These documents shall demonstrate the following:

- *Contractor's* understanding of the key Witness, Hold, Inspection and Verification points of the exercise.
- *Contractor's* expectation in terms of an acceptable standard of workmanship.

3.8.6.40.3 Draft Schedule

The *Contractor* shall submit a draft schedule depicting all activities for the entire scope. The draft schedule shall indicate the different aspects of each area of installation and the duration per activity. The schedule shall be based on a 5-day work week excluding any public holidays and weekends.

3.8.6.40.4 Data / Specification sheets

- The *Contractor* shall provide data / specification sheets for all components of the system inclusive of terminal equipment and cabling.
- Where the data sheet includes several variants of a product or several products, the proposed product shall clearly be marked.
- System brochures shall also form part of this requirement.

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3.8.6.40.5 Data Management

The data acquisition architecture shall align with Eskom Remote Device Communication Standard for Data Retrieval and Remote Access (240-64038621), Eskom Data Concentrator Specification and Eskom Cyber Security Standard for Operational Technology.

3.8.6.40.6 Product Certification / Conformity Documents

- Where requested, all product conformity /certification documents shall be provided for all components, inclusive of terminal equipment, batteries back-up, and cabling.
- Where test certificates have been requested, these shall be submitted.

3.8.7 Architectural Schematics

- The requirement for the architectural schematic shall be limited to the scope of this work.
- Schematic shall indicate the composition of the components making up the system and their interconnectivity in each of the zonal equipment racks as well as the interconnectivity between the zonal racks.

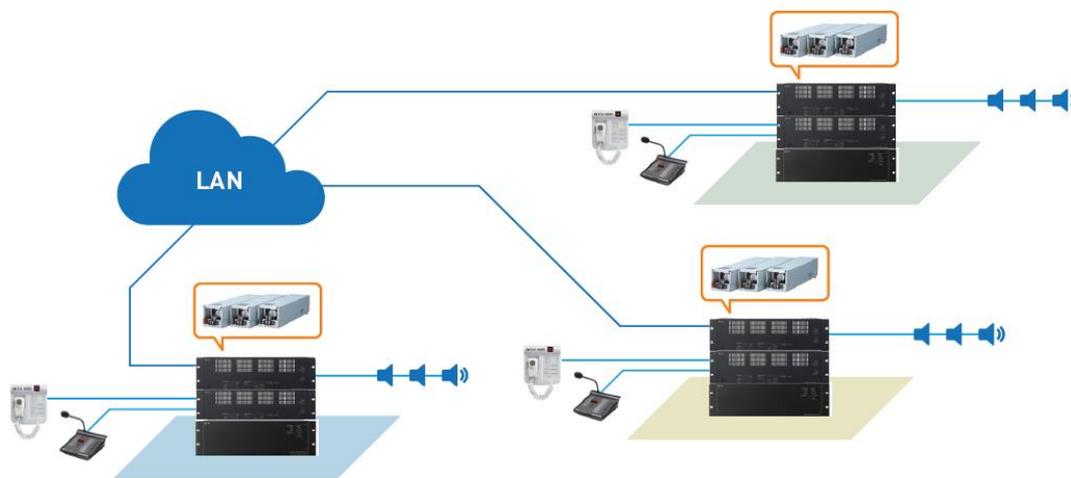


Figure 7: Ring Topology of Decentralised Audio Streaming over WAN

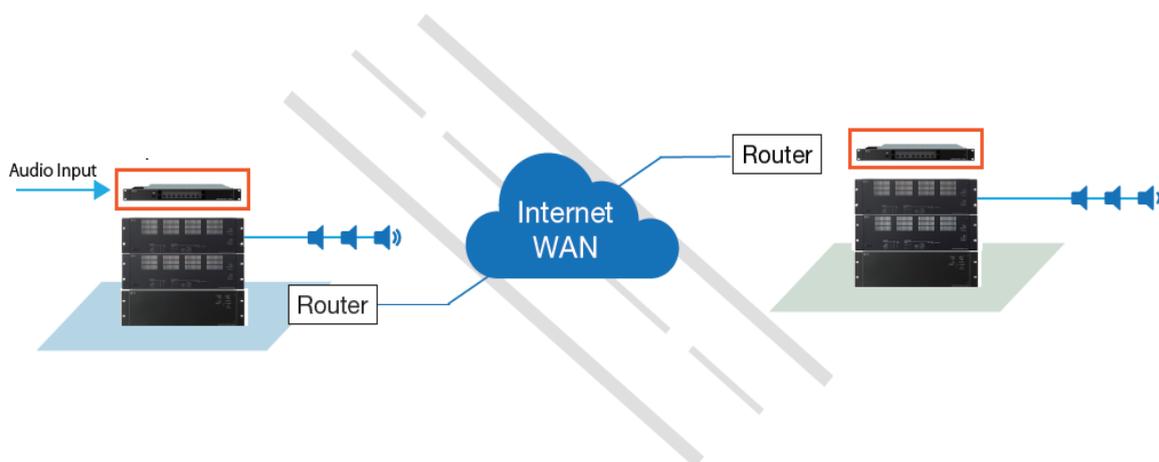


Figure 8: Audio Streaming over the Wide Area Network

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3.8.7.1.1 Rack Layout

- Rack layouts depicting the layout of each of the components within each rack shall be submitted as part of the proposal.
- The layout shall indicate the height of each rack and the positioning of each of the components within each rack.

3.8.7.1.2 Left Over and Recovered Material

- All left over material that formed part of the BoQ shall remain the property of the *Employer* and be left on site.
- All de-installed bi-directional speakers and associated cabling shall also remain the property of the *Employer*.

3.8.7.1.3 Guarantees

- The *Contractor* shall guarantee the equipment to be supplied under this contract against faulty design, materials, and workmanship at the manufacturer's works within the defect liability period (DLP).

3.8.7.1.4 Training

A formal training program for NTCSA Real Estate staff shall be provided by the vendor. This shall make provision for the training of groups of the relevant NTCS Real Estate Staff. A 'standard' training should be performed at the request of NTCSA Real Estate. The training shall be such that the trainees are able to technically support the system independently of the vendor, and shall at least cover the following aspects:

- Principles of operation of the monitoring devices
- Installation and commissioning of the monitoring devices
- Setup and communication of the monitoring devices
- Life cycle management
- Parameter configuration (both local and remote)
- Network Switch/Modem/Firmware/Communication testing and setup
- System software functions
- Troubleshooting
- Disconnection and reconnection of the system including but not limited to the procedures including maintenance schedule and or preventative maintenance schedules of the components and hardware.
- Certification of NTCSA Real Estate for both training types must be provided with a hard copy and soft copy certificate. The training materials should be made available to Eskom for the purpose of internal skills transfer.

CONTROLLED DISCLOSURE

4. AUTHORISATION

This document has been seen and accepted by:

Name	Designation
Sakhi Nkebe	Project Manager Real Estate
Phelokazi Nqwelo	Middle Manager Real Estate
Nomthandazo Mnguni	Real Estate Senior Advisor Quantity Surveyor

5. REVISIONS

Date	Rev.	Compiler	Remarks
26 September 2024	1	Shandukani Vhulondo	First issue

6. DEVELOPMENT TEAM

The following people were involved in the development of this document:

Shandukani Vhulondo

7. ACKNOWLEDGEMENTS

None

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APPENDIX A: TECHNICAL SPECIFICATION OUTPUT DOCUMENTS

Document Number	Rev.	Document Title	Remarks

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APPENDIX B: TRADE STUDIES PERFORMED

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