Eskom	Standard	Technology

Title: **REGIONAL OPERATIONAL VOICE CONTROL SYSTEM**

Unique Identifier:	**240-115024962**
Alternative Reference Number:	**<n/a>**
Area of Applicability:	**Engineering**
Documentation Type:	**Standard**
Revision:	**1**
Total Pages:	**29**
Next Review Date:	**March 2022**
Disclosure Classification:	**Controlled Disclosure**

Compiled by

Zwelandile Mbebe

Chief Engineer

Date: 07/03/2017

Approved by

Cornelius Naidoo

CoE Manager Telecoms T&S

Date: 07/03/2017

Authorized by

Richard McCurrach

PTM&C Engineering Senior Manager

Date: 10/3/2017

Supported by SCOT/SC

Ziyaad Gydien

SCOT/SC Chairperson

Date: 8/03/207

PCM Reference: **240-45541565**

SCOT Study Committee Number/Name: **Telecoms SC**

Content

Executive Summary

Eskom's Operational Technology (OT) voice network for support and operation of the power network is provided by Eskom Telecommunications through the Eskom Telecommunications (ET) Private Network. The network provides fixed and mobile area radio voice services. This standard specifies the requirements for regional operational voice control system which provides the switching of voice calls between area radio and fixed line voice calls in Eskom. The standard only provides the minimum requirements for the switching system and excludes site specific information. Throughout the document the term Voice Control System (VCS) will be used to refer to the regional operational voice control system.

1. Introduction

VCS standard is intended to specify the requirements for the voice control system used in Eskom Regional control centres. This system will be used to manually switch the telephone calls between different areas of the business including mobile area radio and fixed telephone lines. Operator consoles will provide manual call control interface for the operators to patch the calls from different callers and voice platforms. This document provides the minimum technical requirements for the control system and shall be used for enquiries where necessary. On any matter of importance which is not covered by this standard, a ruling shall be sought from Eskom and such a ruling shall form part of the contract. Eskom will appreciate any relevant suggestions to improve system performance and operating procedures.

2. Supporting clauses

2.1 Scope

This standard specification covers the design, manufacture, testing, Delivery, installation and commissioning of a regional operational voice control system.

2.1.1 Purpose

The purpose of this document is to specify the design, manufacturing, testing, delivery, installation and commissioning of regional operational voice control system.

2.1.2 Applicability

This document shall apply throughout Eskom Holdings Limited Divisions.

2.2 Normative/informative references

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

2.2.1 Normative

[1] MPT 1316, UK Radio Communications Agency (Ofcom) Code of Practice: Selective signalling for use in the Private Mobile Radio Services.

[2] 240-60725641 Specification for standard (19 inch) equipment cabinets

[3] Eskom 240-67561934, Telecommunications acceptance test procedure for area radio analogue repeaters and links

[4] Eskom 240-707 32272, MSAP design guide

[5] Eskom 240-75035172, Telecommunications UHF and VHF analogue repeaters

[6] Eskom 240-76628653, Trio radio design guide

[7] Eskom 240-94136376, IP voice and data network design guide

[8] Eskom ESG 32-1200, Eskom Telecommunications Strategy Framework

[9] Eskom ESP 32-1203, Eskom Telecommunications User Requirements

[10] Eskom 240-56576361, Telecommunications transport network equipment installation and commissioning standard

[11] Eskom 240-55410927, Cyber Security Standard for Operational Technology

[12] Eskom 240-91714320, Telecommunications network cybersecurity architecture

2.2.2 Informative

[13] Applicable standards, All relevant ETSI and ITU-T standards, specifications and regulations

[14] Eskom 240-57649119, Standard Specification for Approval of Drawing submitted by Contractors and Consultants

[15] Eskom 32-644, Eskom documentation management Standard

[16] Eskom 32-9, Definition of Eskom documents

[17] Eskom 474-65, Operating manual of the Steering Committee of Technologies (SCOT)

[18] ETSI EN 300 385, European Standard (Telecommunications series). Electromagnetic compatibility and Radio spectrum Matters (ERM)

[19] ETSI ETS 300 019, Equipment Engineering (EE); environmental conditions and environmental tests for telecommunications equipment

[20] ETSI TR 102 398, DMR General System Design

[21] ETSI TS 102 361-1, the DMR air interface protocol

[22] ETSI TS 102 361-3, the DMR data protocol

[23] ETSI TS 102 361-4, the DMR trunking protocol

[24] ETSI TS 102 361, the DMR voice and generic services and facilities

[25] IEC 60529, Degrees of protection provided by enclosures (IP code)

[26] IEC 61000-4-1, Electromagnetic compatibility (EMC) – Part 4: Testing and Measurement techniques – Section 1, Overview of Immunity Tests.

[27] IEC 61000-4-12, Electromagnetic compatibility (EMC) – Part 4: Testing and Measurement techniques – Section 12, Damped oscillatory wave immunity test.

[28] IEC 61000-4-2, Electromagnetic compatibility (EMC) – Part 4: Testing and Measurement techniques – Section 2, Electrostatic discharge Immunity test.

[29] IEC 61000-4-4, Electromagnetic compatibility (EMC) – Part 4: Testing and Measurement techniques – Electrical fast transient / burst immunity test.

[30] IEC 61000-4-5, Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 5, Surge immunity tests.

[31] IEC/TS 61000-6-5, Electromagnetic compatibility (EMC) Part 6-5 Generic standards – Emission for power station and substation environments

[32] IEEE 1588, Precision Timing Protocol supporting software time stamping on Linux & Windows, HW time stamping on the Freescale MPC831X

[33] IEEE 802.3ae-2002, Common equipment management function requirements

[34] IEEE C62.41, IEEE Recommended Practice on Surge Voltages in Low Voltage AC Circuits.

[35] IEEE Std 802.3ae-2002, Gigabit Ethernet (10GE or 10GbE or 10 GigE) standard

[36] ISO 9001, Quality Management Systems

[37] ITU-T G.7710/Y.1701, Common equipment management function requirements

[38] ITUT Q.23, Technical features of push-button telephones.

[39] ITUT Q.45, Transmission characteristics of an international analogue exchange

[40] ITU-T Rec G.703, Physical/electrical characteristics of hierarchical digital interfaces

[41] ITU-T Rec G.823, The control of jitter and wander within digital networks which are based on the 2048 kbit/s hierarchy

[42] ITU-T Rec G.955, Digital line systems based on the 2048 kbit/s hierarchy on optical fibre cables

[43] ITU-T Rec y1731, Ethernet fault and performance monitoring

[44] ITU-T Rec. M.3400, TMN management functions

[45] ITU-T, Rec G.8261, Timing and synchronization aspects in packet networks

[46] MPT 1327, 1997, UK Radio Communications Agency Specification: Signalling Standard for Trunked Private Land Mobile Radio Systems.

[47] NERC/CIP–002–3, Cyber security — critical cyber asset identification

[48] NERC/CIP–003–3, Cyber security — security management controls

[49] NERC/CIP–004–3, Cyber security — personnel and training

[50] NERC/CIP–005–3, Cyber Security — electronic security perimeter(s)

[51] NERC/CIP-006-3c, Cyber security — physical security

[52] NERC/CIP–007–3, Cyber security — systems security management

[53] NERC/CIP–008–3, Cyber Security — incident reporting and response planning

[54] NERC/CIP–009–3, Cyber security — recovery plans for critical cyber assets

2.3 Definitions

2.3.1 General

Definition	Description
Voice Control System (VCS)	This refers to the Regional Voice Control System with its software, hardware, associated interfaces, gateways, modems, recorders and all other peripherals which make the system specified in this document complete.

2.3.2 Disclosure classification

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

2.4 Abbreviations

Abbreviation	Description
AC	Alternating Current
BRI	Basic Rate Interface
CAS	Channel Associated Signalling
CPU	Central Processing Unit
DB	Data Base
DC	Direct Current
DMR	Digital Mobile Radio
DTMF	Dual Tone Multi-Frequency
EEA	Electronic Engineering Association
E&M	Ear and Mouth
EMC	Electromagnetic Compatibility

Abbreviation	Description
ET	Eskom Telecommunications
FXO	Foreign Exchange Office
FXS	Foreign Exchange Subscriber
Hz	Hertz
IDF	intermediate distribution frame
IP	Internet Protocol
ITU-T	International Telecommunication Union-Telecommunication
MTBF	Mean Time Between Failure(s).
n/a	not applicable
NERC (CIP)	North American Electric Reliability (Critical Infrastructure Protection)
NMC	Network Management Centre
PABX	Private Automatic Branch Exchange
PAX	Private Automatic Exchange
PC	Personal Computer
SNMP	Simple Network Management Protocol
TDM	Time Division Multiplexing
VCS	Voice Control System
VHF/UHF	Very High Frequency/ Ultra High Frequency

2.5 Roles and responsibilities

a) The supplier shall be responsible for the design, assembly, testing and delivery of the equipment to the Control Centres as per task order. [I]

b) Installation, commissioning and site acceptance testing of the equipment will be done by the supplier in conjunction with Eskom [I]. Eskom reserves the right to perform this function where deemed necessary.

c) Eskom will provide and install a positive earthed 48DC (+20 %, -15%) power supply (with 8 hours standby) [I].

d) Where necessary Eskom will provide 230 VAC (+/-10%) 50 Hz (+/-2%) power supply depending on specific site requirements [I].

e) For analogue telephones, Eskom will provide mounted Krone blocks and for IP telephones Eskom will provide Ethernet infrastructure and all cabling will be the responsibility of the supplier [I].

2.6 Process for monitoring

Not applicable

2.7 Related/supporting documents

Not applicable

3. Document content

Throughout this document, some clauses are marked by a letter indicating Eskom's expected response to the stated requirement from potential suppliers in cases where this standard is used in an enquiry process. The letters and their corresponding indications are as follows:

- M – Mandatory system or services requirements; 100% compliance is required.
- I – Information; suppliers to give actual values, quantities or other specific details called for. Provision of requested information is mandatory and failure to provide it will lead to suppliers being ruled non-compliant on the requirement.

Requirements that are not marked by any of the letter indications are general and a certain level of non-compliance with them may be tolerated. Suppliers shall state compliance, non-compliance or a degree of compliance in response to these requirements.

On any matter of importance which is not covered by this specification, a ruling shall be sought from Eskom and such a ruling shall form part of the contract. Eskom will appreciate any relevant suggestions to improve system performance and operating procedures

3.1 General requirements

3.1.1 Functional Description

The regional operational control voice control system shall be used to patch the calls originating and terminating between the following voice systems:-

a) Dedicated point-to-point telephone circuits which are supported by different transport systems such as microwave radio, UHF radio, Fibre Optic and power line carriers. These systems can be either Eskom owned or leased from Telkom. [M]

b) Switched telephone circuits supported by Eskom's country wide over private telephone network supported by technologies including TDM PABXs, Call Managers and Voice gateways. [M]

c) Switched telephone circuits supported by Telkom's national public telephone network. [M]

d) Switched telephone circuits supported by mobile operators. [M]

e) Eskom's mobile radio systems including Conventional analogue and DMR tier 2&3. Mobile radio circuits provide voice telecommunications with mobile maintenance teams. [M]

f) Satellite calls hosted through the third party networks. [M]

g) Control Centre mix of single point-to-point circuits and switched circuits (Eskom and Telkom) to Regional Distribution Stations. [M]

h) The VCS specified in this document shall meet the voice telecommunication requirements for the control centre mobile voice. [M]

i) VCS terminating cards are therefore used to interface with the lines and networks with different signalling protocols employed on the voice circuits. [I]

j) A switching matrix interconnects the operator consoles and the ports for the terminating cards. Operator consoles provide the man-machine interface between the control staff and the VCS. All elements of the VCS are controlled by common control equipment. [I]

3.1.2 Scalability of the system

a) The supplier should provide a system capable of 100 operators positions, each capable of handling up to 260 circuits, but equipped as per accompanying task order requirement. [I]

b) The supplier should note that there could be the requirement to link a network of database P.C.'s to the local DB system to provide for the following information:-

1) Customer/Employee information Record handing over conversations. [I]

2) Queueing display. [I]

3) Fault recording with details of operator handling fault. [I]

4) Printout of fault report slip for transfer between shifts. [I]

5) Speed-dial facility. [I]

6) Callout information for particular areas. [I]

c) The supplier should also note that the implementation of successive functions/equipment should not disrupt the use of a single console for more than 24 hours, and of the complete system for more than 30 minutes. [I]

3.1.3 Scope of work

a) The supplier shall be responsible for the design, assembly, testing and delivery of the equipment to the Control Centre. [I]

b) Installation, commissioning and site acceptance testing of the equipment will be done by the supplier in conjunction with Eskom. [I]

c) Installation of the system shall include the supply and installation of all telecommunication and control cabling between the IDF, Ethernet switches, centralized equipment and consoles. [I]

d) The cable distance between the remote and centralized equipment could be 0 — 100m and the equipment should operate satisfactorily over that range. [I]

3.1.4 Quality Assurance

a) The Contractor will be responsible for the relevant quality assurance requirements to be imposed on sub-contractors and suppliers of materials, in terms of the standards mentioned above. [I]

b) For detailed SHEQ requirements the supplier shall refer to the SHEQ specification and related documents issued with the enquiry. [I]

3.1.5 Guarantee

a) A guarantee period of 12 months after taking over and acceptance certificates have been signed is required, [I]

b) Additional to this, the supplier must guarantee availability of all spares and support for the supplied VCS for a period of at least 10 years from the date of signing of contract with Eskom. [I]

c) Components used should be multi-sourced items in RSA. [I]

d) The supplier must supply proof of action taken to ensure availability of spares and also indicate maximum period guaranteed. [I]

3.2 Operational requirements

3.2.1 Authorisation of level of access to system

Distinct levels of access should exist in the system and methods should exist to prevent unauthorized access. These levels are:-

a) Use of comms console for operating. [I]

b) Access and changes to application software where applicable. [I]

c) Changes to data base facility. [I]

3.2.2 Console attendance indicators

a) A person at any one console should be able to determine the attendance status of all other consoles in the system, bearing in mind that the consoles may be visually separated. [I]

3.2.3 Visual call status indicators

a) Visual line status indications shall be provided on the consoles for each and every line. [I]

b) It is proposed to achieve the required indications by means of different colours which can assume different states i.e. off, on, slow flash and fast flash. It is a requirement that any incoming call indication will be flashing. [I]

c) The tenderer shall indicate how all the requirements will be met. [I]

d) The visual indicators should be positioned in such a way that the status of any line is clearly identifiable from any position, be it sitting or standing, one metre away from console. [I]

e) Visual line status indications as listed below shall be provided on the consoles for each and every line:

1) Line is free (no indication). [I]

2) Line is selected and connected to own operator circuit. This will allow an operator under busy conditions to know at any instant to which line he is connected. [I]

3) Line is busy because another operator is using it or has been placed on hold by another operator. [I]

4) Line is busy and has been placed on hold by the operator of the relevant console. This line must be indicated as on hold on other consoles. On a radio channel, only send a busy tone (different tone when busy to when not busy) [I]

5) An incoming call on a line is waiting to be answered. [I]

6) An incoming call is waiting to be answered after it has been transferred from another console. [I]

7) A queue of 20 calls should be provided for, updating the display as calls are answered. It should be borne in mind that calls can be answered in any sequence (clause 3.2.7) and the queuing display (clause 3.2.3 8)) and function should be updated accordingly. It should be clear what the type and source of the call is. [I]

8) At any given instant, display the five unanswered incoming calls per console that have been waiting longest. [I]

9) A facility should be provided where at the depression of a specific key, the longest call waiting should be connected to the operator. [I]

3.2.4 Acoustic annunciator

a) In the case of 3.2.35) and 3.2.36) and it should be possible to announce incoming calls acoustically simultaneous with the visual indications. [I]

b) The acoustic annunciator of each desk will have the following special options which should be selectable independent of the other consoles:

1) Only visual indication, i.e. acoustic annunciator OFF. [I]

2) Once only alarm with volume adjustable. [I]

3) Time adjustable intermittent alarm with volume adjustable. [I]

4) Loud continuous alarm. [I]

c) Each console should be provided with a separate loudspeaker and volume control for the acoustic annunciator. [I]

d) The volume control should not be adjustable to zero. [I]

e) The audible level of the annunciator shall be automatically attenuated whenever the operator's speech circuit is in use. [I]

f) The acoustic indication shall be pleasant eg. a gong instead of a buzzer. A different tone should be provided for each desk, where possible. [I]

g) Incoming calls (telephone or radio) could be grouped in destination categories for the specific functions [M], e.g.

1) Distribution Desk.

2) Reticulation West Desk.

3) Reticulation East Desk.

4) Outage Scheduling Desk.

5) Fault Centre Desk.

6) General Call for anybody to respond [I].

h) It is a requirement that the system be transparent with respect to call destination and console. It should be possible to dynamically configure any console as any one (or combinations thereof) of the above mentioned functions. [I]

i) This affects the acoustic annunciator specifically, as visual indications of an incoming call are mirrored at every console. Specific telephone numbers and call tones will exist for the various functions. Added to this will be general telephone numbers and call tones, which will activate all consoles. A received telephone or radio call will thus be scanned and a decision made on which acoustic annunciator(s) to sound. It should be noted that more than one desk could be configured as being the same function. [I]

j) A console should default in the general function. [I]

k) Provision should be made to discriminate between at least 10 different tone calls on incoming radio calls. [I]

3.2.5 Type of calls

The VCS should be able to accommodate at least 260 individual circuits. The VCS should provide line terminating cards for the following types of circuits:

a) 4 wire E&M, and 2 wire E&M. [I]

b) FXS/FXO. [I]

c) PRI/E1. [I]

d) E1 CAS. [I]

e) BRI. [I]

f) Ethernet for VoIP. [I]

3.2.6 Call answering, initiating and monitoring

a) The system should allow for call answering, initiating and monitoring. A controller at a desk should be able to simultaneously monitor as many as 8 circuits, even if a particular circuit has been selected at that or any other console. [I]

b) The system shall allow for connecting an operator's circuit to any selected line port by means of a select button provided per port. Pressing the select button shall apply the correct criteria to the relevant line terminating circuit for answering an incoming call, initiating an outgoing call and monitoring a mobile radio channel. [I]

3.2.7 Call attendance order

a) The operator shall be able to answer, initiate and monitor any call in any order, regardless of the status of other calls. [I]

3.2.8 Call queuing

a) The system should remember the order in which calls are received. [I]

b) The facility should be provided that at the depression of a specific key, the longest call waiting will be connected to the operator. [I]

c) The supplier shall indicate if the system supports auto answer. [I]

d) The supplier shall indicate if the system supports the queue position and time to answer. [I]

3.2.9 Dialling of numbers and codes

a) After line selection by means of the relevant select button, dialling of telephone call numbers and mobile radio codes should be possible. [I]

b) Automatic selection of the right type of keypad facility should be provided on pressing the relevant select button.

c) Full flexible five-tone EEA encoding (Refer to standard [1]) should be employed, with group call facilities. [I]

3.2.10 Speed dialling

a) The equipment should have the facility that at the depression of only one key, the system will automatically dial a pre-programmed telephone number for the specific key. [I]

3.2.11 Call release

a) It shall be programmable to either automatically place a call on hold when another call is attended to, or to release the call when another call is attended to. [I]

b) A common release button shall release the last operator action and not reset the entire operator console. [I]

c) Auto-release of a radio circuit should be effected when a selected time-delay (adjustable between 30 sec and 10 min) after no PTT or VOX (when using headsets) on the transmit pair of the operators circuit has expired. [I]

3.2.12 Recall facilities

a) An exchange recall facility should be provided (Refer Clause 3.4.2).

3.2.13 Call holding

a) Holding of a call in progress should be possible by means of a common call holding button in order to attend to other calls unless programmed for auto-hold as in clause 3.2.11. [I]

b) In the case of a telephone circuit being held, the caller shall receive an appropriate tone or music-on-hold. No tone or music is permissible on mobile radio circuits. When placing a call on hold, it should leave all consoles free of that particular call, except for the visual indication. [I]

3.2.14 Transfer of calls between consoles

a) Transferring of calls between consoles of the same centre should be possible without visual or vocal contact to a specifically selected remote console. This implies that the receiving operator should get an indication of a call being transferred to that console. Once a call has been transferred, the operator who made the transfer shall be free to attend to other calls. [I]

3.2.15 Answering devices

a) The following devices shall be supplied:

1) Operator handset with PTT on handset. [I]

2) VOX enabled headpiece with parallel foot switch. [I]

3) The supplier shall indicate if Android or IOS app is available. [I]

4) (As an option) Cordless remote microphone and PTT facility. [I]

b) These plug-in devices with dynamic micro-phones should satisfy Eskom with respect to quality, robustness, durability and ease of use. [I]

c) A buffered monitor port should be provided next to the normally used port for training and maintenance. They should also be line powered, not requiring additional batteries [I]

3.2.16 Press-to-talk (PTT) facility

a) The PTT facility will be used to key the transmitter on mobile radio circuits. [I]

3.2.17 Conference facilities

a) The equipment shall allow conference facilities on all types of circuits. The conference parties may include other consoles in the same centre as well as outside parties. The system shall support a minimum of 8 conference parties with good speech quality. [I]

b) The supplier is to indicate the permissible extent of use of this facility without degrading the speech quality. The maximum number of conference parties must be specified. [I]

3.2.18 Intercom facilities

a) The equipment shall allow operators to converse with each other via intercom channels. [I]

b) The supplier is to indicate the number of channels provided. [I]

3.2.19 Patch Facilities

3.2.19.1 Radio to radio

a) The system should allow a mobile in one repeater area to be connected to another mobile in a different repeater area with or without operator intervention. [I]

3.2.19.2 Radio to telephone

a) The system should allow a mobile to automatically select a PAX line, when the mobile either sends a specific radio call or a DTMF code. [I]

b) The mobile must receive some form of indication to acknowledge this facility has been activated. [I]

c) The system should allow a mobile to automatically select a VoIP line, when the mobile either sends a specific radio call or a DTMF code. The mobile must receive some form of indication to acknowledge this facility has been activated. [I]

3.2.19.3 Telephone to radio

a) The system should allow a PAX extension to automatically select a radio channel and then allow the extension to dial a mobile radio code. [I]

b) The system should allow a VoIP extension to automatically select a radio channel and then allow the extension to dial a mobile radio code. [I]

c) The supplier shall indicate all the supported VoIP codecs and protocols. [I]

d) The system should allow a cell phone to automatically select a radio channel and then allow the extension to dial a mobile radio code. [I]

e) The supplier shall indicate how they intend keying the transmitter when a telephone patch is in progress and how they intend releasing the patch. [I]

f) The system shall support analogue and digital mobile radio system (DMR tier 1 &2.). [I]

3.2.19.4 Broadcast function

a) The supplier shall indicate if the system supports radio channel broadcast. [I]

3.2.20 Line monitoring

a) The system should allow traffic on any line to be monitored/ listened to on specific speakers. [I]

b) The requirement could be to monitor as many as eight circuits simultaneously whilst leaving the operators console free to deal with other circuits. [I]

3.2.21 Auto sound cut-off for external devices

a) Eight sets of change-over contacts should operate upon:

1) Selection of a channel. [I]

2) Receipt of a valid tone call. [I]

3) Receipt of incoming ringing. [I]

b) This facility will be used to cut the sound of devices such as radio's and TV's. [I]

3.2.22 Privacy on calls

a) It shall be possible to either select privacy or non-privacy per line CCT. [I]

b) For privacy calls, it must not be possible for any other person to listen to the conversation but it must be recorded like all other calls. [I]

c) It shall be possible to listen to any non-privacy calls [I]

3.2.23 Call logging

a) The requirement could arise where a report needs to be generated by the system, reporting on the following:

1) Operator efficiency. [I]

2) Time to answer per line and average. [I]

3) Time on hold per line and average. [I]

4) Outgoing calls per Operator. [I]

5) Outgoing calls per line. [I]

b) The supplier is to indicate the type of reports it is able to generate or, failing that, whether a port is available for connection to a PC running a proprietary management software package. [I]

3.2.24 Short code dialling

a) The system should be capable of storing 150 - 200 common telephone numbers which are available to any operator by the dialling of an abbreviated code. [I]

b) Each console should be capable of storing 10 individual short codes, which are separate from the common stored numbers. [I]

3.2.25 Call restriction

a) The system should provide the facility to restrict calls. Each operator console user should be able to be configured in one of the following groups: -

1) Unrestricted. [I]

2) Short code dialling. [I]

3) Local calls only. [I]

4) International calls. [I]

5) Specified areas only. [I]

3.2.26 Voice logging

a) Provision shall be made for the connection of each operator's speech circuit to a track of a third party external multi-track voice logger. [I]

b) The supplier shall provide an option for internal system voice logger. [I]

c) The supplier shall provide a solution for an external system voice logging system. [I]

d) Potential-free change-over contacts shall be provided per channel which shall operate upon the selection of that channel or the presence of earth on the E-wire. [I]

e) Output levels to the voice logger should be OdBm, 600 Ohms balanced. [I]

f) It shall be possible to activate/deactivate voice recording per line. [I]

3.2.27 Grouping of radio channels (special function)

a) A quick group button facility is required and shall support buttons assigned on the operator console which will automatically group a pre-programmed number of radio channels when selected.

b) The group should automatically be removed when the call is dropped and these buttons must be programmable to any of the available consoles.

c) This grouping shall allow up to 32 groups with up to 8 radio channels in each group.

d) The requirements exist to group radio channels with or without the operator being involved by using the 5-tone EEA calling system. It will be required to group between two and ten radio channels in one group. A time out facility should exist which is adjustable between 30 sec and 5 min. [I]

e) In addition to the above requirement, it shall be possible to group between 2 and 20 radio channels indefinitely. Such grouping must only be achievable via the system manager's intervention (ie. not by the operator or via tone calling as described above). [I]

f) It shall be possible to have ten such groups established at any one time. It shall be possible to select a group of channels by depressing the line button associated with any individual channel in that group. [I]

g) The status lamps of the other channels in the group shall mirror those of the selected line. Temporary linking of these groups to other such groups shall be possible as described in the first paragraph of this section. [I]

h) The system should be able to automatically detect and reset a locked radio channel. [I]

i) Supervisor console should be able to route calls as and when needed. [I]

j) Also the individual desk should be able to select calls /channels on their own. The system should be accessible via corporate network. [I]

3.2.28 Radio answer back facility

a) Upon receiving a correctly decoded tone call on the mobile radio circuits, an answer back signal should be given to the calling party. This will inform the user that the call has been received at the control centre. Two types of answer back signals shall be provided:

1) Call has been received at the Control Centre. [I]

2) Call has been received at the Control Centre but operator is busy. [I]

b) Every valid tone call received must get an answer back, even if the line is selected. [I]

c) With a radio call, only a busy tone should be heard and with a telephone line a message should be sent back to the caller (option of caller number). [I]

3.2.29 Simple operating procedures

a) Because operators sometimes have to work under emergency conditions, all VCS operating procedures shall be as simple and universal as possible. Fast and easy operation should be possible under all conditions. [I]

3.2.30 System response time

a) The system's response to external stimuli shall not noticeably deteriorate as loading of the system increases. The response time specified below shall therefore be regarded as the worst acceptable under any loading condition. [I]

b) The delay between receipt of an external stimulus (button depression, touching of VDU screen, incoming seizure signal on a line etc) and execution of the appropriate functions (connection, disconnection, outgoing seizure, display, announcement etc) by the system shall not exceed one second for all operations. [I]

3.2.31 Expansion

a) The requirement could arise to expand the system with respect to channel capacity and amount of consoles. [I]

b) The tenderer should indicate what the maximum expansion capabilities are and how this will be achieved.

c) For modular systems, if expansion can be achieved in modules, this shall be clearly explained. [I]

3.2.32 Remote acoustic annunciator silence

a) It shall be possible to silence the acoustic annunciator sounding at any desk by the depression of a reset button at any of the other desks. [I]

b) The sounding annunciator so silenced shall be replaced with a low volume, intermittent tone. This remote silencing shall have no effect on the visual indication of that call status. Any further call arriving at a console so silenced shall reactivate the acoustic annunciator. This may in turn be silenced remotely as above. [I]

3.3 Console requirements

a) The system consoles must be PC based without mechanical push buttons. [I]

b) The consoles must be touch-screen. [I]

c) Programmed radio channels must be saved alphabetically. [I]

d) Peripheral cables, e.g. mouse, should be longer than normal office mouse cable. [I]

e) PCs shall be industrial PCs ruggedized for extended use. [I]

f) The supplier shall provide antivirus and software updates for the offered consoles. [I]

g) The tenderer shall submit details of the type of consoles being offered. [I]

h) It shall be possible to have different colours for touch screen buttons of differing functions on the same console. [I]

i) A speaker with volume adjustable to zero should be provided per console. Note that this is a separate speaker to that of the acoustic annunciator. The zero adjustability should not apply to the headpiece mentioned in Clause 3.2.13. [I]

j) It shall be possible to label each button or response block on the console with the appropriate alpha numeric designation. These labels should be clearly visible and such visibility. [I]

k) Each console shall be equipped with a dial keypad as per Clause 3.4.2 as well as operational elements for the facilities specified. [I]

l) Provision shall be made to test the functioning of the visual indicators. [I]

m) Due consideration shall be given to ergonomic factors pertaining to console shape, height, layout and slant as well as operational elements, labelling, etc. [I]

n) Operational elements shall be of robust construction and the supplier shall indicate the degree of modularity (if applicable) of such equipment. [I]

o) The Tenderer shall quote for the supply of and mounting of equipment into the desks for the consoles. The design of these desks will be subject to Eskom's approval. [I]

p) Future released consoles shall be backwards compatible with the offered system. [I]

q) The supplier shall indicate if console mobility using VoIP, virtual and web based consoles is supported. [I]

r) Console PCs shall be secured in such way that users cannot plug in personal devices e.g. CD, DVD, and USB which could potentially result in a virus being loaded onto the console.

s) The supplier shall propose any other measures which prohibit the users from running any software other than the Console software pre-loaded by an authorised person with the correct access rights.[I]

t) The supplier shall indicate if the supplied consoles support remote login. [I]

u) The supplier shall list and provide all licences associated with the consoles. [I]

3.4 Terminating circuits and signalling modes

3.4.1 General

a) The system shall make provision for terminating circuits compatible with the signalling modes detailed below. [I]

b) For modular systems preference will be given to as few as possible universal terminating circuit modules that can provide the specified signalling modes on a selectable basis by means of simple methods without the need to replace equipment. [I]

c) If the circuits are not universal, a requirement would be that not more than one line will terminate per card. If a termination circuit is universal, multiple line terminations per card will be allowed. [I]

3.4.2 PAX and PABX extensions

a) These 2-wire circuits provide interfacing with extension line circuits of PAXs, PABXs, and voice gateways as well as subscriber lines of the public telephone network in a central battery mode [I].

3.4.2.1 Incoming calls

a) An incoming call will be signalled by 17/25Hz AC ringing current provided by the exchange. [I]

3.4.2.2 Outgoing calls

a) The equipment shall provide for outgoing loop seizure followed by dialling. Transmission of outgoing dialling information will be either Decadic or DTMF, selectable for each line and as specified below:

1) Decadic loop impulsing at 10 ± 1 IPS with a make-to- break ratio of 1:2 with ± 5% tolerance [I]

2) DTMF in-band dialling employing 2 (*<) codes in accordance with CCITT Q.23. [I]

b) The exchange recall function shall, depending on the dialling employed, be signalled either by dialling digit "1" (Decadic dialling) or by means of a calibrated opening of 90 ± 30 ms (DTMF dialing). Manual hook-flash or a system requiring earth on a third wire is not acceptable. [I]

3.4.3 Direct voice circuits

a) Most of the Eskom direct voice circuits are based on 4 wire E&M .The 4 wire E&M telephone circuits are used for direct voice (point-to-point) communications to and from remote substations. [I]

b) The system shall accommodate analogue and VoIP based direct voice circuits. [M]

3.4.3.1 Incoming calls

a) An incoming call will be signalled by an earth received on the E-wire of more than 200ms in duration. This signal shall be detected by the relevant terminating circuit, which shall initiate the incoming call condition and indication as well as an audible signal to the distant calling party. This condition shall be maintained until the call is answered, irrespective of the presence or absence of further earths on the line. [I]

b) Earths less than 200 ms will be regarded as false signalling. [I]

3.4.3.2 Outgoing calls

a) An outgoing call shall be signalled by applying an earth to the M-wire. This signal shall be either in the form of a pulse with adjustable duration of between 1 and 5 seconds or continuous. In the event of pulsed signalling, subsequent ringing pulses shall be sent out by pressing the call button again .[I]

3.4.4 Mobile radio signalling circuits

a) These termination circuits will be used for interfacing with Eskom's mobile radio systems for telecommunications with mobile radios, repeater stations, base stations and radio paging systems [I]

b) Four wire E&M, E1s and digital connections will be used. [I]

3.4.4.1 Incoming calls

a) An incoming call will be initialized by correctly decoded 5- tone EEA signal on the receiver pair of any one or more of the mobile radio circuits. [I]

b) It should be possible to present all five digits of these decoding facilities to respond to 10 different (5-tone) tones. This will indicate (clauses 3.2.3 and 3.2.4) to the operator at the relevant console that an incoming call is waiting. [I]

c) An acknowledgement tone shall be automatically transmitted to the calling party to indicate that the call has been successfully detected and decoded (clause 2.16). [I]

d) This tone shall be a suitable unique tone eg. 1000Hz, sent once on the speech transmit wires for a preset time adjustable between 30ms and 2 seconds in the following way: -

1) Key the transmitter by applying an earth potential to the M-Wire. [I]

2) After expiry of the link establishment time (LET), send out the acknowledgement tone. Allowance should be made for an adjustable LET of 10ms to 1s. [I]

3) Remove the earth on the M-wire after transmission of the acknowledgement tone. [I]

e) The acknowledgement tone sent when the operator is busy on another call should be suitably different to the standard acknowledgement to prevent confusion. [I]

f) Once the operator has answered the call, further keying of the transmitter shall be under control of the PTT facility (simplex operation). [I]

3.4.4.2 Outgoing calls

a) The following method for establishing outgoing calls will be used when selective calling is used: -

1) Select appropriate channel. [I]

2) Momentarily depress the appropriate tone call enable button to automatically:

i. Key the transmitter by applying an earth to the M- wire. [I]

ii. Encode the relevant number into the calling code. [I]

iii. Send the inband calling code via the encoder after the expiry of the LET. [I]

b) Keying of the transmitter (ie. the application of earth potential to the M-lead by means of the call button) shall provide for half duplex operation. [I]

c) Once activated, keying continues only until the calling code has been transmitted. Subsequent intermittent keying shall be under control of the PTT button. [I]

d) It shall be possible to establish an outgoing call without employing EEA multi-frequency codes, in the manner proposed below. This method will be used for the majority of calls to mobile radios. [I]

e) Monitor the channel to establish that it is free. [I]

f) Key the channel transmitter associated with the channel by means of the PTT button. [I]

g) Call the wanted party by speech. [I]

h) The keying earth on the M-lead shall be removed while any radio call is placed on hold. When the operator retrieves such a call, it will be necessary to key the transmitter again by means of the PTT button. [I]

3.5 Selective calling

3.5.1 Eea signalling system specification

a) The EEA signalling system shall be implemented according to the Code of Practice MPT 1316 [1]. [I]

b) Five tones shall be combined into a tone sequence. Any combination shall be possible, but to avoid difficulty in decoding identical tones sent in succession, an eleventh tone shall be provided for use as a repeat tone (R). This tone shall be generated in the sequential tone transmitting equipment whenever the code number contains identical digits in succession. [I]

c) For example: 77733 shall be transmitted as 7R73R. [I]

d) Group calls and all calls shall be achieved by use of a group tone (G). After the initial digits are transmitted to select the group, the five tone sequence shall be completed by adding group and (where necessary) repeat tones. [I]

e) For example: A group of 100 units numbered 12300 to 12399 shall be called by transmitting 123GR. [I]

f) "All call"s shall be transmitted as GRGRG. [I]

g) The tone frequencies shall be specified in MPT 1316 [1]. [I]

3.5.2 Selective call decoder

a) It shall be possible to preset the code to which the system responds for each operator console.

b) All five digits of the codes shall be preset independently. [I]

c) The method of presetting the decoder shall be clearly documented in the technical manual. [I]

d) It should be possible to display the identification number of the calling mobile to the operators. [I]

3.5.3 Selective call encoder

a) All five digits shall be selectable. The LET, i.e. time allowed between TX initiation of the code transmission and the signal burst, shall be adjustable between 10ms and Is It should not be necessary to set up the code each time, the last code used is to be memorized by the equipment. [I]

3.5.4 Monitoring of selective calls

a) The system shall be capable of providing an output indicating selective call transmissions on the radio network, independent of operator call codes. [I]

3.6 Electrical characteristics

3.6.1 Digital switching equipment

a) All types of switching equipment will be considered. [I]

b) The tenderer shall supply full details of the equipment employed. The supplier should indicate how system faults are prevented and coped with, should they occur. [I]

3.6.2 Incoming AC ringing

a) AC ringing from a PAX, PABX or voice gateway will be 75V rms +-10% at 17 Hz to 25 Hz. Such a call shall not be registered until the ringing has been received for at least 200Ms. Ring current detection circuitry shall have the following characteristics -

1) Present a nominal 1.8 to 2.2 uF capacitance to line. [I]

2) Have a DC resistance of not less than 5 MEG OHMs. [I]

3) The magnitude of the detecting circuit impedance including the capacitor at 17 Hz and 25 Hz shall be between 4 KOhms and 10 KOhms when tested at 35 V and 75 V rms. [I]

4) Respond reliability to ringing voltages over 35 V but not respond to voltages less than 10 V. [I]

3.6.3 E&M Signalling

a) The earth potential on the E-wire of an E & M or radio circuit must be present for at least 200ms before an incoming call is registered in order to mask possible spurious signals (noise) on the line. [I]

b) The source current on the M-wire shall not exceed 200 mA and the E~lead circuitry shall be capable of sinking 200 Ma. [I]

3.6.4 Speech path unbalance

a) The 2-wire speech path unbalance during conversation for a 600 OHM termination shall not exceed the following limits -

1) 40 dB at 300 to 600 Hz. [I]

2) 46 dB at 600 to 3600 Hz. [I]

3.6.5 Test tone levels

a) Nominal test tone levels from the various types of circuits to be connected to the VCS are as follows [I]:-

1) 2-wire telephone extensions:

i. Transmit to exchange from VCS terminating circuit = 0 dBm.

ii. Receive at VCS terminating circuit from exchange = -7 dBm.

b) 4-wire direct voice and mobile radio circuits [I]:

1) Transmit to transmission equipment from VCS terminating circuit = -4 dBm.

2) Receive at VCS terminating circuit from transmission equipment = 0 dBm.

c) Average speech levels are nominally 10 to 15 dB below the stated test tone levels. [I]

3.6.6 5-Tone decoder sensitivity

a) The receive sensitivity of the 5-tone decoder should be adjustable +4dBmO to –10dBmO with respect to test tone levels [I]

3.6.7 5-Tone encoder levels

a) The transmit 5-tone level should be adjustable between 0dBmO and -20dBmO with reference to the test tone levels. [I]

3.6.8 Nominal impedance termination

a) The nominal impedance of external 2-wire central battery equipment such as an extension line circuit of a PABX will be 900 Ohm complex as per Telkom specification. [I]

b) The nominal impedance of 4-wire transmission systems will be 600 Ohms resistive. Termination of such systems by the VCS terminating circuits shall match this impedance. [I]

c) All speech circuits shall be terminated in the above-stated impedance during the idle and hold conditions, even if several consoles are employed. [I]

3.6.9 Mobile radio tone levels

a) The mobile radio acknowledgement tone and coded signalling tones shall nominally have the same level as speech when measured at the 4 wire output point. The level of these tones shall be adjustable from +4dBmO to -10dBmO. [I]

3.6.10 Psophometric noise

a) When measuring noise with a psophometer conforming to the latest CCITT recommendations, the total psophometric potential difference, appearing on any connected speech circuit and attributable to the communication control system, shall not exceed 0.5mV. [I]

b) The measurement shall be made at the transmission bridge during a busy hour. Refer to CCITT Q. 45 Paragraphs 3.5. [I]

3.7 Power supplies

a) All the supplied equipment shall support both AC and DC. [I]

b) Power supply shall be redundant and support two feeds. [I]

c) Equipment shall support 48DC (+20 %, -15%). [I]

d) Equipment shall support 230 V (+/-10%) 50 Hz (+/-2%). [I]

e) Supplier to specify the power consumptions for all the proposed equipment. [I]

f) All POE ports shall be compliant with IEEE802.3af (15.4W/port).

3.8 Operating environment

3.8.1 Climatic conditions

a) The equipment will normally be operated in a controlled environment with the following parameters -

1) Ambient temperature: 0°C to 50 °C. [I]

2) Temperature slew rate: 5 ° per hour. [I]

3) Relative Humidity: 40% to 60%. [I]

4) Elevation: 0 to 2000 m. [I]

b) The tenderer shall state the following information:

1) The ideal ambient conditions for continuous operation of the equipment.

2) The range of extreme ambient conditions under which the equipment can operate satisfactorily on a temporary basis as well as the permissible duration and frequency of such periods.

3) The maximum permissible temperature slew rate in the event of a failure of the air conditioning.

4) Whether the equipment is convection or force ventilated and what precautions are taken against failure of the ventilating fans.

5) Whether provision has been made for over-temperature alarms and facilities to shut down equipment in the event of the equipment temperature exceeding a safe limit.

5) The maximum heat dissipation of individual parts of the equipment.

3.8.2 Static and surge protection

a) The tenderer shall indicate what levels of static and surge protection are provided. [I]

3.8.3 Server based VCS

a) The supplier shall clearly indicate if the main controller of the offered solution is software based. [I]

b) Supplier shall indicate if the software based system supports virtualised environment. [I]

c) The supplier shall list the advantages and disadvantages of the server based systems. [I]

d) Supplier must clearly indicate how the server based system will integrate with legacy voice system. [I]

e) The server based systems shall support full redundancy. [I]

3.9 Equipment housing requirements

3.9.1 Equipment mounting and enclosures

a) The centralized equipment shall preferably be housed in 19 inch racks provided by the tenderer/Eskom. [I]

b) The tender shall state the dimensions of all equipment and floor loading of the centralized equipment. [I]

c) Cabinets shall meet the Eskom cabinet specification requirements [2]. Should the supplier provide equipment with not meeting these cabinet requirements the supplier shall clearly indicate. [I]

3.9.2 Plugin-in modules

a) In order to simplify maintenance, all equipment shall be easily accessible and slide-in, pluggable modules shall be used where applicable. [I]

b) Where applicable, card extenders shall be provided for every type of plug-in module to allow for ease of measurements for maintenance purposes. [I]

c) All modules are to be clearly labelled. The supplier shall indicate if the modules are hot swappable.

d) The system shall have a dual processor and power supply. [I]

3.9.3 Terminating card slots

a) The equipment shall provide for universal type card slots, i.e. any type of terminating circuit card can be plugged into any line terminating card slot. [I]

3.9.4 Earthing

a) The equipment must be bonded to the main station earth which will be provided by Eskom. The equipment shall be installed as per the transport installation guide [10] . [I]

3.10 Tests

3.10.1 General

a) All equipment shall be subjected to the manufacturer's standard works test and inspection. [I]

b) A report on the test, including voltage withstand capability of the equipment, shall be submitted to Eskom at least one week before delivery. [I]

3.10.2 Witnessing of tests

a) Eskom reserves the right to appoint representatives to be present at the specified tests. Such inspection shall not relieve the contractor of his responsibility for meeting all the requirements of the specification, and it shall not prevent subsequent rejection, if such material or equipment is later found to be defective. [I]

b) The manufacturer shall ascertain in writing whether inspection or witnessed tests, or both, are required. Eskom shall be given at least four weeks prior notice of any tests to be witnessed. [I]

3.10.3 Type tests

a) The equipment shall be type tested at either the manufacturer's works or his appointed agent in order to verify compliance with the Eskom specification. [I]

b) The tenderer shall submit a list of type testing criteria for Eskom's approval as soon as possible but not later than six weeks prior to commencement of such tests. [I]

c) Type testing shall include a 100 hour continuous operational test during which Eskom Engineers shall have full access to the complete and assembled system. Reasonable invalid operations may also be performed to ensure that the system reacts in an acceptable manner. [I]

d) If the system does not pass all the type testing criteria during the continuous test called for in Clause 3.10.3 or reacts in an unacceptable manner with invalid operations, it shall be deemed to have failed the 100 hour operational test. In this event, Eskom will give in writing within two weeks, a statement of non-compliance to the Contractor. [I]

3.11 Technical documentation

3.11.1 General

a) Technical documentation comprising data sheets, drawings, technical descriptions, operational manuals and instruction manuals form an essential part of the contract works and shall be submitted with the technical compliance schedules. [I]

b) No payment will be made for any equipment supplied as part of the contract works until the relevant documentation has been supplied in accordance with the requirements detailed in the contract. [I]

c) Three sets of approved technical documentation shall be delivered with the equipment. Eskom may for adjudication purposes, and before a contract has been awarded, request a sample copy of the documentation. [I]

3.11.2 Basic requirements

a) The documentation shall be in English. [I]

b) All documentation shall be contained in A4 size hardcover ring binders which will allow removal and insertion of sheets for updating purposes. [I]

c) The supplier shall provide a softcopy of all submitted hardcopy documents. [I]

d) Documentation shall correspond in exact detail with the equipment supplied to Eskom. [I]

e) Documentation shall adequately cover all aspects of installation, first line maintenance, data base changes (where applicable) and operation of the system. [I]

3.11.3 Revision of documentation

a) The tenderer shall advise Eskom in writing of any revisions or updates concerning documentation. [I]

b) The relevant revisions or sections containing updates shall be supplied to Eskom as soon as possible after such changes. [I]

c) Updating of documentation shall apply for the duration of the guarantee period of the equipment. [I]

3.12 Maintenance

3.12.1 Automatic maintenance testing

a) Where applicable, diagnostic programmes shall be incorporated to automatically test correct functioning of the system in order to simplify and assist maintenance. [I]

b) Remote from maintenance from within NMC and database changes should also be possible though the NMC management system. [I]

c) Remote maintenance through internet shall comply with Eskom OT cyber security standards [11] [12]. [I]

3.12.2 Alarm and test points

a) Provision shall be made for urgent and non-urgent alarms, extendable to remote points by means of potential-free contacts. [I]

b) Provision shall be made for sufficient test points and LED's to monitor system. An urgent alarm is any fault that will affect the total system. A non-urgent alarm is a fault that will affect only one console. [I]

3.12.3 Repair and exchange of faulty modules

a) The tenderer shall submit proposals on how he intends dealing with faulty modules sent to him for repair or exchange, the turn-around times, the charges for repair or exchange, and the guarantee periods. [I]

3.12.4 Spares

a) The Tenderer shall submit a detailed list of all components of the system. [I]

b) These items shall be itemized and individually priced. The supplier should also supply a recommended spares list for the system. [I]

3.12.5 Locking facility

a) Unauthorized access to all hardware shall be prevented by means of a locking device. [I]

3.12.6 Maintenance contract

a) The Tenderer shall quote for an optional maintenance contract to cover all equipment and to be renewed on an as and when required basis. [I]

b) This contract will take effect after expiry of the equipment guarantee period. Tenderer should indicate whether, and on what basis, software upgrades will be made available to Eskom as and when these upgrades are released. [I]

3.13 Network management system

a) The supplier shall indicate if the system supports the following requirements:

1) Simple network management protocol (SNMP). [I]

2) Hot standby. [I]

3) Remote configurations. [I]

4) Remote fault diagnosis. [I]

5) Alarm monitoring. [I]

3.14 Roadmap and MTBF

a) The supplier shall provide the roadmap for the proposed equipment. [I]

b) Roadmaps to clearly indicate the release date, the end of sale and the end of life for the proposed equipment. [I]

c) The supplier roadmap shall clearly indicate the hardware, software and licences which must be changed when upgrading to the newer versions. [I]

d) The change of hardware when upgrading to newer versions shall be very minimal. [I]

e) The supplier shall support new purchases and support of the proposed equipment for a minimum period of 10 years from the date of signing of contract with Eskom. [I]

f) The supplier shall provide the Mean Time between Failure (MTBF) for all the proposed equipment including the related modules. [I]

3.15 Availability

a) The system shall support availability of 99.999%. [I]

4. Authorization

This document has been seen and accepted by:

Name and surname	Designation
Cornelius Naidoo	COE Design Engineering Manager – PTM&C
Danie Du Plessis	Senior Manager - Grids
Paul Grobler	Chief Engineer - Tx
Prudence Madiba	Senior Manager - GX
Sikelela Mkhabela	Senior Manager - Dx
Joe Manyisa	Senior Manager – Eskom Telecommunications (Acting)
Nondumiso Zibi	Senior Manager - GIT

5. Revisions

Date	Rev	Compiler	Remarks
March 2017	1	Z. Mbebe	Specification required

6. Development team

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

- Eric Mabotja
- Jacques Schutte
- Kevin Plasket
- Lesiba Buthane
- Renier Joubert
- Rodney Westwood
- Thabang Ramokoena
- Thuli Tladi
- Ziyaad Gydien

7. Acknowledgements

KZN and Mpumalanga OU for providing the detailed requirements

Annex A – Sample Heading for Appendix

Suppliers shall return the compliance schedule below completed. Suppliers shall take note of the mandatory clauses as 100% compliance is required on these clauses. Suppliers shall indicate the status of compliance with each clause as compliant or non complaint.

ST_240-115024962 Rev 1.xlsx