

	Specification Report	Transmission Eskom Telecommunications NPAE
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**New System Operating Control
(SOC) Telecomms Network**

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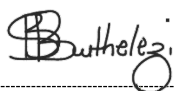
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1. Introduction

Transmission intends to build a new standby control room at eMkhiweni SS. The current Standby National Control, also known as System Operating Control (SOC) is located within Generation's Duvha Power Station currently. Several risks and issues have been cited with this building as a result of its age, location and current ergonomic conditions. Audit also reported that the Tx server room at Duvha does not meet the requirements of the Eskom server room and data centre standard.

2. Supporting Clauses

2.1 Scope

2.1.1 Purpose

This document outlines the specifications for an EPC contractor to provide a low level/detail design for the Telecommunication equipment for **System Operating Control (SOC) New Building** for telecommunication purposes.

The assigned EPC contractor will need to convert the specification indicated in this report into a low level design and present it to the TDRT committee for approval.

2.1.2 Applicability

This document shall apply throughout Eskom for SOC at eMkhiweni.

2.1.3 Effective date

This document is effective once all relevant parties have signed it.

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] ISO 9001 Quality Management Systems
- [2] 240-56362336 Standard for the Installation of a Telecoms Equipment Cabinet.
- [3] 240-56576361 Telecommunication Transport Network Equipment Commissioning Standard.
- [4] 240-77092389 Installation of Telecommunication Cable.
- [5] 240-170000055 Installation and Commissioning of Power Electronics Equipment
- [6] 240-132190480 Telecommunications Equipment Installation Standard.
- [7] .240-70044602 Occupational Health & Safety (OHS) Baseline risk assessment.

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- [8] 240-76666863 Telecommunications Network Architecture Standard.
- [9] 240-139189078 Project and Turnkey Supporting Templates Rev 4.
- [10] 240-73198174 SHE Specification.
- [11] 240-53458797 Process Control Manual (PCM) for Perform PTM&C Systems Engineering process governed the design process.
- [12] 240-101578948 Specification for CCTV Surveillance and Intruder Detection Systems
- [13] 240-62772907 Standard for Stationary Diesel Generator Systems

2.2.2 Informative

- [14] 240-46263618 Labelling of Fibre-Optic Cables.
- [15] 240-64455961 OLTE Design Guide
- [16] 240-170000419 OT voice design guide rev 2
- [17] 240-94136376 IT DATA Network Design guide Rev 3 Cisco Hardware.
- [18] 240-150755516 OTN OSN1800 AND OSN9800 DESIGN GUIDE rev 3
- [19] 240-56872313 Radio Station Earthing and Bonding Standard
- [20] 240-46264031 Fiber Optic Design Standard Substations.
- [21] 240-70732902 Fibre Optical Connector Standard
- [22] 240-46263618 Labelling of Fibre-Optic Cables.
- [23] 240-110412152 Generic QA Tick Sheet for Project
- [24] 240-118870219 Standby power systems topology and autonomy
- [25] 240-70732272 MSAP Design guide REV 2
- [26] 240-170000675 Ceragon Split unit microwave access radio design
- [27] 240-170001056 SCOPE OF WORK AND EVALUATION CRITERIA FOR OTN CABINET

2.3 Definitions

.

2.4 Abbreviations

Abbreviation	Explanation
AC	Alternating Current
ATP	Acceptance Test procedure
CCTV	Close Circuit Television
dB	Decibels
DC	Direct Current
DCN	Data Communication Network

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Abbreviation	Explanation
DEC	Data Energy Center
ET	Eskom Telecommunications
ETSI	European Telecommunications Standards Institute
GT	Golden Triangle
HLD	High Level Design
ICCP	Inter-control Centre Communication Protocol
IP	Internet Protocol
IPS	Interconnect Power System
IQA	Internal Quality Assurance
ITU	International Telecommunication Union
ITU-T	International Telecommunication Union - Telecommunication
KZN	KwaZulu-Natal
LLD	Low Level Design
MCB	Miniature Circuit Breaker
MOU	Mpumalanga Operating Unit
MSAP	Multiple-service Access Platform
MUX	Multiplexer
NCC	National Control Centre
NCE	Network Cloud Engine
NCE-T	Network Cloud Engine - Transmission
NMC	Network Management Centre
NMC	Network Management Centre
NMS	Network Management System
NPAA	National Planning and Application Engineering
O & FS	Operations and Field Services
OPGW	Optical Ground Wire
OTN	Optical Transport Network
PAX	Private Automatic Exchange
PM	Project Manager
PMO	Project Management Office
POD	Proof of Delivery
PS	Power Station
QA	Quality Assurance
REH	Regional Engineering Head
RS	Radio Site
RTU	Remote Terminal Unit
SAPP	South African Power Pool
SCADA	Supervisory Control and Data Acquisition
SCC	Standby Control Centre
SDH	Synchronous Digital Hierarchy

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Abbreviation	Explanation
SFP	Small Form-factor Pluggable
SHEQ	Safety, Health, Environment and Quality
SME	Subject Matter Expert
SOC	System Operating Control
SOW	Scope of Work
SS	Substation
TCM	Telecoms Contracts Manager
TDRT	Telecommunications Design Review Team
TEMSE	Transmission Energy Management System Evolution
TPSCM	Transmission Power System Control and Monitoring
UAT	User Acceptance Test
UPS	Uninterrupted power supply.
URS	User Requirement Specification
WAMS	Wide area Monitoring system
WEF	Wind Energy Facility

2.5 Roles and Responsibilities

Roles	Person	Contact no
Planner	Gerald Willemse	013 693 3126
Senior Engineer	Blessing Buthelezi	013 693 4519
Snr Technologist Engineer	Alphonse Malete	011 871 3166
Customer Relation Manager	Mmushi Langa	011 629 4000
O&FS Mpumalanga	Johan Le Roux	013 693 3540
Chief Engineer (Customer)	Mini Palamooti	011 871 2907
Project Execution Transmission TPD	Salamina Khanyile	011 800 4215
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Organizer to Mpumalanga local workgroup	Santa Steenkamp	SteenkS@eskom.co.za
Secretariat for TDRT	Sandra Makhatini	MakhatSL@eskom.co.za

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2.6 Process for Monitoring

The designated project planner shall be responsible to ensure that this design follows technical governance and authorisation. The TDRT committee shall carry the responsibility of ensuring that the proposed telecoms solutions are technically viable. The Telecommunications management must ensure that the recommendations in this report are implemented and the responsibility to implement this document will rest with the project management department.

2.7 Related/Supporting Documents

ETFM 1846 ET Project Planning Book Rev 1

- [1] User Manual of OSN1800V
- [2] User Manual of OSN9800 M12

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3. New System Operating Control (SOC) Telecomms Network

The high-level project scope is to develop and construct a new System Operating Control (SOC) building, making provision for adequate operating facilities, space to house the Transmission Power System Control and monitoring (TPSCM) equipment, and provide for the necessary telecommunications infrastructure in a suitable place as per the relevant standards. This will be a national key point and preferably situated near one of the Transmission substations in the Witbank area. This new project will be a for the Standby Control Center (SCC)

The design specification will be incorporated or attached in the User Requirements given to the EPC contractor from the Transmission project Team. This design specification highlights the telecommunication specification for the control room builds.

3.1 Financial

Financial and project cost for the Telecommunication requirements is not provided in this report.

This report only provides specification to which the EPC contractor needs to design the Telecommunication network.

3.2 New System Operating Control (SOC) Telecomms User Requirements (URS)

The URS stipulate the following requirements

300 X.21 serial ports + 120 ports growth per room (40%)

Ethernet Capacity for 1 G bandwidth which will include

- NCC – SCC TPSCM connecting the corresponding rooms (x2)
- NCC – SCC IMM
- WAMS connection 10 meg per room
- ICCP connection 10 meg per room
- SAPP IPP 10 meg per room
- SCC to 6 respective Dx Control centers
- Telephone
- Dealer board

Ethernet Capacity for 1 G bandwidth with the possibility of growth

- Security

Ethernet Capacity for 1 G bandwidth which will include

- Group IT connections (1 G)

Future

- Ethernet capacity is expected to grow for future use.

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3.3 Design Specifications.

The project from Transmission will be a contractor self-build.

This report will supply a BOQ with quantity as a reference for the low-level design.

The procurement and installation and commissioning of the telecommunication equipment will be for the assigned contractor.

The commissioning of the equipment will be overseen by Telecommunications staff.

The EPC Contractor needs to present a low-level/detail design to the Mpumalanga local workgroup.

Upon recommendation of the workgroup, the EPC Contractor needs to present the low level detail design to the Telecomms Design Review Team (TDRT) for approval.

The design should comply to 240-76666863 Telecommunications Network Architecture Standard. The Eskom requirement is to design for platinum + services. Dual DC feed to all equipment and dual control cards to eliminate a single point of failure.

All equipment to be commissioned up to the stage that they are visible and configurable on the Telecommunication Network Management Centre (NMC) system.

All equipment will require a soak test and ATP. ATP to be witnessed by Eskom Telecommunication staff.

The Design shall cater for all the services listed in section 3.2 as a minimum. The specification indicated in the document does cater for future growth.

Provide a power consumption calculation for all the equipment. The power consumption calculation should also indicate that the standby time on power backup system complies to 240-118870219 Standby power systems topology and autonomy standard. There should be reference that the power consumption of the Telecommunication network has been taken into account when the power supply or UPS system is designed.

Equipment to be installed according to 240-56362336 Standard for the Installation of a Telecoms Equipment Cabinet.

Equipment to be commissioned according to 240-56576361 Telecommunication Transport Network Equipment Commissioning Standard.

The design specification for the Telecommunication equipment for the SOC is further explained under the following headings

1. Emkhiweni SS Control room - 3.5.1
2. Arnot fiber ring completion - 3.5.2
3. eMkhiweni System Operating Control Equipment room - 3.5.33.5.3
4. DEC room A and B - 3.5.4

The detail design should include the above and the interconnection there off.

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Figure 1 below shows the high level integration into the Eskom Telecommunication network

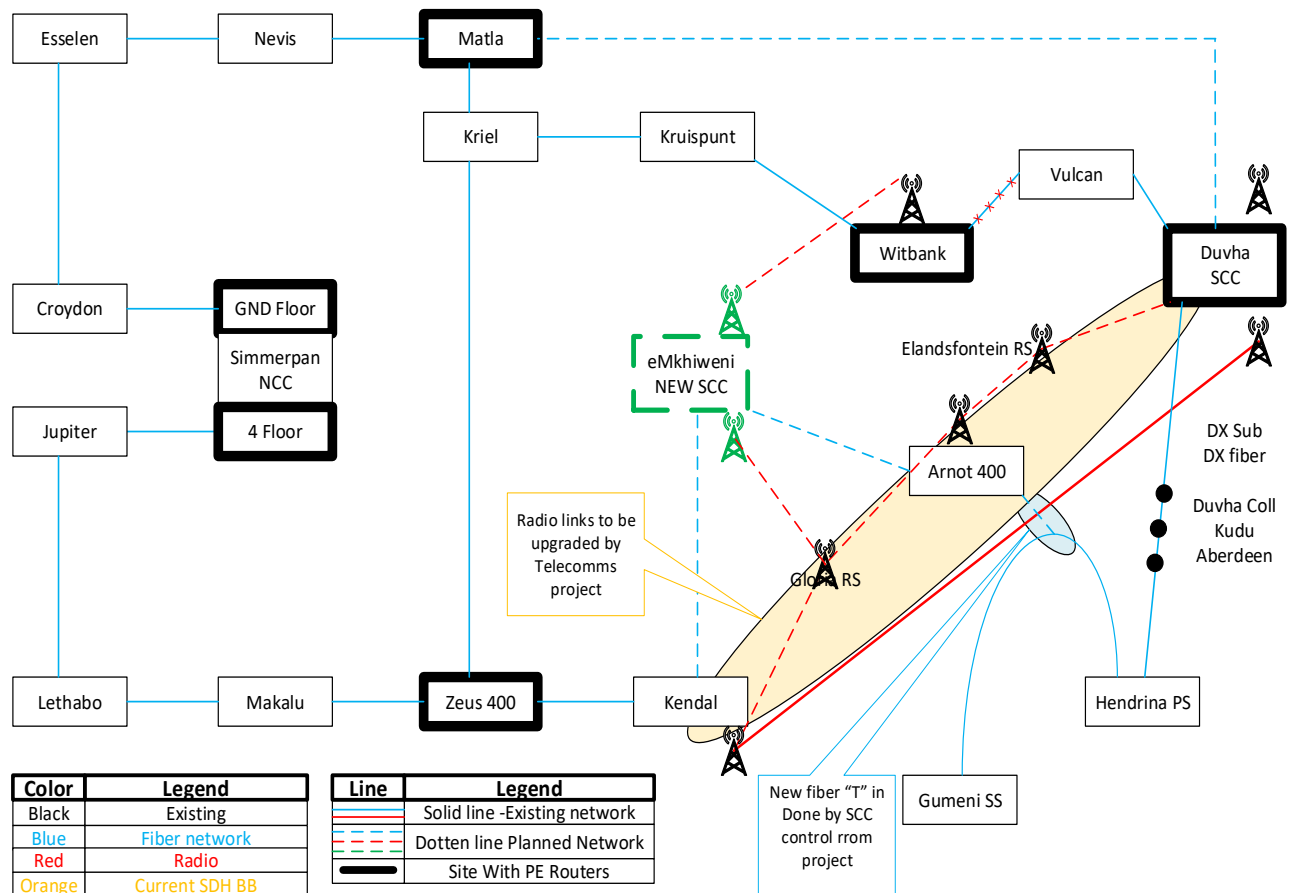


Figure 1: Design

3.4 Additional design factors not prescribed in this report specifications.

- Control room, equipment room and DEC room layout and cabinet positions
 - The design should provide or request the control room layout where a different entity designed it. The design must indicate the cabinet position for all telecommunication equipment required to complete the design. These drawings need to be included in the design presented to TDRT.
- DC requirements.
 - The telecommunication supplied equipment must be capable of operating on 48 V DC. The 48 V DC supply is not specified or described in this document. The DC supply should comply to 240-118870219 Standby power systems topology and autonomy standard.
- OPGW cable
 - This document is not providing any specification with regards to the high voltage power line or the installation of OPGW fiber.

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- This document stipulates a 48-core single mode fiber to be used on installations and the use of SC-APC patch panels.
- Radio tower
 - This document is not providing a tower design specification for the procurement and construction of a radio tower.
 - The Radio tower design will be evaluated by the Eskom Line services department.
- Tele protection equipment
 - The low level design required for TRDT approval is only up to the X.21 port of MUX equipment. Tele-protection equipment not covered in this document.
- Emkhiweni SS project exclusion
 - The following is part of the Emkhiweni substation build and does not form part of the control room build.
 - Installation of a 48 core OPGW fiber between Kendal 400 SS and Emkhiweni SS.
 - Installation of a 48 core OPGW fiber between Arnot 400 and Emkhiweni SS
 - Design and Erection of a 50 meter radio tower
 - Installation of the Telecommunication equipment such as OTN , MSAP FOX 615 and Router equipment. Design drawing have been included in this design.

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3.5 Low level design specifications.

Where additional drawings are required the Telecommunication department can only provide it in Microsoft Visio or PDF format.

3.5.1 Emkhiweni SS control room.

3.5.1.1 OTN network Emkhiweni SS

Reference to **Error! Reference source not found.** , Drawing 2

This Telecommunication equipment in drawing 1 will be present and commissioned to provide communication from Emkhiweni SS. This connection needs to be augmented in the design to accommodate the System Operating Control.

Provide an augmented OTN design that indicate where a minimum of 40 Gb/s is connected. It is the network designer choice to increase the line rate to 100Gb/s. The new design should show the new line connection in the following directions.

- Emkhiweni SS - Kendal 400 SS
- Emkhiweni SS - DEC Room A and B respective
- Emkhiweni SS – eMkhiweni SOC equipment room
- Reference to Eskom OTN plan rev 5.6.

The cabinets to comply with SCOPE OF WORK AND EVALUATION CRITERIA FOR OTN CABINET. Unique Identifier 240-170001056

Provide a cabinet layout if equipment has been changed or added.

Provide a BOQ for the OTN and or modules

Provide a DC drawing of the DC connection inside the cabinet if equipment has been changed or added. There should be a trip switch rated for each equipment in the cabinet.

Provide an optical layer and configuration sheet indicating the distances and losses on the fiber. Lazer transmit power and expected receive levels. Where the line rate remains at 40 Gb/s this information can be provided for the Kendal 400 direction.

Eskom to provide the following and must form part of the overall Telecommunication design.

- OTN NE number and IP address. Table 3
- MUX drawing indicating connections and line rate. Drawing 4

3.5.1.2 Microwave Radio Emkhiweni SS

The microwave radio between Emkhiweni SS and Witbank Eskom Park will be an IP 20N radio designed. Detail on the frequency and modulation is indicated in Table 2 : Ceragon IP20N Radio Information.

This capacity of the installed radio is insufficient to provide the required bandwidth. This radio need to be upgraded / replaced to a radio capable of both STM 1 and 1 Gb/s.

Emkhiweni SS 50 m radio tower detail. Drawing 5

Eskom Park radio tower detail. Drawing 6

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Eskom has frequencies license in the 8 G and 7 G frequency band. The design needs to indicate which frequency band will be used. Note the use of existing frequencies from Witbank Eskom Park.

Provide a microwave radio design showing the following

- Radio path profile
- The radio link to accommodate hybrid STM 1 and > 800 Mb/s Ethernet
- Radio link budget.
- Link must be protected by space diversity or specify alternative protection offered.
- 99.999 % availability with a rain fall factor of K
- Microwave radio frequency to be used is 7 or 8 Ghz range. The Radio should be designed using 28 MHz Channels spacing as Recommended by ITU-R 497 (6).

The microwave radio links design will indicate the radio configuration, antenna size and antenna height.

Provide a proposed cabinet layout for Emkhiweni and Witbank Eskom Park if the equipment has changed or added. Witbank Eskom Park cabinet layout and floor plan drawings available on request. The final design is to be provided by the EPC Contractor.

Provide a DC drawing of the DC connection inside the cabinet if the equipment has changed or added. There should be a trip switch rated for each equipment in the cabinet.

Provide a BOQ for the microwave radio link.

This design should provide a microwave radio link budget to comply to 240-70783066 Telecoms Transport Network Design Standard. And provide a 99.999 % availability.

Structural analysis on radio towers to be provided to ensure the new antenna does not overload the tower.

Eskom to provide the following and must form part of the overall Telecommunication design.

- Frequency application to ICASA. (the awarding of frequencies is not guaranteed)
- MUX drawing indicating connections and line rate.

3.5.1.3 MSAP Fox 615

The Existing MSAP FOX 615 installed for the substation communication remain as installed and commissioned. As the microwave radio will be replaced, the E1 connection to the microwave radio should be redirected to the OTN equipment using a different E1 card (PL1D). The MSAP FOX 615 carry platinum plus services and require separating paths not using the same module or card.

The design should provide a new MSAP FOX 615 at Emkhiweni substation. This MSAP FOX 615 will be labelled Emkhiweni Gateway A.

The design principle in Drawing 9 indicates a concept of the MSAP FOX 615 gateway

Provide a proposed cabinet layout for a new MSAP Fox 615 unit.

Provide a DC drawing of the DC connection inside the cabinet. There should be a trip switch rated for each equipment in the cabinet.

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A minimum of 6 LEDE1 modules to be included in the Design. The design should cater for multiple E1 connections from outside sites.

Design and provide sufficient connections that need to be made to the MSAP FOX 615 in DEC room A and DEC ROOM B respective.

Refer to Drawing 7 and Drawing 8 of suggestive option to consider. The design can have E1 or STM 1 connections as indicated in 240-70732272 MSAP Design guide REV 2 but need to provide dual route and sufficient bandwidth. The design needs to indicate the concept as indicated in Drawing 9

Provide a module layout for Fox 615.

Provide a BOQ for the Fox 615 mux.

Eskom to provide the following and must form part of the overall Telecommunication design:

- Fox 615 IP addresses of the Gateway Node
- MUX drawing indicating connections and line rate.
- Link numbers terminating on the OTN.
- Link numbers termination between the Gateway and DEC Rooms.

Circuit numbers for the substation that will terminate on the X.21 ports are available for the respective substations. The cutover from the existing TPSCM system at Duvha will use port multi-dropping on the MSAP FOX 615. Ensure sufficient bandwidth for this cutover period.

3.5.1.4 Router ASR903 and Switch

There will be an ASR903 router present at Emkhiweni SS.

The System Operating Control design can repurpose this router in the design. This router can be used as an aggregate router(PE) or be left as a CE router. It is recommended to have two routers at the Emkhiweni SS, one as an aggregate and one as a CE router. The design still needs to indicate the connection with sufficient bandwidth for the SOC Ethernet requirements. The design should follow 240-94136376 IT DATA Network Design guide Rev 3 Cisco Hardware.

Refer to the proposed Telecommunication architecture in [Figure 1: Design](#) and the bandwidth requirements for each direction so Eskom can ensure that required bandwidth is available at the respective end routers.

Provide a BOQ for the router requirements at Emkhiweni.

Provide a proposed cabinet layout for the routers.

Provide a DC drawing of the DC connection inside the cabinet if the equipment has changed or added. There should be a trip switch rated for each equipment in the cabinet.

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3.5.2 Arnot Fiber ring completion.

To comply with 240-76666863 Telecommunications Network Architecture Standard a second fiber route need to be established.

For sufficient bandwidth to be provided for the SOC and to comply with route recumbency the second fiber route needs to be connected to the OTN Network.

Kendal and Duvha respective is part of the OTN Network as indicated in Eskom OTN Plan Rev 5.6

Indicated in the [Figure 1](#) the SOC will be linked to Kendal via fiber. Kendal can be linked to the OTN and National Control Center with high bandwidth capacity.

The second fiber route from Emkhiweni substation to Arnot cannot be used currently as an alternative or secondary route. Arnot is not connected to the OTN Eskom Telecommunication fiber Network. Arnot is connected via microwave radio with limited bandwidth capacity.

For the fiber ring to be completed this design should include the following fiber installation:

The design should be done in conjunction with LES (Eskom Line Engineering services). Detail and specification on the high voltage line is not described in this design specification and will have to be presented to the LES committee for approval.

The Arnot fiber ring completion will be achieved by designing and installation of two 48 core OPGW fiber cable on the Arnot Rockdale 275 KV line between Arnot Power Station and where the Hendrina Gumeni 400 KV line cross. An OPGW fiber cable to replace both earth guard wires on Arnot Rockdale 275 KV line. Reference to Figure 2

There is an existing 48 core OPGW installed on the Hendrina Gumeni 400 KV line.

The Arnot Rockdale 275 KV fiber should " T " in to the Hendrina Gumeni 400 fiber. This will form a loop in and loop out but with fiber.

It will be for the fiber designer to specify where and how this will happen. A recommendation is to terminate the fibers with appropriate dome joints and join the dome joints with underground DUCT Fiber cable between the HV pylons.

The Arnot -Rockdale line crosses the Hendrina -Gumeni line about 5 km outside of Arnot Power Station. At the crossing cut the 48 core OPGW fiber on the Hendrina Gumeni line and redirect the fiber to Arnot Power Station.

The first 48 core OPGW fiber is from Arnot on the Arnot -Rockdale line is to connect in direction Hendrina on the Hendrina -Gumeni HV line.

The second 48 core OPGW fiber on the opposite earth guards wire from Arnot on the Arnot - Rockdale line to connect in direction Gumeni on the Hendrina -Gumeni line OPGW fiber.

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3.5.3 eMkhiweni System Operating Control (SOC) Equipment room

This section will describe all the design specification required at the eMkhiweni System Operating Control (SOC) Equipment room and will include the OTN fiber connection to Arnot then Hendrina up to Duvha central to complete the ring.

3.5.3.1 eMkhiweni SOC Equipment room building and DC

Provision needs to be made to include an equipment room in the System operation Control room building to install all the relevant equipment. This specification in this document is only pertaining to the Telecommunication requirements. This document does not indicate the physical building room size, Security requirements, HVAC and DC requirement and will be left to the Civil design to include.

The contractor doing the Telecommunication design should engage with the Civil design to ensure adequate space in the room for all the Telecomms related equipment.

The contractor doing the Telecommunication design should engage with the AC and DC design to ensure adequate 50 V DC supply to the Telecomms equipment. The DC design to comply with 240-118870219 Standby power systems topology and autonomy. This document does not describe any AC or DC specification. Drawing 10 only indicate a proposal as a concept.

3.5.3.2 OTN network SOC equipment room

Reference to Drawing 7 and Drawing 8

This equipment will be present and commissioned to provide communication from eMkhiweni SCC to the rest of the Eskom Network. New OTN equipment need to be designed for this. This OTN design will need to make connection to the DEC Rooms, Emkhinweini SS and Arnot 400 up to Duvha to complete the network as a ring.

Once the Arnot ring connection have been completed a fiber connection will exist from Arnot to Hendrina. Hendrina has a fiber connected to Duvha 400. This Fiber route is a DX ADSS fiber and will require a through patch at 3 respective substation. Duvha Coll SS, Kudu SS and Aberdeen SS.

The design needs to provide an OTN equipment and connection at 40 Gb/s or higher from eMkhiweni System Operator Control equipment room to Arnot 400 SS passing by Hendrina SS and terminating at Duvha 400 SS on the OTN equipment.

Provide an OTN design that indicates where a minimum of 40 Gb/s is connected. It is the network designer choice to increase the line rate to 100Gb/s.

- eMkhiweni SOC control room – Emkhiweni SS
- eMkhiweni SOC control room – Arnot 400 Kv substation
- eMkhiweni SOC control room – DEC Rooms A and B respective
- Arnot 400 Kv substation – Hendrina
- There are substations between Hendrina and Duvha 400 where the fiber will require patch leads. No OTN equipment is required to be installed at substation between Hendrina and Duvha 400
- Hendrina – Duvha 400 SS
- Reference to Eskom OTN plan rev 5.6.

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The cabinets to comply with SCOPE OF WORK AND EVALUATION CRITERIA FOR OTN CABINET. Unique Identifier 240-170001056

Provide a cabinet layout for all substation in question

Provide a BOQ for the OTN for all substation

Provide a DC drawing of the DC connection inside the cabinet for all substations. There should be a trip switch rated for each equipment in the cabinet.

Provide an optical layer and configuration sheet indicating the distances and losses on the fiber. Lazer transmit power and expected receive levels for all substation

Eskom to provide the following and must form part of the overall Telecommunication design.

- OTN NE number and IP address.
- MUX drawing indicating connections and line rate.

3.5.3.3 Microwave Radio at eMkhiweni SOC equipment room

The new radio tower is to be erected next to eMkhiweni SOC equipment room for a radio link to Gloria Radio Station. This new radio tower should not be confused with the 50 meter radio tower installed for Emkhiweni SS. As per standard a new radio tower will be required to provide diverse radio routes. As indicated previously the radio tower design specification will not be described in this document.

Provide a microwave link design from SOC equipment room building to Gloria Radio Station. The radio link to accommodate an STM 1 and 800 Mb/s throughput.

Microwave radio frequency to be used is 7 or 8 Ghz range and is left to the link designer to decide. Note needs to be taken into account of current frequency usage at Gloria Radio site. The Radio should be designed using 28 MHz Channels spacing as Recommended by ITU-R 497 (6)

Gloria Radio Station tower is existing, and its location is Latitude 26°06'15.9"S and Longitude 29°33'09.84"E. Gloria consists out of a 34 m tower. Drawing 11_tower layout.

Provide a proposed cabinet layout for eMkhiweni SOC equipment room and Gloria RS. Due to the variety of microwave radio link designs no equipment drawings is supplied for Gloria RS. The final design is to be provided by the EPC Contractor. Current layout drawings available for Gloria RS

Provide a DC drawing of the DC connection inside the cabinet. There should be a trip switch rated for each equipment in the cabinet.

Provide a BOQ for the microwave radio link.

This design should provide a microwave radio link budget to comply to 240-70783066 Telecoms Transport Network Design Standard. And provide a 99.999 % availability.

The microwave links design will indicate the radio configuration, antenna size and antenna height.

Structural analysis on radio towers to be provided to ensure the new antenna does not overload the tower.

Eskom to provide the following and must form part of the overall Telecommunication design.

- Radio terminal IP addresses.
- Frequency to be used.

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- Frequency application to ICASA. (The awarding of frequencies is not guaranteed)
- MUX drawing indicating connections and line rate.

3.5.3.4 MSAP Fox 615 eMkhiweni SOC equipment room

A new MSAP FOX 615 installed for the equipment room will be required. This MSAP FOX 615 will be referred to as eMkhiweni Gateway B

Provide a design for a new MSAP FOX 615 at eMkhiweni equipment room.

The design principle in Drawing 9 indicate a concept of the MSAP FOX 615 gateway

Provide a proposed cabinet layout for a new MSAP Fox 615 unit.

Provide a DC drawing of the DC connection inside the cabinet. There should be a trip switch rated for each equipment in the cabinet.

A minimum of 6 LEDE1 modules to be included in the Design. The design should cater for multiple E1 connections from outside sites.

Design and provide sufficient connection that need to be made to the MSAP FOX 615 in DEC room A and DEC ROOM B respective.

Refer to Drawing 7 and Drawing 8 of suggestive option to consider. The design can have E1 or STM 1 connections as indicated in 240-70732272 MSAP Design guide REV 2 but need to provide dual route and sufficient bandwidth. The design needs to indicate the concept as indicated in Drawing 9

Provide a module layout for Fox 615.

Provide a BOQ for the Fox 615 mux.

Eskom to provide the following and must form part of the overall Telecommunication design.

- Fox 615 IP addresses of the Gateway Node
- MUX drawing indicating connections and line rate.
- Link numbers terminating on the OTN.
- Link numbers termination between the Gateway and DEC Rooms

Circuit numbers for the substation that will terminate on the X.21 ports are available for the respective substation. Cater for port multi-dropping on the MSAP FOX 615 from Duvha TPSCM system. Ensure sufficient band width.

3.5.3.5 Router ASR903 and Switch eMkhiweni SOC equipment room

A new router will be required at the eMkhiweni equipment room. This router design should cater for an Aggregate router and CE router and POE Switch for Telephone use. As there will be a number of Ethernet services to be connected to these routers. The design should follow 240-94136376 IT DATA Network Design guide Rev 3 Cisco Hardware.

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Refer to the proposed Telecommunicating architecture in [Figure 1: Design](#) and the bandwidth requirements for each direction so Eskom can ensure that required bandwidth is available at the respective end routers. Stipulate the bandwidth requirements for each direction so Eskom can ensure that required bandwidth is available at the respective end routers.

Provide a proposed cabinet layout for the routers.

Provide a DC drawing of the DC connection inside the cabinet. There should be a trip switch rated for each equipment in the cabinet.

Provide a module layout for the router.

Line connection needs to be provided to the respective direction with dual route redundancy.

- DEC Rooms A and B respective
- Emkhiweni Substation
- Duvha 400
- Microwave Radio to Gloria RS

Ethernet services to must be catered for. The design should include the cabling and equipment below

- 21 Dealer Boards [8 Dealer Boards for Senior Controllers; 4 Dealer boards for NCC Controllers; 9 Dealer boards for the Simulator]
- 50 Telephone and telephone line reticulation. Detail will be as per Civil design and final concept of room layout in the building.
- 240-170000419 OT voice design guide rev 2 is the reference of the Dealer board and telephones to be supplied and included in the design.
- Voice recording on the dealer boards and telephones as required.as the standard.

Ethernet services must be catered for but only the port connection to be provided.

- Security 1 Gb/s port and a connection to Simmerpan National control.
- Group IT 1 Gb/s layer one connection to Mega Watt Park on the OTN.

Provide a BOQ for the ASR903.

Eskom to provide the following and must form part of the overall Telecommunication design.

- Router IP address.
- Link numbers terminating on the OTN.
- Circuit numbers for each connection to the router.

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3.5.4 DEC Room A and B (Data Energy Centre)

DEC Room A and B will be exact replicas of each other thus a design for DEC room A and B can be duplicated. The name DEC Room A and B might change. For the design specification listed in this document the two respective rooms will be referred to as DEC Room A and DEC Room B.

3.5.4.1 DEC Room A and B room size and DC

The contractor doing the Telecommunication design should engage with the Civil design to ensure adequate space in the room for all the Telecomms related equipment.

The contractor doing the Telecommunication design should engage with the AC and DC design to ensure adequate 50 V DC supply to the Telecomms equipment. The DC design to comply with 240-118870219 Standby power systems topology and autonomy. This document does not describe any AC or Dc specification. Drawing 10 only indicate a proposal as concept.

This specification in this document is only pertaining to the Telecommunication requirements and not the physical building room size, security requirements, HVAC and DC requirement will be left to the Civil design

3.5.4.2 OTN network DEC Room A and B

Reference to Drawing 7, Drawing 8. These are options and not limited to give a variety of design directions and equipment to be presented. Where the OTN equipment will be used in the design it is expected that the design principals as described in 3.5.3.23.5.3.2 will be followed and presented in the design report.

Where the OTN equipment will be used at DEC Room A and B respectively a minimum of 40 Gb/s is connected is required. It is the network designer choice to increase the line rate to 100Gb/s. The following connection will be required

- DEC room A – Emkhiweni SS
- DEC room B – Emkhiweni SS
- DEC room A - eMkhiweni SOC control equipment room
- DEC room B - eMkhiweni SOC control equipment room
- Connection to the MSAP FOX 615 with module redundancy on connections

3.5.4.3 MSAP Fox 615 DEC Room A and B

New MSAP FOX 615 equipment DEC Room A and B respective will be required.

Provide a design for a new MSAP FOX 615 for the respective DEC rooms.

The design principal in Drawing 9 indicate concept of the MSAP FOX 615 gateway

Provide a proposed cabinet layout for a new MSAP Fox 615 unit.

Provide a DC drawing of the DC connection inside the cabinet. There should be a trip switch rated for each equipment in the cabinet.

Design and provide the require the three hundred (300) X.21 serial ports + hundred and twenty (120) ports growth per room (40%). It is recommended to have only 60 ports per MSAP FOX box.

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Every X.21 port must be protected by a physical X.21 protection unit. The design and installation should cater for the wiring of the X.21 port between the X.21 protection unit and MSAP FOX 615 X.21 panel.

The current X.21 standard used by Eskom is a DB 15 pin connector plug.

It is recommended to have all the X.21 protection units in one cabinet so a central point can be used to make a connection between the Telecommunication equipment and TPSCM equipment. The design should cater for proper labelling of ports so that record keeping, and fault finding will be easier.

The design responsibility stops at the X.21 protection unit. The System Ops SCADA will be responsible to connect each port from the protection unit to their TPSCM system.

Refer to Drawing 7 and Drawing 8 of suggestive option to consider. The design can have E1 or STM 1 connections as indicated in 240-70732272 MSAP Design guide REV 2 but need to provide dual route and sufficient bandwidth. The design needs to indicate the concept as indicated in Drawing 9

Provide a module layout for Fox 615.

Provide a BOQ for the Fox 615.

Eskom to provide the following and must form part of the overall Telecommunication design.

- Fox 615 IP addresses of the Gateway Node
- MUX drawing indicating connections and line rate.
- Link numbers terminating on the OTN.
- Link numbers termination between the Gateway and DEC Rooms

Circuit numbers for the substation that will terminate on the X.21 ports are available for the respective substation. Cater for port multi-dropping on the MSAP FOX 615 from Duvha TPSCM system. Ensure sufficient band width.

3.5.4.4 Router ASR903 at DEC room

A new router will be required at the respective DEC Room. This router can be used as an CE router. As there will be number of Ethernet services to be connected to this router. The design should follow 240-94136376 IT DATA Network Design guide Rev 3 Cisco Hardware.

Provide a proposed cabinet layout for the ASR903 router.

Provide a DC drawing of the DC connection inside the cabinet. There should be a trip switch rated for each equipment in the cabinet.

Provide a module layout for the router at the respective DEC room.

Line connection needs to be provided to the respective direction with dual route redundancy.

- Emkhiweni SS router
- eMkwiweni SOC equipment room router

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Ethernet services to be catered for by providing the port availability.

- Telephone services.
- WAMS
- ICCP
- IMM
- TPSCM
- Distribution Control Rooms
- SAPP
- Prots for these services need to be included.

Provide a BOQ for the ASR903.

Eskom to provide the following and must form part of the overall Telecommunication design.

- ASR903 IP address.
- Link numbers terminating on the OTN or between router. The designer needs to indicate
- Circuit numbers for each connection to the router.

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3.6 Safety

Safety requirements will be done by project assigned safety officer.

3.7 Procurement

A Proposed BOQ is shown below and it should be used as a guideline and not as specification on the low level/detail design.

Item No.	Bill of Materials for Telecommunications (Standard Design, Contract Items)	Emkhweni SS	DEC A	DEC B	SOC equipment	Arnot PAX	Gloria RS	Kendal	Durba	Hendrina	Eskom Park	Total Qty
	Description (enter contract number first, then enter descriptions)											
1												
2	ABB Fox 615 4600064029											
3	SHELF ASSY, ELCTR:ABBMSAP-6U;FOX:FFT	1	6	6	1							14
4	MODULE,COMMS:ABB-MSAP-E18;FOX	8	12	12	8							40
5	MODULE,COMMS:ABB-MSAP-UNIDA;FOX - X.21		90	90								180
6	MODULE,COMMS:ABB-MSAP-CPU;PROCESSOR	1	6	6	1							14
7	MODULE,COMMS:ABB-MSAP-STM;FOX											
8	MODULE,COMMS:ABB-MSAP-S11;FOX											
9	SOFTWARE:ABB-MSAP-LIC;FOX	1	6	6	1							14
10	MODULE,COMMS:ABB-MSAP-L41;FOX											
11												
12	Com 10 Charger 4600062264											
13	MODULE:M; DISTRIBUTION;I/P 50 VDC	1	6	6	4							17
14	MODULE:P; DISTRIBUTION;I/P 50 VDC	1	6	6	4							17
15												
16	OTN 4600066137 - Use 20 ZAR to 1 USD											
17	ASSY:10G3W080;OTN;ADD DROP MULTIPLEXER		1	1	1			1		1		5
18	BOARD PC:03030URB-E;OTN;TNF1EMR410-E	2	2	2	2			2		2		12
19	BOARD PC:02311LGE-9-EA;OTN - UNQ2 with 2 XFP		2	2	2			2	2	2		12
20	BOARD PC:02311LGA-017-E;OTN	1	2	2	2			2		2		11
21	BOARD PC:03030MJE;OTN;XFP-LH40-192	8	8	8	8			8		8		48
22	BOARD PC:02311LGE-010-EA;OTN		1	1				1		1		4
23												
24	OT Voice Contract number: 4600068823											
25	ANSWERING MACHINE TEL;CP-7821-K9-;FIXED		2	2	48							52
26	Enhanced Flex Plan 3.0 Smart License		2	2	48							52
27												
28	WORLD TELECOM AND DATA 4600069611											
29	SHELF ELCTR:16		24	24								48
30	ARRSTR ELECTRNC:PORT SINGLE MODULE (X.21)		360	360								720
31	TERMINAL FDTHRU:DISCONNECT MODULE;PBT	8	20	20	8	8	8			8	8	88
32	CABLE COMM:TEL INDRF(50) PAIR;0.6 MM	200	100	100	200	200	200			200	200	1400
33	PANEL PTCH:SINGLE MODE FO (48) SC/APC		2	2	2	2	2			2	2	16
34	CABLE FBR OPTC:HDD;24;9 U;9/125 U		4000	4000								8000
35	CABLE COMM:CAT5E U/FTP:SOLID 24 AWG;PVC		500	500								1000
36	CABLE ELECT:BVX02FCM;600/1000 V;2;6 MM2 (100	1	1	1	1	1	1			1	1	8
37	FRAME:BACK MOUNT;WD 19 IN	4	6	6	4	4	4			4	4	36
38	CABLE ELECT:300/500 V;2;CU;2.5 MM2	1	1	1	1	1	1			1	1	8
39												
40	WIRCONN 4600071130											
41	CABINET:COMPLETE A-48U;WD 600 MM;600 MM	1	12	12	6				1	2		34
42												
43	Ceragon Radio											
44	IP-20N 2RU/10-slot base package w/ 2x48	1			1		1				1	4
45	IP-20 TCC-B-MC, w/ SD-Card	2			2		2				2	8
46	IP-20 RMC-B	5			5		5				5	20
47	IP-20 LIC 1 x STM1/OC# RST	5			5		5				5	20
48	SL-- Capacity 150M, per carrier	5			5		5				5	20
49	SL-- ACM, per carrier	5			5		5				5	20
50	SL - MC-ABC, per carrier	5			5		5				5	20
51	SL-- Edge-CET-Node mode	1			1		1				1	4
52	SL-- Main card redundancy	1			1		1				1	4
53	1500HP 8G 2RX SM / All Indoor	5			5		5				5	20
54	HFA-8 5+0 SD X PDU2	1			1		1				1	4
55	8 GHz, 3.0 m, High Performance, Dual Polarized	2			2		2				2	8
56	STD TERMINATION LOAD PDR84/CPR112G (WR112)	2			2		2				2	8
57	SFP STM-1 Module Short Haul 1310nm	2			2		2				2	8
58	Power cable D-Type/Open-end, 40A, 2.2m	2			2		2				2	8
59	Automatic High Pressure Dehydrator	1			1		1				1	4
60	Earthing kit per 25 m	2			2		2				2	8
61	Clamp Kit	50			50		50				50	200
62	7/8 GHz Elliptical Waveguide Per Meter	70			70		70				70	280
63	7/8 GHz Waveguide Installation Kit per 25m	2			2		2				2	8
64	NM_PRO_TRX	5			5		5				5	20
65												
66	Cisco hardware contract 4600072214											
67	UNIT:ROUTER SERIES:CHASSIS:ASR-903		1	1	1							3
68	PROCESSOR:A900-RSP3C-400-S=	2	2	2	2							6
69	MODULE:ROUTER:SLASR903A	1	1	1	1							3
70	MODULE:ROUTER:A900-IMA85	2	2	2	2							6
71	MODULE:ROUTER:A903-FAN-E	1	1	1	1							3
72	MODULE:ROUTER:A903-FAN-F	1	1	1	1							3
73	SOFTWARE:L-ASR903-EPNM2RTM;EPNM,NMS	1	1	1	1							3
74	MODULE:GLC-TE;SFP;I/P ETHERNET;O/P 1 GB	2	8	8	6							24
75	CX LEVEL 1.8X5XNBD APIC Cluster Large		1	1	1							3
76	MODULE:STEEL:SWITCH SFP;GLC-LH-SMD=	2	16	16	16							50
77	MODULE PWR SUP:A900-PWR900-D2;ROUTER		2	2	2							6
78												
79	MODULE COMM:A900-IMA48D-C=;E1											
80	PANEL PTCH:PANEL-48-1-RJ48=;E1											
81	CORD COMM:CABLE-16TDM-C=;TDM,LG 3.048 M											
82												
83	SWITCH NETW:IE-4010-4S24P;ETHERNET	1	2	2	1							6
84	MODULE PWR SUP:PWR-RGD-LOW-DC-H;SWITCH	2	4	4	2							10
85	NTFC-8X5XNBD IE4010 4x 1G SFP, 24	1	2	2	1							6
86	IE 4010 DNA Essentials, 3 Year Term license	1	2	2	1							6
87	SOLN SUPP SW SUB IE 4010 DNA Essentials	1	2	2	1							6

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88												
89	Site Design	1	1	1	1	1	1	1	1	1	1	10
90	Hardware Installation	1	1	1	1	1	1	1	1	1	1	10
91	Basic Configuration	1	1	1	1	1	1	1	1	1	1	10
92	Commissioning	1	1	1	1	1	1	1	1	1	1	10
93	Cut over	1	1	1	1	1	1	1	1	1	1	10
94	As Built Documents	1	1	1	1	1	1	1	1	1	1	10
95	Project manager rate per hour	1	1	1	1	1	1	1	1	1	1	10
96	SHEQ File and site audit	1	1	1	1	1	1	1	1	1	1	10
97	Design and planning per link	1	1	1	1	1	1	1	1	1	1	10
98	Transport Costs for Materials	1	1	1	1	1	1	1	1	1	1	10
99	Accommodation	1	1	1	1	1	1	1	1	1	1	10
100												
101	BE7K Server: CUCM											
102	Cisco Business Edition 7000H (M5) Appliance, Export Restr. SW (BE7H-M5-K9)				2							2
103	UCS SUPP PSS 24X7X4 Cisco Business Edition 7000H (M5) Applia (CON-PSJ3-BE79M5KH)				2							2
104	Cisco BE Embedded Virt. Basic Plus 7x, BE6K/7K only (BE6/7K-VIRTBASP-7X)				2							2
105	PSS SW/SS UPGRADES Cisco BE Embedded Virt. Basic Plus 7x, B (CON-PSBU-BE67KVSP)				2							2
106	UCSC-C220 Server: Recording											
107	UCS C220 M5 SFF 10 HD w/o CPU, mem, HD, PCIe, PSU (UCSC-C220-M5SX)				1							1
108	UCS SUPP PSS 8XSXNBD UCS C220 M5 SFF 10 HD w/o CPU, mem, HD, (CON-PSJ1-C220M5SX)				1							1
109	32GB DDR4-2933-MHz RDIMM/2Rx4/1.2v (UCS-MR-X32G2RT-H) (UCS-HD600G10K12N)				2							2
110	600GB 12G SAS 10K RPM SFF HDD (UCS-HD18TB10K4KN)				1							1
111	1.8TB 12G SAS 10K RPM SFF HDD (4K) (UCS-HD18TB10K4KN)				2							2
112	Intel i350 quad-port MLOM NIC (UCSC-MLOM-IRJ45)				1							1
113	32GB SD Card for UCS servers (UCS-SD-32G-S)				1							1
114	Ball Bearing Rail Kit for C220 & C240 M4 & M5 rack servers (UCSC-RAILB-M4)				1							1
115	Intel 5218 2.3GHz/125W 16C/22MB DCP DDR4 2666MHz				2							2
116	Cisco 12G Modular SAS HBA (max 16 drives)				1							1
117	Cisco UCS 1050W AC Power Supply for Rack Server				2							2
118												
119	Recording											
120	ATMOS on prem hardware - 100 extensions				1							1
121	ATMOS on prem license - 100 extensions				1							1
122	SLA and Installation 100 extensions				1							1
123												
124	Trader Board											
125	MONITOR VIDEO:IPT-PRO-T4-MIC-BUN;15 IN				21							21
126	channel support				21							21
127	TSS and TPO application software bundle - 400 concurrent channels				2							2
128	Redundant				2							2
129	TSS Virtual appliance license				2							2
130	TPO Virtual appliance license				4							4
131												
132	Analogue Gateway											
133	Cisco VG450 144 FXS Bundle				4							4
134	PRTNR SS 8XSXNBD Cisco VG450 144 FXS Bundle				4							4
135	16G DRAM (1 DIMM) for Cisco ISR 4461				4							4
136												
137	SRST Gateway											
138	Cisco ISR 4331 UC Bundle, PVDMA-32, UC license				3							3
139	PRTNR SS 8XSXNBD Cisco ISR 4331 UC Bundle, PVDMA-32, UC L				3							3
140	8 port Multiflex Trunk Voice/Clear-channel Data T1/E1 Module				3							3
141	256-channel DSP module				3							3
142												
143	Switches											
144	Catalyst 1000 24port GE, Full POE, 4x1G SFP				5							5
145	PRTNR SS 8XSXNBD Catalyst 1000 24port GE, Full POE, 4x1G				5							5
146	Rack Mount Kit for 1RU for 2960-X, 2960-XR and 2960-L				5							5
147	1000BASE-LX/LH SFP transceiver module, MMF/SMF, 1310nm, DOM				8							8
148												
149	IP Phones											
150	Cisco IP Phone 8851				8							8
151	PRTNR SS 8XSXNBD Cisco UC Phone 8851				8							8
152	8800 Series Audio KEM, 28 Button				8							8
153	PRTNR SS 8XSXNBD 8800 Series Audio KEM, 28 Button				8							8
154												
155	Ad Hoc											
156	Ad hoc Support (Installation & Commissioning)											
157	Installation and commissioning (including SHEQ files preparation)				5							5
158	Ad hoc Support (Project Management)											
159	Accommodation (3 Star Hotel)				20							20
160	KM's (Class A vehicle)				600							600
161	Flight (Economy - Johannesburg to East London)											
162	Car rentals (Class A vehicle)											
163	Flight (Economy - Johannesburg to Cape town)											
164												

Table 1 : Proposed BOQ

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3.8 Completion

ATP and commissioning will be provided by the contractor and witnessed by Telecomms for each technology installed.

Telecomms will do a QA on the installation.

Commissioning will be accepted once all terminals/elements are visible and configurable on the respective nodes.

4. Acceptance

This document has been seen and accepted by Mpumalanga workgroup and TDRT participants:

Name	Designation
Johan Le Roux	Manager Field Services Mpumalanga
Lawrence Tau	Snr Supervisor Tech Field Mpumalanga
Mini Palamootil	Chief Engineer Prof Electrical
Zanele Mathunjwa	Snr Technician Engineering Mpumalanga
Alphonse Maletse	Snr Technologist Engineer
Santa Steenkamp	Snr Clerk Support Services Mpumalanga
Blessing Buthelezi	Snr Engineer Prof Engineer Mpumalanga

5. Revisions

Date	Rev.	Compiler	Remarks
September 2023	0	G Willemse	First Edition

6. Development Team

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

- Gerald Willemse

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7. Acknowledgements

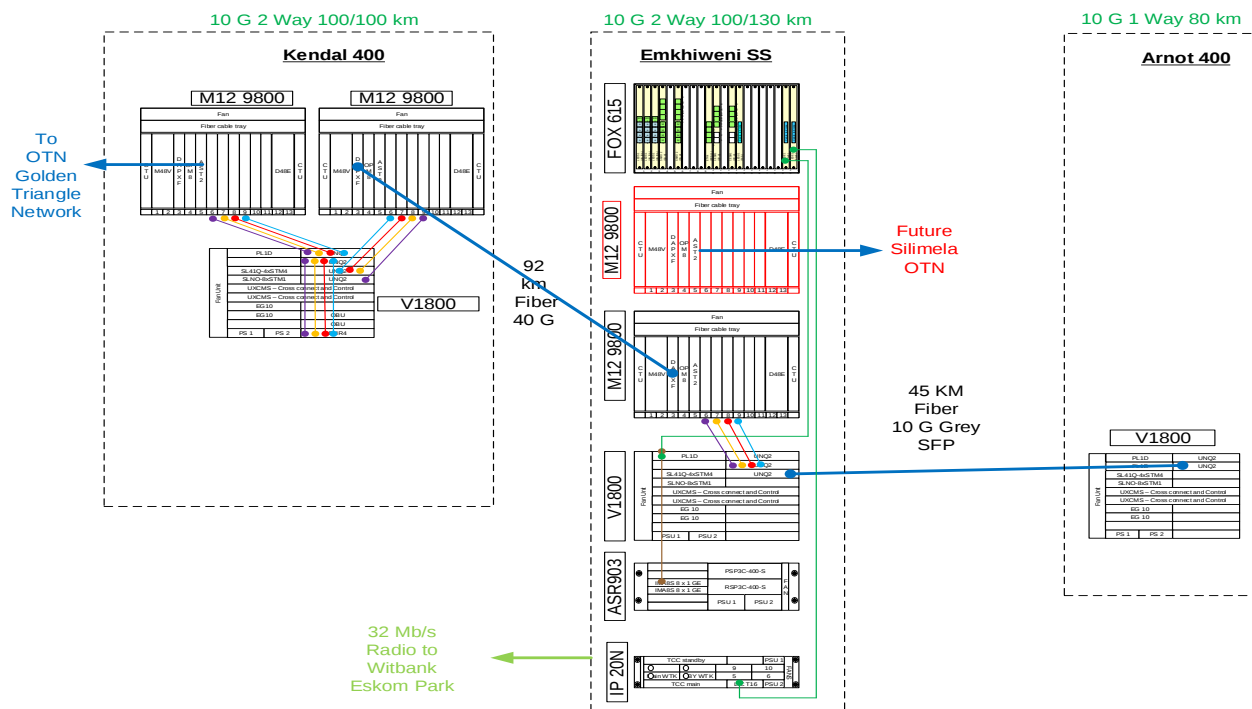
- Blessing Buthelezi
- Mini Palamootil
- Thabo Morule
- Fanie Bergh
- Alphonse Malete

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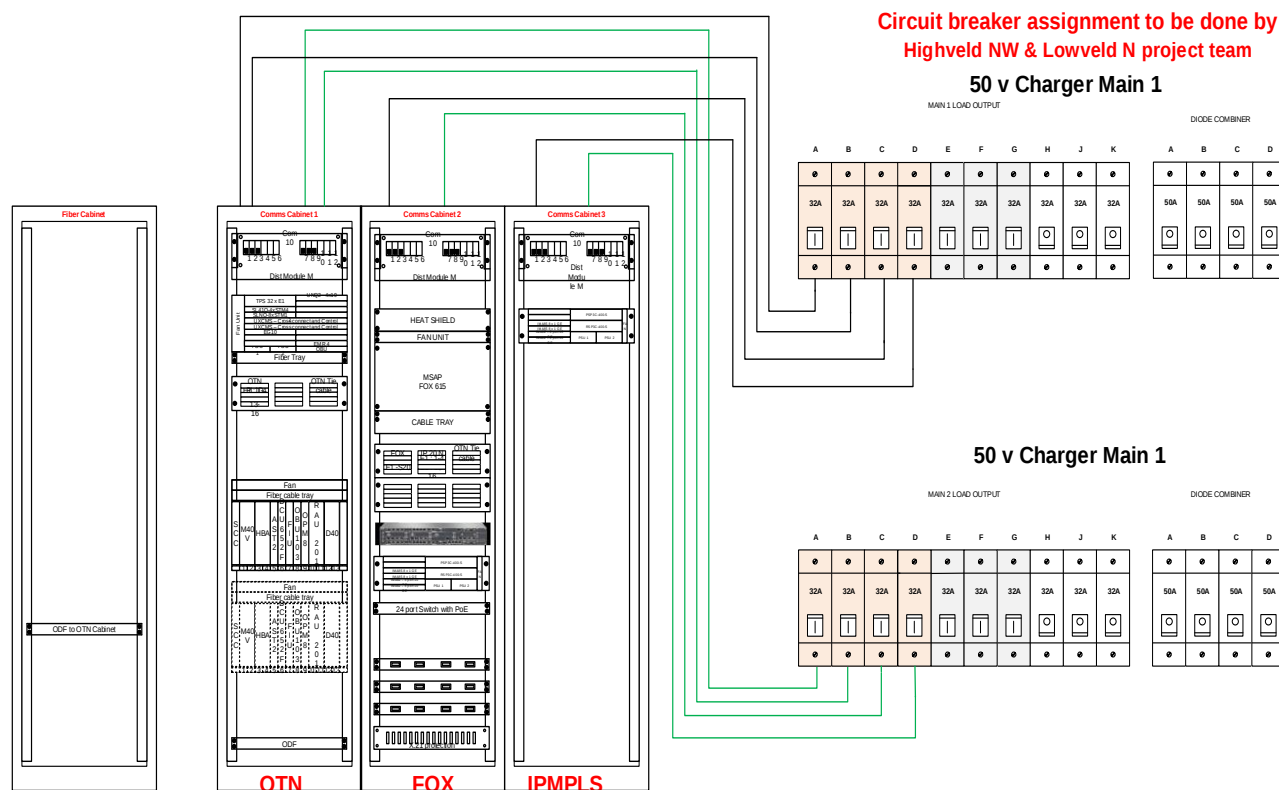
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- Annexures



Drawing 1 : Emkhiweni substation build project equipment and connection

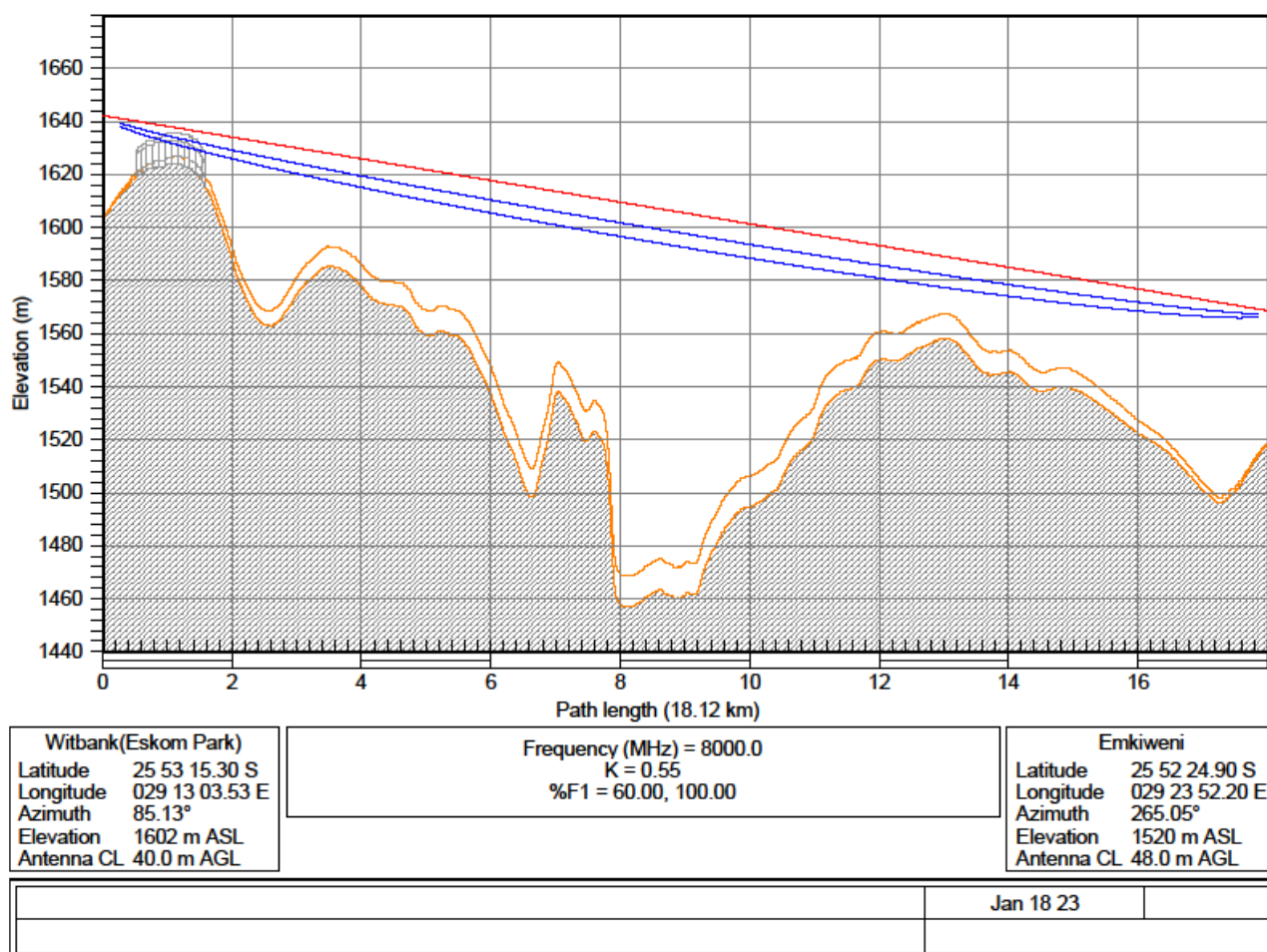


Drawing 2 : Emkhiweni substation build project cabinet layout and DC

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Drawing 3 : Emkhinweni to Witbank Eskom Park Radio Path profile

Unit	IP 20 N 1+1 hot standby
TX Frequency Emkhiweni	8300 MHz
RX Frequency Emkhiweni	8426 MHz
DNS Router loopback IP on router	10.46.26.161 / 28 – Tsv52879
Emkhiweni Unit IP address	10.46.26.162
Modulation Emkhiweni	128 QAM – 39 Meg
Channel spacing	7 MHz
Site Co-ordinates Latitude (S)	25° 52' 26.84'
Site Co-ordinates Longitude (E)	29° 24' 01.59'
Antenna direction Witbank Eskom Park	1.2 m vertical
Radio current consumption	4 A
MCB rating	6 A
E1 Connection MUX reference	Arnot MUX

Table 2 : Ceragon IP20N Radio Information

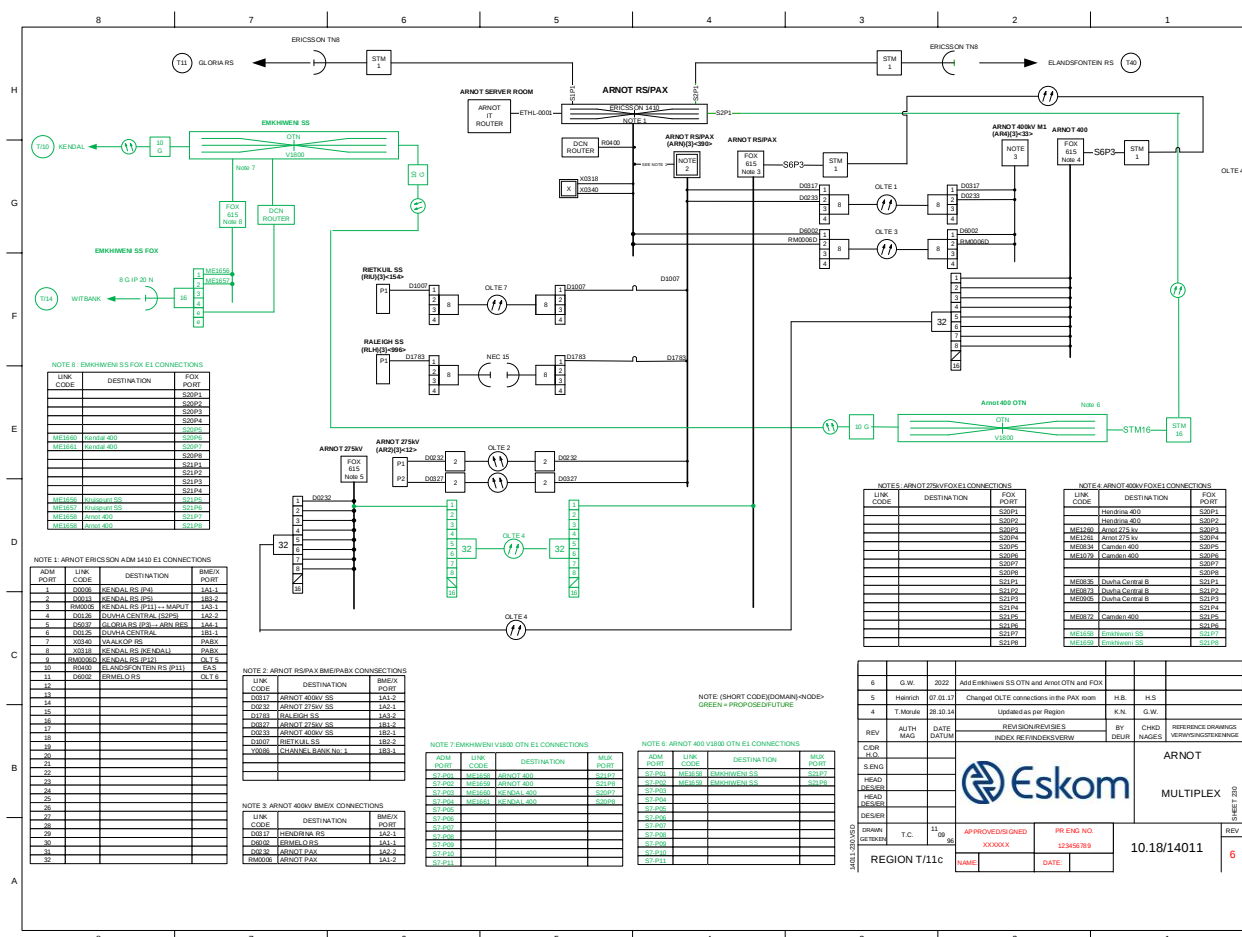
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No	Site	Chassis	NE ID	IP
62	Kendal 400	OSN 1800V	32-5633	10.32.22.1 / 24
63		OSN 9800 M12 -1	32-5634	10.32.22.2 / 24
64		OSN 9800 M12 -2	32-5635	10.32.22.3 / 24
65	Emkhiweni SS	OSN 1800V	32-5636	10.32.22.4 / 24
66		OSN 9800 M12 -1	32-5637	10.32.22.5 / 24
67		OSN 9800 M12 -2	32-5638	10.32.22.6 / 24
68	Arnot 400	OSN 1800V	32-5639	10.32.22.7 / 24
69	Arnot IT	OSN 1800-1v	32-5640	10.32.22.8 / 24

Table 3 : IP Assignment of existing equipment

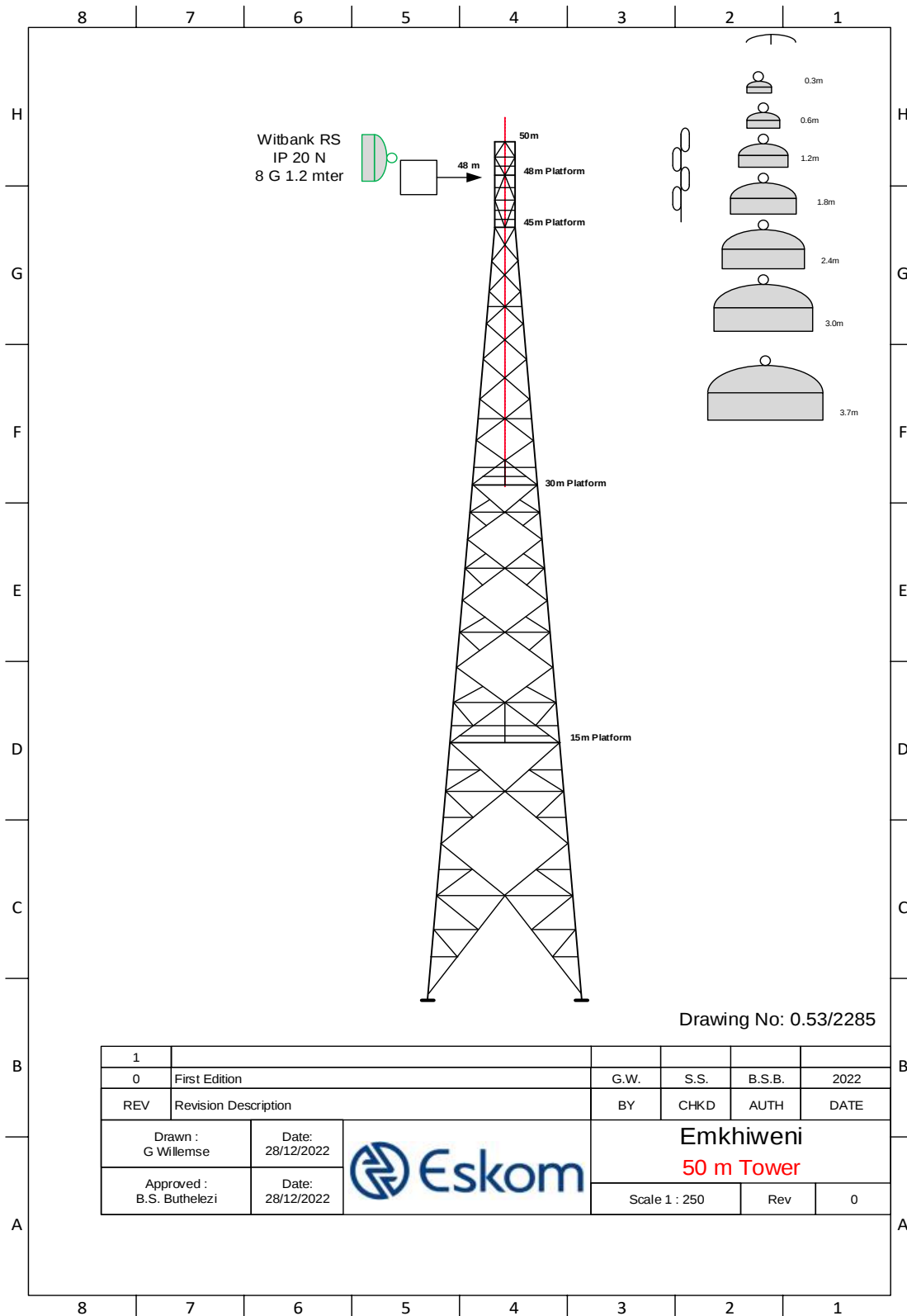


Drawing 4 : MUX Emkhiweni and Arnot

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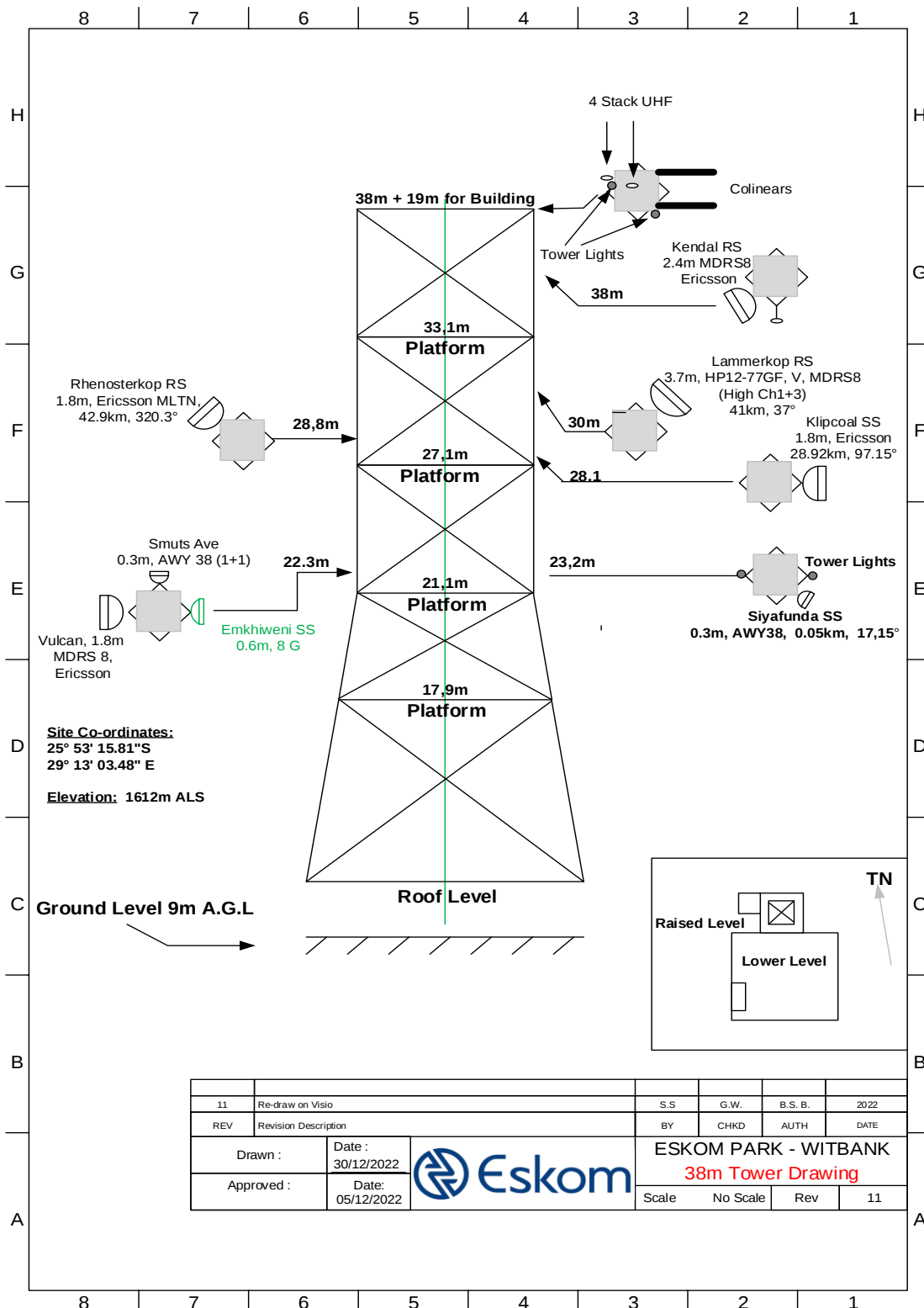
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**Drawing 5 : Emkhiweni SS 50 meter radio tower****CONTROLLED DISCLOSURE**

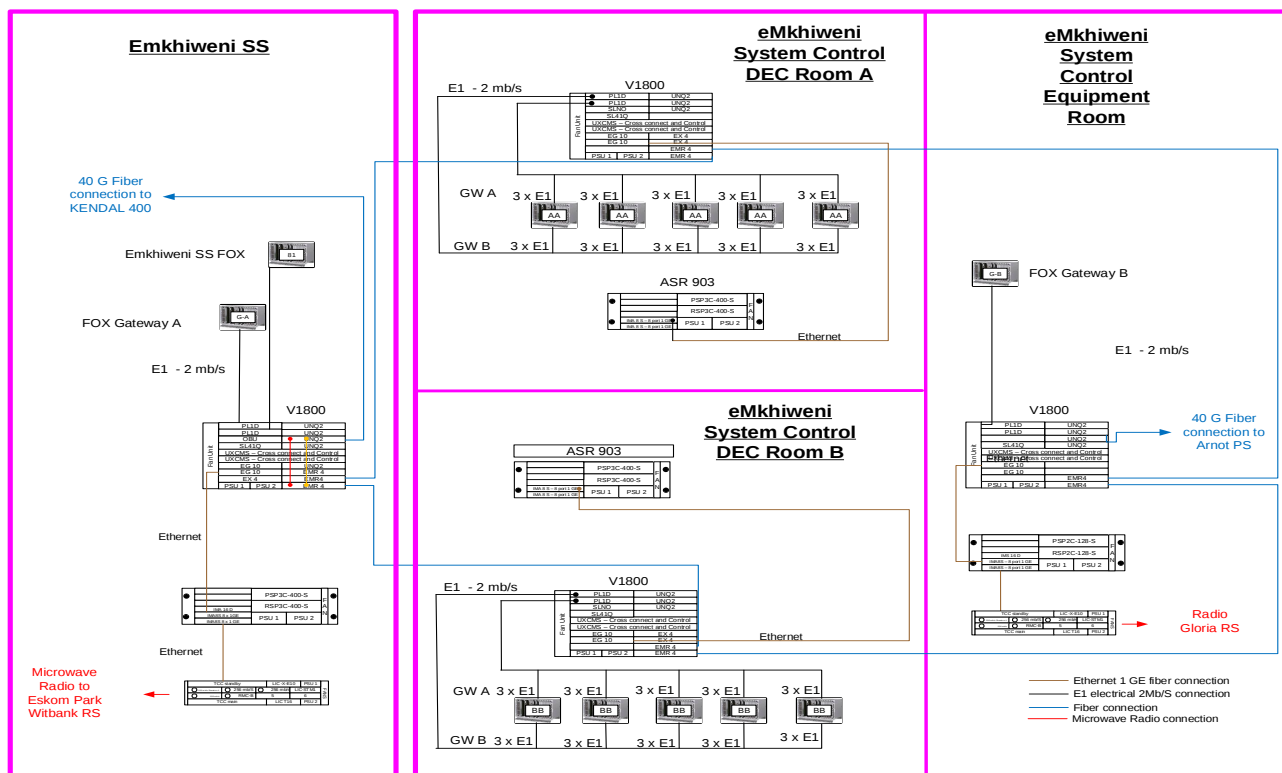
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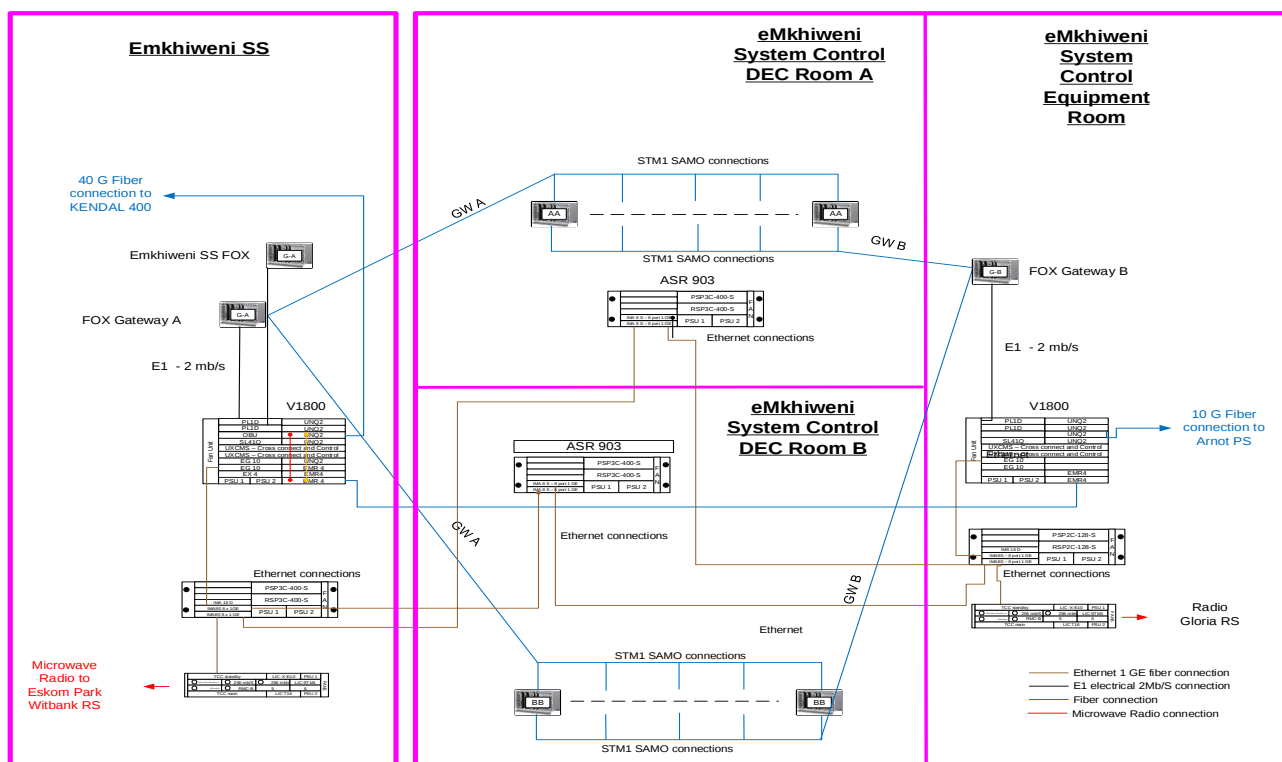
**Drawing 6 : Eskom Park Radio tower****CONTROLLED DISCLOSURE**

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Drawing 7 : Option A

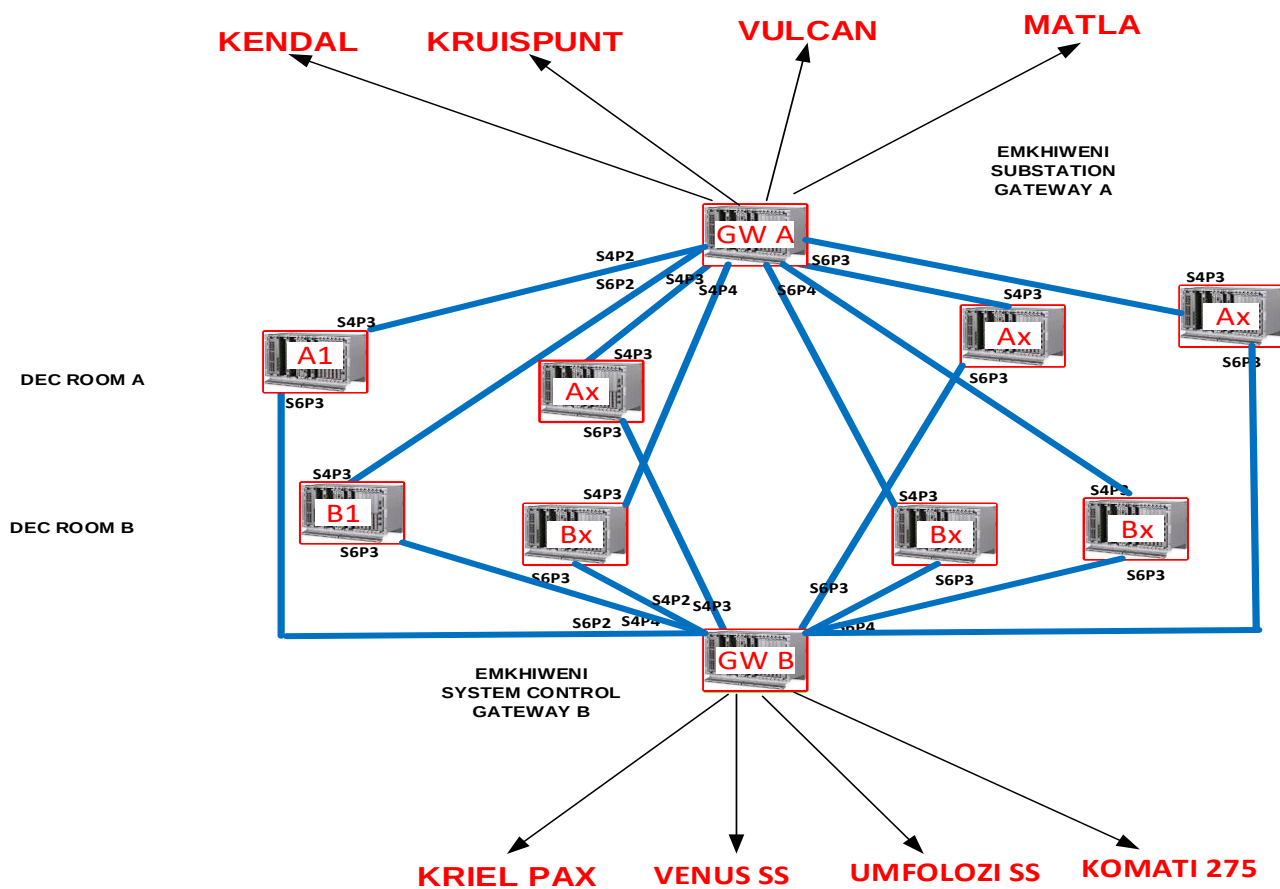


Drawing 8 : Option B

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Drawing 9 : Gateway concept

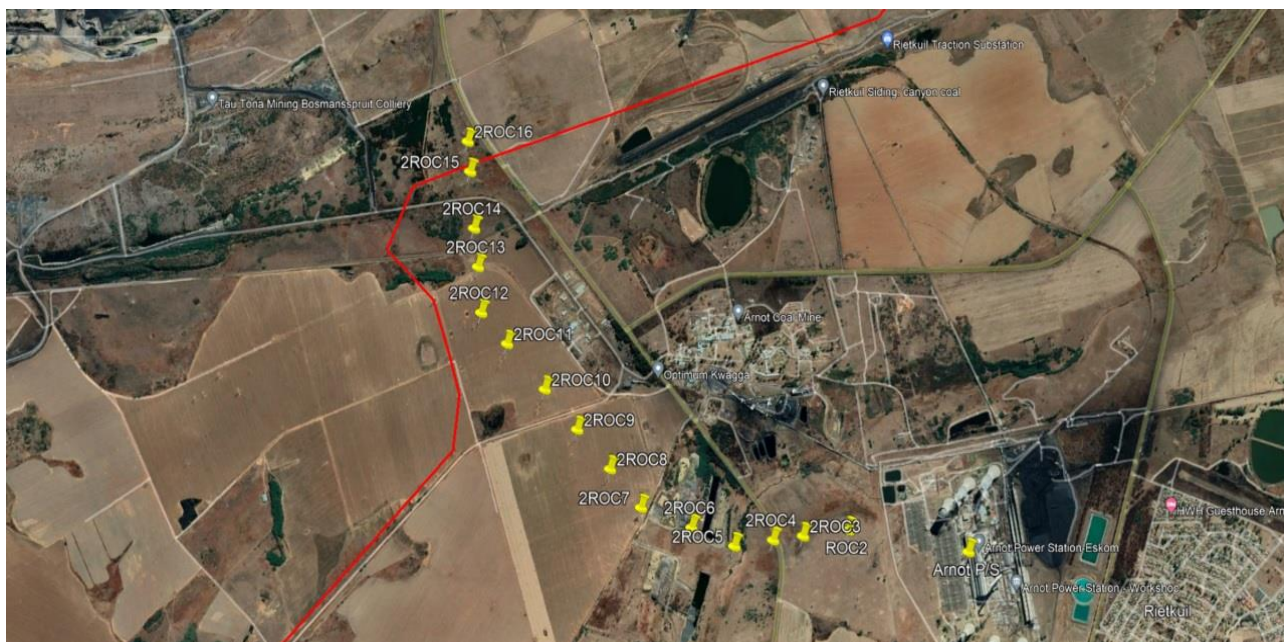
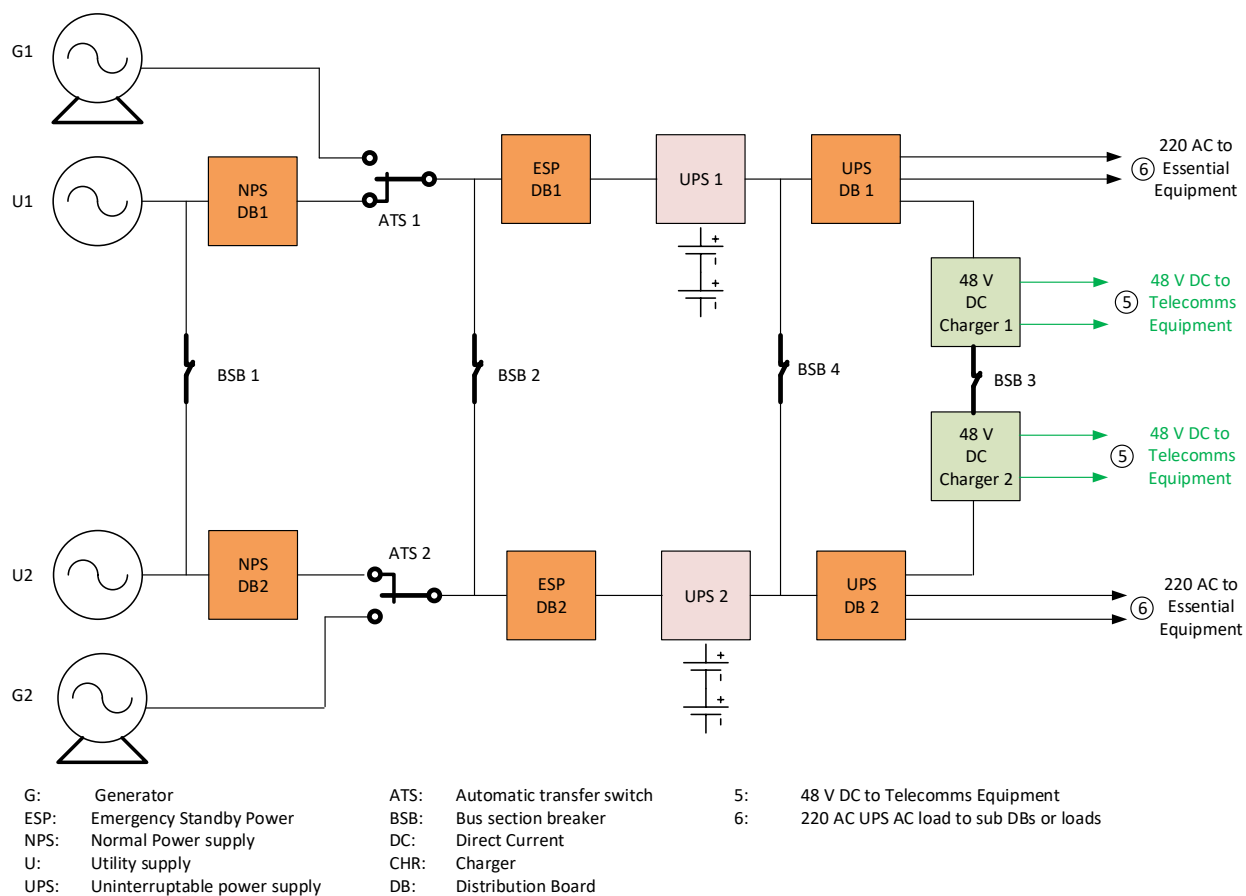


Figure 2 : Arnot Gumeni line crossing

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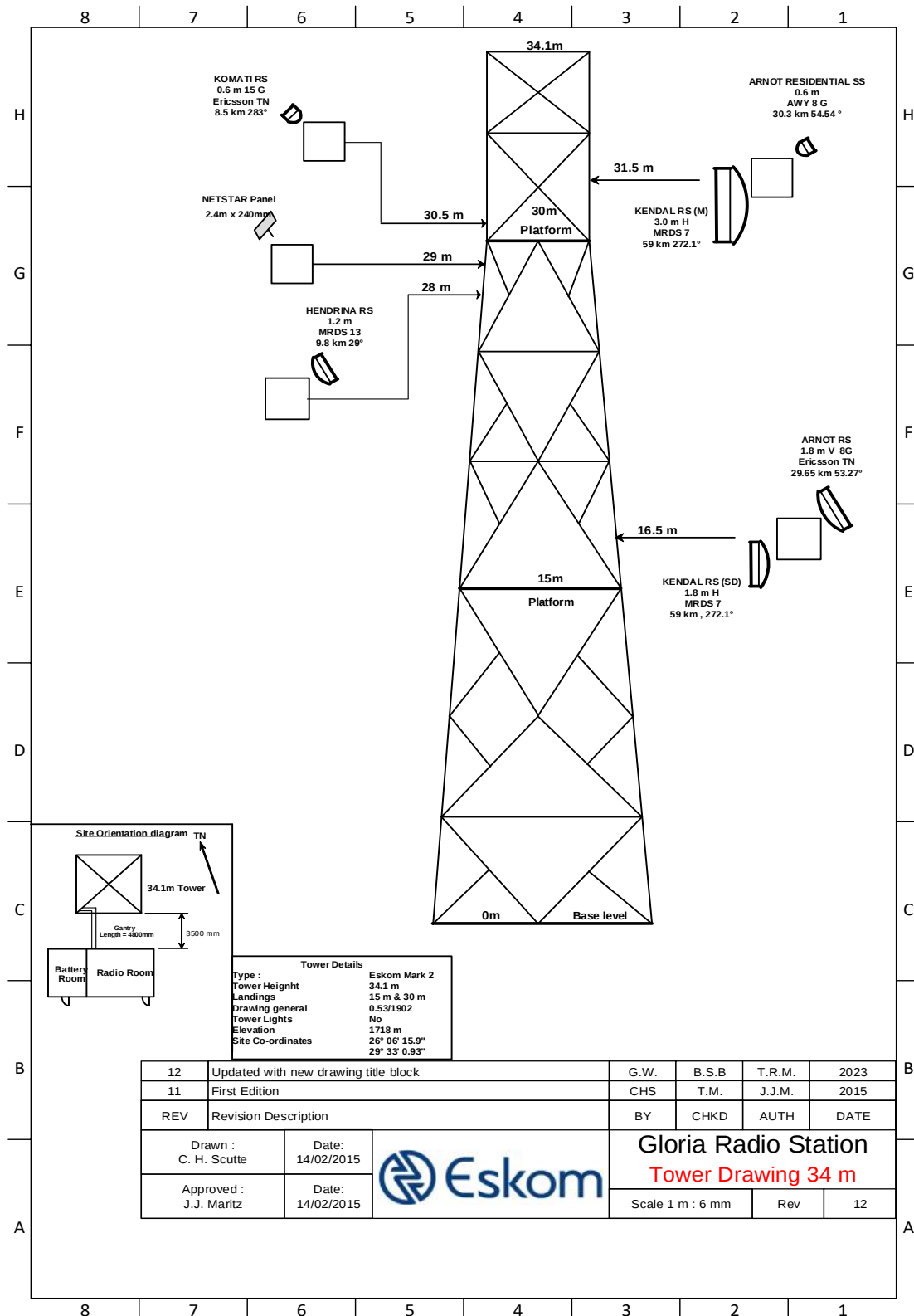


Drawing 10 : DC topology for telecommunication equipment

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Drawing 11 : Gloria Radio Station Tower layout

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