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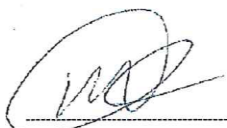
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Compiled by



Omolemo Matlou

**PTM&C:Engineer in
Training(EIT)**

Date: 26/03/2018

Approved by

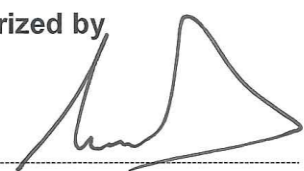


Cornelius Naidoo

**Telecoms T&S CoE
Manager**

Date: 2018/04/09

Authorized by



Richard McCurrach

Senior Manager – PTM&C

Date: 9/4/2018

Supported by SCOT/SC



**Kgomotso Setlhapelo
SCOT/SC Chairperson**

Date: 9 April 2018

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1. Introduction

The standard describes Eskom Telecommunication's functional requirements for the generic telecommunications equipment installation.

2. Supporting clauses

2.1 Scope

This document covers the internal and external aspects of telecommunications equipment installations. Links to OEM for specific telecommunications equipment installation guide will be provided.

2.1.1 Purpose

The purpose of this document is to provide the operational staff and contractors with a procedure that covers the generic telecommunication installations. These standards are applicable to green field installations, expansions and redeployments.

This standard should always be used in conjunction with the specific manufacture's installation guide for the specific equipment to be installed. In areas where this document contradicts the manufacturer's installation guide and the performance of equipment might be affected, the installer shall raise the issue. This document serves as guidance telecommunications equipment installation and it is recommended to use it with the specific equipment to be installed.

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] SANS 10199 (SABS 0199) the Design and Installation of Earth Electrodes
- [2] 32-9: Definition of Eskom documents.
- [3] 32-644: Eskom documentation management standard.
- [4] 474-65: Operating Manual of the Steering Committee of Wires Technologies (SCOWT)
- [5] 240-56872313: Radio Station Earthing and Bonding
- [6] ST_240-75975613 Rev 2 Installation of a Telecoms equipment cabinet
- [7] 240-112264430 INSTALLATION OF SPLIT UNIT MICROWAVE RADIO SYSTEMS USING COAXIAL CABLE

This document supersede the transport network equipment installation and commissioning standard Doc No.: 240-56576361

2.2.2 Informative

None

2.3 Definitions

2.3.1 General

Eskom telecommunications – A business unit mandated to provide telecommunications services throughout Eskom.

2.3.2 Disclosure classification

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

2.4 Abbreviations

Abbreviation	Description
DC	Direct Current
DDF	Digital Distribution Frame
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
IDF	Intermediate Distribution Frame
ODU	Outdoor Unit
OEM	Original Equipment Manufacturer
ADM	Add Drop Multiplexer
NMC	Network Management Centre
RX	Receive
Tx	Transmit
SD	Space Diversity
UV	Ultra violet
VSWR	Voltage Standing Wave Ratio
WSB	Working Standby
XPIC	Cross Polar Interference Cancellation

2.5 Roles and responsibilities

Not applicable.

2.6 Process for monitoring

Not applicable.

2.7 Related/supporting documents

Not applicable.

3. Requirements

3.1 Site Visits

Site visits must be completed, before any project or installation is carried out. Exemptions are granted on installations that have no impact on the infrastructure, for example the replacement of a faulty module. Information to be verified during the site visit includes, but not limited, to the following:

- a) Availability and allocation of floor space,
- b) Authorisation of use of space in the existing rack,
- c) Ensuring that the existing cabinet is securely mounted on the floor,
- d) Cable space on existing cable routes,
- e) Physical routes for new cable trays (if required),
- f) Floor type (raised or concrete floor),
- g) Radio tower earth conditions, identification of radio Outdoor Units' (ODU) nearest earth points and identification of stolen earth bars,
- h) Possible line of sight obstructions,
- i) Present DC power capacity meets the equipment requirements,
- j) Present air-conditioning capacity meets the equipment requirements (note the additional requirements for full indoor radio installation),
- k) Feeder space on waveguide entry point including earthing and sealing of waveguide entry plate,
- l) Cable lengths (to comply with manufacturer's specification for recommended/ acceptable maximum cable lengths)
- m) Space for cable terminating point (cable /fibre patch panel),
- n) Cable entry space hole and earth point on the top or bottom gland plate of the cabinet.

Site inspections must always consider current and future expansions. If there is a requirement to make use of existing, installed cabinets, the owner of that cabinet shall always be contacted before any installation is carried out. Installing equipment in any available, but unauthorised space may have impact on the expansions of the already installed system.

Installations shall be done as per scope of work. Blue books (as built documentation) shall be complete with all the required information before commencement of installation.

3.2 Indoor Equipment

- a) Inside the building, installation shall comply with the rest of Eskom's indoor installations standards for all telecoms equipment in both Eskom Telecoms Equipment Room and substations.
- b) Feeders shall be clamped and supported at every 0.5 m.



Figure 1: Feeder clamped

- c) For full telecoms Installation equipment each unit must be clearly labelled with the same label as indicated in the OEM documents, link to OEM documents is provided in section 5.5 below.
- d) If there is no space for a label on the unit, the label must be put on the side of the cabinet holding the telecoms equipment.



Figure 2: Equipment labelling

- e) All cables connecting the telecoms equipment to DDF must be neatly secured. Where lacing is not done, a cable tie must be used in such a manner as to ensure a similar standard of neatness.
- f) IDF and DDF must be individually earthed and labelled.
- g) All racks must be fully wired out as if the rack was fully equipped to its maximum capacity.
- h) Joints are not permitted in internal cables.
- i) Power distribution cables shall be sized to ensure the voltage drop does not exceed 1% with the racks fully equipped. No joints will be permitted in DC supply cables.
- j) The DC circuit breakers must also be labelled with the distant station name. Each sub rack/unit shall have its own circuit breaker.

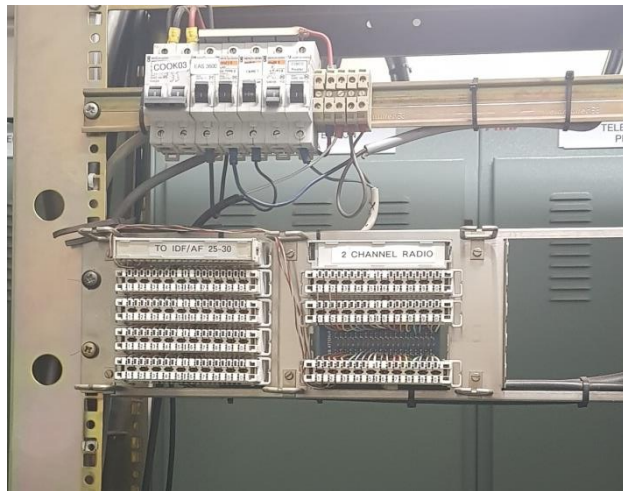


Figure 3: Circuit breakers labelled

- k) Each telecom equipment's alarm cables must be supported and cabled to the allocated IDF position and each cable must be clearly labelled as per the project's as built documentation. Refer to OEM document for instruction on how the wiring should be done.
- l) Flimsy brush panels with no proper support are not allowed.
- m) Some telecoms equipment will need to be installed in EMC/EMI shielded cabinets while others do not; refer to OEM document for each equipment for this.
- n) For costumed cabinet received from supplier, these cabinets must be accompanied by their certificates of compliance with the substation environment voltage.
- o) For equipment with empty slots, these slots must be covered with dummy units to comply with either EMC or manufacturer's cooling specifications.
- p) For instances, where suppliers have specific requests e.g. a requirements for shielded cables; this shall be identified during the site visit.
- q) For raised floors, where there is forced cooling through the cabinet, the contractor/supplier shall indicate (during the site visit) whether the airspeed and temperature meets the equipment environmental requirements.
- r) If the air speed and temperature does not meet the equipment requirements, appropriate fans shall be used.
- s) Cable bands must be kept within suppliers' requirements and should be controlled with cable bands panels, where possible and ensure that cables are routed through the cable guides.
- t) Space on the cable panels must always be planned for future growth. See cable tray manufacturer's specification on the recommended number of cables per cable tray and the allowed maximum cable banding radius.
- u) Allocation of modules on the slots shall be as recommended by the supplier guideline. This includes control modules, power modules, service modules and plug in units.
- v) To ensure future compliance, each rack must be installed with a wrist strap.
- w) All cable trays shall be earthed.
- x) Fibre patch cords running through a conduit shall not be installed between cabinets. Fibre patch panel shall be used, instead. The latest revision of 240-46264031 Fibre Optic Design Standard: Substations shall be used as a fibre installation guide.
- y) Patch cords slack shall be rolled neatly in the patch panels.

-
- z) For full radio indoor installations each radio unit must be clearly labelled with the same label as the feeder indicating the:
- site name of the opposite end of the link,
 - operating frequency,
 - operating mode, and
 - Link capacity.
- aa) All IDU's and sub-racks shall be firmly earthed to the cabinet earth bar. This cabinet earth bar shall be firmly earthed to the station earth within the building using a minimum of 16mm² insulated cables.
- bb) For Greenfield installations, 75 Ohm DDFs shall no longer be used. 120 Ohm CAT 6 shall be used. This shall even be more enforced in the substation installations, due to EMC requirements.
- cc) Where radio indoor units are installed in Bearer Comms Cabinets, the Euro rails in the Cabinets must be positioned 85mm from the front door when the door is closed to avoid front entry cables being damaged when the door is closed.
- dd) Indoor units in Bearer Comms Cabinets must be labelled with the distant station name on each unit and with the TX and RX frequencies, working mode and the link capacity.
- ee) On the IDF, the EOW cable will be wired first and the Alarm cable next. Some radio EOW's (for example Melodie) will not be cabled to the IDF. In this case, only alarm functions will be wired.
- ff) In substations, all installations must only be done in the EMC/EMI shielded cabinets. Installation in the glass door cabinets and any other non EMC hardened cabinets is not allowed.
- gg) Additional heat generated by ODU must be taken into consideration in full indoor radio installations.
- hh) For concrete floors, where there is no forced cooling through the cabinet, fans shall always be installed. Air guide plates must be installed according manufacturers' specification. The fan units must be earthed as per supplier recommendation and 240-56872313 Radio Station Earthing and Bonding Standard.
- ii) Special demands on module positions for 1+1 radio installation must be handled according manufacturer's recommendation.
- jj) The polarisation pairs for 1+1 XPIC must be noted, where applicable.
- kk) During installation, care against for electrostatic discharge must be taken to avoid damaging modules.

3.2.1 Cabinet

- a) Feeders used to connect the ODU to the radio equipment in a cabinet or rack must be clamped. If circulators are used, they must be securely fastened with stand-offs.
- b) All telecoms equipment installed in the cabinet must be firmly earthed using the cabinet earth bar. This cabinet earth bar shall be firmly earthed to the station earth within the building using a minimum of 16mm² insulated cables.



Figure 4: Cabinet earthing bar

- c) Where telecoms equipment is installed in bearer comms cabinets, the euro rails in the cabinet must be positioned 80-100 mm from the front door when the door is closed to avoid front entry cables being damaged when the door is closed.
- d) Indoor units in Bearer Comms Cabinets must be labelled with the distant station name on each unit and with the TX and RX frequencies, working mode and the link capacity.
- e) For concrete floors, where there is no forced cooling through the cabinet, fans shall always be installed. Air guide plates must be installed according manufacturers' specification. The fan units must be earthed as per supplier recommendation and Earthling and Bonding Standard.

Note: This section to be used with document: ST_240-60725641 specification for 19 inch equipment cabinets which incorporates cabinet earthing.

3.3 Cables and cabinet population

- a) All infrastructure upgrades, including air conditioning, DC power and cable trays must only be performed by Eskom (or a contractor identified to perform infrastructure upgrades appointed by Eskom).
- b) For raised floors, all cables, including feeder cables must always run under the floor and the cabinet must be populated from the top to the bottom.
- c) In sites where there is forced airflow under the floor, the tile under the rack must be removed to allow air flow through the cabinet and the space for cables.
- d) For green field cable trays installations, all T joints, L joints, horizontal bends, internal and external riser must have smooth bends with a standard acceptable radius. Joints without smooth bends are only acceptable on existing sites.
- e) Green field installation shall have separate cable trays for feeder cables, power cables, optic fibre and the rest of the traffic/signal cables. Cable trays for fibre must always be aerial cable tray irrespective of the nature of the floor.
- f) For existing installations where cables are already mixed, an effort must be made to maintain a distance between signal and power cables with preferably a separation of 200mm where possible. Crossing with AC cables may only be allowed at 90°.
- g) All cables shall be neatly tied with cable ties.
- h) Cable tray sizes must always be planned for current and future requirements.
- i) Cable trays running through the wall must be continuous throughout the wall.
- j) Make sure that the rack where the equipment is installed has a label.

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- k) For concrete floors all cable tray requirements and cabinet equipment population are the same as in the raised floor with the difference being all cables including fibre cables must always be on aerial cable tray.
- l) A Sanky cable tray must be used as a support to the cables before they drop on the horizontal tray. The standard size for dropdown Sanky tray shall be 200 to 250mm. The Sanky tray must be connected to the cable tray above and the cabinet below, with correct byte washes to ensure continuity between the two systems.
- m)

3.4 Outdoor Equipment

Outdoor telecomms equipment installation include includes transport network equipment. Installation requirements are outlined below.

3.4.1 Antenna installations

This section incorporates and/or supersedes ETST 0218 Standard of Antenna Installations at Eskom Radio Sites and ETPR 0702 PDH Digital Installation & Commission Procedure.

- a) The antenna support structure and panning arm brace shall be properly secured using galvanised bolts. The antenna-mounting bracket shall sit firmly against the tower and the bolts shall be long enough to protrude from the nut. A washer and spring washer shall be used on each bolt. No antenna shall be secured directly to the tower with stainless steel straps.
- b) On Tubular towers, i.e. Webb, do not clamp the panning arms to braces of 34mm OD – extend the panning arm to a tower corner. Only “Cross-over” clamps as manufactured by Eskom / Webb Industries / Andrew Satcom (or similar) to be used to clamp panning arms to tower – available on request if not supplied with the antenna-mounting bracket.
- c) 1.8m and larger antennas shall be fitted with at least one stabilising pipe (over and above the panning arm) & 3.7m antennas must be fitted with a 3rd stabilising pipe.
- d) Only approved brackets obtained from Eskom or the antenna supplier shall be permitted to install and stabilise antennas. Avoid clamping panning arms on tower braces that cannot support the antenna adequately. Panning arms must be fixed to tower legs, where practically possible. Panning arms must be cut off neatly, if too long. Panning arms shall not protrude more than approximately 500mm from the tower.
- e) Any additional clamps and brackets needed to properly stabilise antennas are available on request from Eskom. “Custom” made brackets can also be supplied. Antennas should not “twist” the tower leg where it is installed in high wind conditions, as this will cause metal fatigue.
- f) When panning antennas ensure that all of the main antenna fastening clamps / U-bolts are sufficiently loosened to prevent stripping the threads of the micro adjustment mechanism. All bolts are to be re-tightened once panning has been completed.
- g) The threads of all stainless steel bolts shall be lubricated with copper lubricating compound (sometimes referred to as “Copper-slip” grease) before any form of tightening or adjustment of the bolts or micro adjustment mechanism takes place.
- h) No drilling or welding on the radio tower is allowed.
- i) Bolts supporting the tower structure shall not be removed during installation, as this may compromise the strength of the structure.
- j) Environmentally friendly cold galvanising zinc spray shall be used to cover any spots exposed to corrosion.

3.4.2 Outdoor Units (ODU)

This section incorporates and/or supersedes ETPR 0702 PDH Digital Installation & Commission Procedure.

- a) For outdoor radio installation, ODUs must be mounted onto the antenna mounting bracket or tower leg (unless it is of the integrated antenna mounting type) using the manufacturer supplied mounting brackets.
- b) For full indoor radio installations the ODU must be installed indoor and be connected to the antenna using a waveguide. ODUs must be neatly mounted inside a rack.
- c) Waveguides shall be ordered by the Project Engineer, who shall also be required to take waveguide losses into account when designing the link.

3.4.3 Feeder

This section incorporates and/or supersedes ETST 0218 Standard of Antenna Installations at Eskom Radio Sites, ETPR 0702 PDH Digital Installation & Commission Procedure ETST 1010 RF Feeder Installation Standard.

- a) The feeder must be clamped within 1m from the back of the antenna or ODU as the case may be.
- b) The minimum bending radius of the feeder must be maintained on all bends. Standoff supports shall be used on any bend, where the distance between clamps exceeds 2m.
- c) Feeders shall be clamped at every crossing.
- d) Feeder trays/ ladders shall have a crossing at every 1m as a minimum.
- e) Installers and/or contractors shall report on any cable tray/ladder that does not meet these requirements (3.4.3c and 3.4.3d).
- f) Feeder clamps shall be ordered by Eskom from the radio system manufacturer. The metallic portion of the clamps including washes shall be galvanised.



Figure 5: Feeder clamps

- g) The feeder to antenna / ODU connection shall be covered with self-vulcanising tape. Connectors shall be covered a minimum of 50mm before and 50mm after the connector, where possible. This tape shall be covered with UV resistant Scotch / 3M black tape from the back of the antenna to a few centimetres past the end of the self-vulcanising tape. Each end of this tape shall be firmly secured with a stainless steel cable strap to stop the tape from unwinding. As an alternative to the strap, a UV resistant air shrink sleeve may be used.
- h) The feeder must be labelled within 1m from the back of the antenna / ODU. A second label must be provided on the horizontal section of the feeder at the waveguide entry, outside the building. The label must clearly indicate the following:

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- site name of the opposite end of the link,
- the operating frequency,
- operating mode (Hot Standby/ Working Standby), and
- Link capacity.

Any space diversity feeders shall be labelled "SD" in addition to the site name.

- i) The label must be readable from ground level. The label and label clamp shall be UV resistant and rust proof. Stainless steel punched or aluminium labels shall be used, as they are less likely to fade away with time, as compared to copper and plastic labels.
- j) The following is the example of a label for an 8 GHz STM1 link operating between Site A and site B.
 - Label on site A operating as the main link: SiteB-STM1-8GHz
 - Label on site operating as Hot Standby: SiteB-HSB-STM1-8GHz. If operating as a working standby replace HSB with WSB.
- k) For safety reasons, no feeder cable shall obstruct the platform walkway. The preferred routing of these cables is under the platform, or at least 2m above the platform.
- l) Crossing of feeders shall be avoided.
- m) No plastic cable ties will be allowed on any tower: for lighting and earthing cables, stainless steel straps/cable ties shall be used; for feeder cables, a suitable insulated hanger as specified by the cable manufacturer, which can firmly secure the cable as well as hold the weight of the cable.
- n) The recommended maximum spacing between insulated hangers for FSJ Superflex cables is 1m (0.91m for 6mm and 1.22m for 10mm) in 200 km/hr winds (without ice). In the event that an installer and/or contractor reports a ladder/ cable tray not meeting this requirement a "Sanky" tray (125mm wide) must be installed. The distance between insulated hangers for RG6/U cable must not exceed 1m. The RG6/U cable must be pulled straight inside the hangers and each hanger clip shall be tightened to hold and keep the cable straight. No "loops" between hangers will be permitted. It is also recommended that a small cable tie be installed around RG6/U cables between hangers to minimise vibration and chafing.
- o) The feeder cables on the waveguide cable tray may not run diagonally across the cable tray, but shall run vertically from the bottom of the tower to the exit point.
- p) No cable may be attached to any other feeder cable for support.
- q) Joints in the feeder cable shall not be permitted.
- r) The feeder cable must be installed so as to comply with the manufacturer's recommendations, especially regarding the bending radius.
- s) All installations in Eskom Transmission substation, where teleprotection services are required, shall be full indoor installations and shall always implement a waveguide.

3.4.4 Earthing

This section shall be read in conjunction with 240-56872313 Radio Station Earthing and Bonding Standard.

- a) The feeder shall be earthed at the two extremes (top and bottom) of the VERTICAL section of the feeder run: At the top, the earth kit shall be connected on the vertical section of the feeder just before the horizontal bend to the antenna; At the bottom, the earth kit shall be connected on the VERTICAL section of the feeder, just before the horizontal bend to the waveguide entry. The earth kits shall be earthed to the earth network with a short as possible lead. This could be the tower or a specific earth point on the tower and earthing system. Only on 45m towers higher must be fitted every 30m.

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- b) The earth kit connection must be covered with self-vulcanising tape. This tape shall, then, be completely covered with UV resistant Scotch black tape to a few centimetres past each end of the self-vulcanising tape. Each end of this tape shall be firmly secured with a stainless steel strap to stop the tape from unwinding. As an alternative to the strap, a UV resistant air shrink sleeve may be used.
- c) In the case of radio systems with outdoor units, the above rule also applies, i.e. install an earth kit per feeder. Outdoor units must be earthed using a minimum of 16mm² insulated cables. Suitably sized lugs must be crimped on the cable ends and connected to the provided ODU earth stud and the nearest tower earthing point. Stainless steel bolts, nuts, washers and spring washers must be used to prevent corrosion at these connection points. If the earthing point is at a distance greater than the allowed manufacturer's earthing cable length, the manufacturer shall supply a longer and thicker, resistance equivalent cable to reach the earthing point and so as not to void the ODU warranty.
- d) The earth cable from the feeder earthing kit shall be taken to the nearest proper earth point in such a way that bends in the cable are minimised. The shortest practical route must be used without crossing any platform walkways.
- e) The earth cable from the feeder earthing kit shall be taken to the nearest proper earth point in such a way that bends in the cable are minimised. The shortest practical route must be used without crossing any platform walkways.
- f) Where the distance of the vertical feeder exceeds 45m, additional earth kits must be installed at every 30m.
- g) For Ericsson/Marconi Long Haul radios, there shall be earthing kits at every 25m of the vertical feeder portion.
- h) Where the distance from the tower to the building exceeds 5m, an additional earthing kit/lightning surge arrestor must be installed on the feeder at the entry to the building. In the case of new towers, an earth bar will be provided at the waveguide entry point for this earth. On existing sites, where no proper earthing point exists, one must be provided. This earth must firmly bond the waveguide entry & earth bar to the site earth mat. Flat copper bar shall be used. The tower shall be earthed in accordance with the latest revision of the "Radio Station Earthing and Bonding Standard" – 240-56872313.
- i) The contractor shall report on the radio towers where this earthing requirement is not met.
- j) Manufacturer's guide must be consulted when installing the earth kits and care must be taken to avoid damaging the cable shield.
- k) As stated in 240-56872313 Radio Station Earthing and Bonding Standard, Eskom to ensure the integrity of the entire earthing system is in compliance with SANS 10199 (SABS 0199), The Design and Installation of Earth Electrodes. Tests must be performed to ensure that there is electrical continuity between the ODU earth and the IDU earth. The tests must ensure that all ODU, feeder, waveguide entry, IDU, and cabinet earth connections are firmly and securely connected to the station earth. Ensure that there are records of the station earth mat tests available. Periodic station earth testing is recommended to ensure that the earthing system remains intact.
- l) Inspection of the site earthing system shall include ensuring that the legs of the radio tower are earthed to the tower earth ring, air termination spike is installed as recommended on 240-56872313 Radio Station Earthing and Bonding and none of the copper earth points are stolen.
- m) As per 240-56872313 Radio Station Earthing and Bonding Standard, a minimum of two legs of the tower shall be grounded on the earth.
- n) The latest revision of ST 240-60725641 Spec for 19 inch equipment cabinets Installation shall be used for cabinet earthing in the substations.
- o) Earth from the cable tray must terminate on the bolt on top of the cabinet.
- p) Armoured cables must be connected on both sides onto the cabinet entry gland plate with armoured glands.

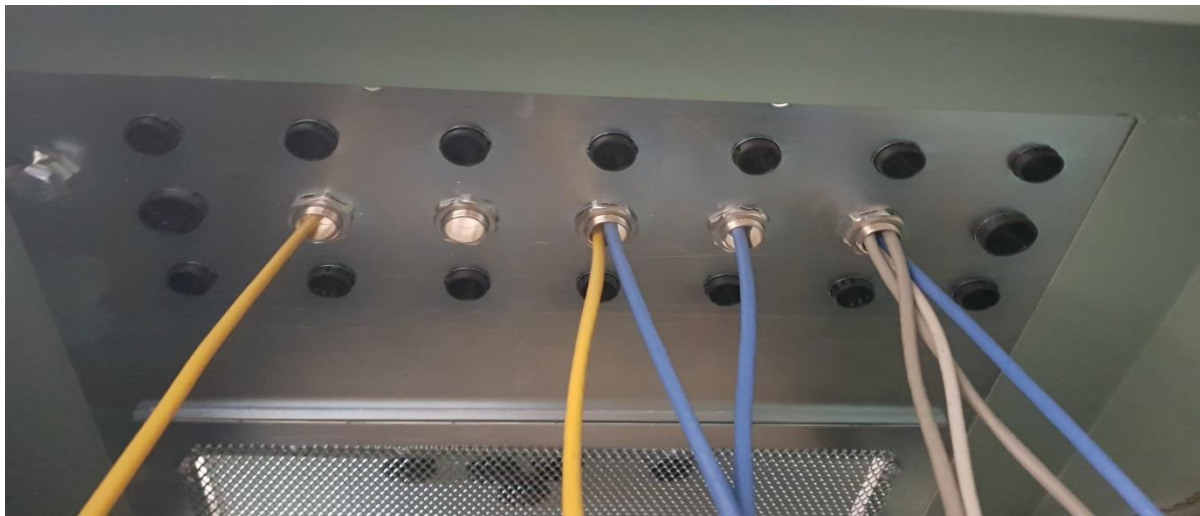


Figure 6: Cabinet gland plate

- q) For installations in the Eskom Telecoms Radio sites, termination of the cable on the inside cabinet earth bar shall be allowed using a 16mm² earth cable.
- r) For earthing and bonding standards during the installation of split-unit radio systems used at Eskom Telecommunication's radio sites, please refer to 240-112264430 installation of split unit microwave radio systems using coaxial cable by Roy Hubbard.

3.4.5 Waveguide Entry

- a) The waveguide entry must be securely bolted to the wall. Each feeder entry hole/ pipe must be sealed with a waveguide boot on the outside of the waveguide entry around the pipe and feeder.



Figure 7: Waveguide entry

- b) Any other sealer that will make it difficult to run an additional cable shall not be used.
- c) Existing installations without sealer shall also be corrected.
- d) All drillings and any other structural alteration shall only be done by Eskom. Wave guide entry must be earthed to the tower earth ring. See Figure 5 for sealed waveguide entry with gland plate earthed to the tower earth ring. The support (racking) needs to be terminated at both ends onto the gland plate at point of entry and onto the earthing network on the tower.

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3.5 Commissioning

Note: This section applies to transport network equipment.

Equipment specific manufacturer guide must be consulted for commissioning. The following constitutes the commissioning minimum requirements.

- a) Antennas must be panned for maximum receivable of signal strength. This “maximum” signal level should meet the “design” receive signal strength as indicated in the project blue book. If any discrepancies are found, this must be brought to the attention of the Project Engineer concerned in order for a solution to be found.
- b) The configuration and commissioning must be carried out using the specific radio and ADM manufacturer’s configuration & commissioning procedure. If there is equipment specific Eskom Procedure available for this purpose, the Eskom version will take precedence.
- c) Radios and ADMs that require an IP address, each radio terminal must have a unique IP address; this can be obtained from the Simmerpan NMC.
- d) A Bit Error Rate test of at least 24 hours must be performed on the radio link before traffic can be placed on the link. In certain cases NMC may request that these tests be carried out for a period of 7 days.
- e) A system sign off will only happen after the acceptance by the NMC. NMC sign off will constitute the final sign off and will be done after the onsite sign off.

3.6 Test Results

Note: This section applies to transport network equipment.

- a) Tests must be carried out using the approved Eskom Procedure and ATP test result forms. The name of the tester and the date of the tests must be clearly indicated.
- b) The correct units of measurement for example dB, V etc. must be clearly indicated.
- c) All test results must be neat and clearly legible. Extra copies must be typed.
- d) Test results must be bound in a file and clearly labelled on the front cover as well as the spine.
- e) Where more than one system is commissioned at a site, each system test results must be placed in a separate file.
- f) Use an Ohmmeter to make sure there is no short circuit in the radio cable before connecting it into operation. A Voltage Standing Wave Ratio (VSWR) meter can be used for a more complete test of the radio cable.
- g) Feeder test results (if applicable) must be in a clearly labelled section. Three sets of test results – the actual value at the TX and RX frequency as well as the worst case result – must be presented. The actual Return Loss (or VSWR value) must be clearly indicated on the test sheet for each test.
- h) Two sets of files are required: One for Bearer Project radio link designer and one for the Maintenance section.
- i) The Test results are to be forwarded to the Bearer Project radio link designer within one week of final commissioning.
- j) Where a Contractor has performed the final commissioning, a pre-designated Eskom representative must witness the final commissioning. Full names and title must be printed with signature on the official Eskom “Hand Over/Take Over” sheet.
- k) The Radio alarms must be connected and tested to the management/supervisory system (DCN, EAS) before traffic is allowed on the radio link.
- l) Any deviations of the obtained test results from the planned/expected levels must be clearly stated. No deviation which degrades the performance of the system will be accepted and Eskom reserves the right to reject any installation where the obtained results deviate from the design.

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- m) On acceptance, all equipment shall be entered on the asset register. No equipment shall be moved without updating the asset register including moving for redeployments and loaning.

4. Related/supporting documents

The following are links to specific OEM documents for the following telecoms equipment's

Transport network

- [Ericsson - All Documents](#)

Wireless Access network

- Motorola - [Access Network - Home](#)

Voice and data

- [Voice and Data](#)

Oss and cybersecurity

- [OSS and Cyber Security - All Documents](#)

PLC and tele-protection

- [PLC and Teleprotection - All Documents](#)

5. Authorization

This document has been seen and accepted by:

Name and surname	Designation
Danie Du Plessis	Senior Manager-Grids
Anthea Solomon	Middle Manager-TX Secondary Plant
Sikelela Mhabela	Senior Manager-DX
Prudence Madiba	Senior Manager-DX
Joe Manyisa	Senior Manager- Eskom Telecommunications(Acting)
Olivia Muwanga-Zake	Senior Manager-GIT
Lloyd Chego	Senior Manager- Group Security

6. Revisions

Date	Rev	Compiler	Remarks
April 2018	1	OG Matlou	Telecommunications Equipment installations standard (240-132190480)

7. Development team

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

- Zwelandile Mbebe
- Tejin Gosai
- Krupa Jose
- Matthew Taljaard

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- Viictor Matlala

8. Acknowledgements

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