Eskom	Standard	Technology

Title: **TELECOMMUNICATIONS INSTALLATION, COMMISSIONING AND TESTING OF FEEDERS AND ANTENNAS**

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Content

Executive Summary

Standardisation for the installation, commissioning and testing of Feeders and Antennas operating below 7 GHz.

1. Introduction

This procedure defines the Eskom Telecommunications' functional requirements for the installation, commissioning and testing of feeders and antennas on Eskom Telecommunications' masts.

2. Supporting clauses

2.1 Scope

This document covers the procedures for installation, commissioning and testing/ fault-finding on antennas and feeders on the Eskom telecommunication VHF, UHF and IF (Intermediate Frequency) radio systems.

2.1.1 Purpose

The purpose of this document is to provide the field technicians with a guideline procedure to install, commission and test antennas and feeders. This document should also be used when the need arises to perform fault location/investigation exercises on an antennae system.

2.1.2 Applicability

This document shall apply throughout Eskom Telecommunications.

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 9001:2015 Quality Management Systems.

[2] OHSAS 18001:2007

[3] Occupational Health and Safety Act and Construction Regulations

[4] ETPR0745 Safe Hauling Procedure

2.2.2 Informative

[5] 240-67561934 Telecommunications Acceptance Test Procedure for Area Radio Analogue Repeaters and Links

[6] 240-104035350 Standard for Antenna Installations at Eskom Radio Sites

[7] 32-418 Work at Heights Standard

[8] 240-56872313 Radio Station Earthing and Bonding Standard

[9] 240-132190480 Telecommunications Equipment Installation Standard

2.3 Definitions

2.3.1 General

Definition	Description
Antenna	Device use to effectively radiate the radio output power
Dummy Load	Perfect 50 ohm load
Feeder	Transmission line use to get radio power to antenna

Definition	Description
Return Loss	Is the magnitude of the reflection coefficient expressed in decibel RL = 20log ((VSWR – 1) / (VSWR + 1))
Voltage Standing Wave Ratio: (VSWR)	A measure of impedance mismatch on a transmission line. The higher the VSWR, the greater the mismatch. The minimum VSWR, *i.e.*, that which corresponds to a perfect impedance match, is unity.

2.3.2 Disclosure classification

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

2.4 Abbreviations

Abbreviation	Description
dB	decibel
ET	Eskom Telecommunications
FS	Field Services
LMR	Land Mobile Radio
OP	Output Power
PTN	Private Telecommunications Network
QA	Quality Acceptance
RL	Return Loss
SCOT	Study Committee of Technologies
T&S	Technology and Support
UHF	Ultra-High Frequency
VHF	Very High Frequency
VSWR	Voltage Standing Wave Ratio

2.5 Roles and responsibilities

FS Managers are to ensure that personnel, who will be performing maintenance, receive the appropriate training required to work on this equipment.

All service, repair and maintenance personnel shall comply with this procedure

2.6 Process for monitoring

Project QA

Workplace tasks

2.7 Related/supporting documents

This document supersedes Eskom Telecommunications document number ETPR0750.

3. Document content

The aim of this document is to provide guidance and information to Eskom Telecommunications' personnel to perform installation, commissioning and testing of feeders and antennas used in the Eskom Telecommunications PTN.

3.1 Installation Procedure

3.1.1 Install the antenna bracket firmly against the tower in the desired position. Make sure that the bolts protrude through the nuts. A washer and spring washer must be used on each bolt. If the bolt and nut is stainless steel then make sure to treat the thread with an anti-seize paste.

3.1.2 Inspect feeder before installation and make sure that there is no damage on it. Also make sure that you can unroll it in such a way that it will not get damaged.

3.1.3 Fit the top connecter while the feeder is still on the ground (It is easier and safer than to fit it at height).

3.1.4 Put a cable sock over the fitted connector and over 500mm of feeder. Tie to hauling ropes and haul the feeder as per Safe Hauling Procedure ETPR 0745.

3.1.5 The feeder must run parallel to the other feeders and not across any of them. Get the feeder in the right position to connect to the antenna.

3.1.6 Install suitable feeder clamp not further than 1 meter from connector, thereafter install suitable feeder clamp every 500mm or according to cable manufacturer's specification.

3.1.7 The feeder must be installed as to comply to the manufacturers specifications regarding bending radius.

3.1.8 Install earth kits and properly earth to mast at the two extreme points of the vertical section. If horizontal section from mast to radio room is longer than 5 meters then another earth kit shall be installed just before the feeder enters the equipment room through the entry plate.

Note: If vertical section of feeder is longer than 45 meters then another earth kit shall be installed 25m from the top earth kit.

3.1.9 Lightning arrestors must be fitted to all antenna feeders (except IF). Install a lightning arrestor as close as possible to entry plate inside radio room. Fit the connector on feeder and terminate onto lightning arrestor.

3.1.10 Terminate the feeder with a dummy load and sweep the feeder with a spectrum analyser or a site analyser (e.g. Anritsu etc.). Make sure it is within specification; if not then investigate for a possible cable fault.

3.1.11 All feeder tails must be half inch foam dielectric co-axial (e.g. LMR400).

3.1.12 Terminate onto antenna, cover from 50mm before connection to 50mm after with self-vulcanizing tape. Cover self-vulcanizing tape completely with ultra violet resistant insulation tape

3.1.13 Label the feeder not further than 1 meter from antenna connection, a second label must be placed on the horizontal section just outside the radio room.

3.2 Commissioning Procedure

3.2.1 Sweep the feeder and antenna with a spectrum analyser or site master (e.g. Anritsu).

3.2.2 The return loss should be better than 15 dB over the spectrum that the antenna is designed for (the ideal for the exact frequency is 23 dB for a VSWR of 1.5:1).

3.2.3 VSWR should be less than 1.5:1.

3.2.4 The loss of the feeder must be taken into consideration on all measurements. (The greater the loss the more it will have a smoothing effect on your measurements - VSWR etc.).

3.2.5 Complete the check sheet in Annexure A and keep for future reference.

3.3 Testing Procedure

3.3.1 Sweep the feeder and antenna with a spectrum analyser or site master (e.g. Anritsu).

3.3.2 The return loss should be better than 15 dB over the spectrum that the antenna is designed for (the ideal for the exact frequency is 23 dB for a VSWR of 1.5:1).

3.3.3 VSWR should be less than 1.5:1.

3.3.4 Note all the test results down as in annexure A.

3.4 Safety

The installation, commissioning and testing of feeders and antennas is a high risk activity involving work at height and rigging. Due care must be exercised by persons performing these tasks. Workers shall comply with ET Work at Heights and Rigging procedures.

4. Authorization

This document has been seen and accepted by:

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5. Revisions

Date	Rev	Compiler	Remarks
Jan 2019	2	S Makhatini	Updates on Normative & Informative References, SCOT Chairperson, Seen & Accepted List only
Dec 2013	1	J Schutte	Only reformat/template change to SCOT. Refine the procedure with best practise techniques
Sep 2009	0	J.P.J Smit	New Procedure – ETPR0750.

6. Development team

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

- Jacques Schutte Senior Engineer Last Mile Networks
- Kevin Plasket Senior Advisor Last Mile Networks
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7. Acknowledgements

Not applicable.

Annex A – Installation, Commissioning and Testing of Feeders and Antennas Checklist

	Items	Results
1	Site Name	
2	Feeder Name	
3	Antenna type and gain	
4	Antenna height	
5	Tail type and length (if used)	
6	Feeder Type	
7	Feeder length	
8	Feeder loss (dB)	
9	Connector type	
10	Earth kit (antenna side)	
11	Earth kit (radio side)	
12	Labelling (both sides)	
13	Feeder clamp type	
14	Number of clamps used	
15	Self-Vulcanizing tape	
16	Scotch tape	
17	Return loss with dummy load	
18	Return loss with antenna	
19	VSWR	