

 Eskom	Standard	Technology
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ANALOGUE AND DMR MOBILE
RADIO SPECIFICATION**

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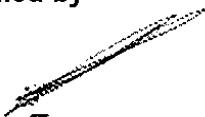
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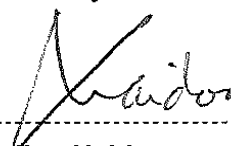
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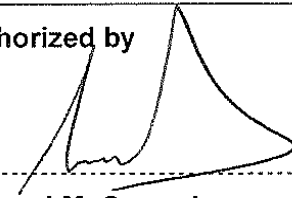
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1. Introduction

The current Eskom Very High Frequency (VHF) network has been in existence since the early 90s. It was created solely for the Regulated business's voice system. There are presently 6 regional control centres using the VHF network.

Eskom's philosophy is to use off-the-shelf, standard equipment as far as possible, with development kept to a minimum. Proprietary systems should be avoided as much as possible. The current Eskom analogue area radio network has been in existence for many years. It was created originally as an operational voice communication network for the regulated business's field team operations. There are Regional Centres for reticulation control. Eskom's privately owned telecommunications network is used to facilitate mobile voice and limited data communications between the field teams and the control centres. An MPT1327 trunking system has been implemented at campus environments, namely power generation stations.

The backbone of the Eskom telecommunications network consists of high bandwidth digital microwave and fibre optic links that enable data communications between Eskom's regional control centres and more than 640 VHF ~~and UHF~~ analogue radio repeaters.

2. Supporting clauses

2.1 Scope

This specification covers the functional, operational and performance requirements, as well as environmental conditions in which the equipment is required to perform. With the planned migration from analogue to digital network Eskom need to cater for the legacy equipment as well as the next generation.

The following type of radio is specified:

- Digital Mobile Radio (DMR all Tiers) capable of operating in both DMR and Analogue mode for conventional and MPT1327 networks mode

Nothing in this specification must lessen the tenderer's obligations, detailed in any other document forming part of the contract specification covers the functional, operational & performance requirements, and environmental conditions in which the equipment is required to perform.

The supplier must complete schedule A "Statement of Technical Conformance" as explained in Annex A. The identifier (M) is used to indicate which clauses will be marked/scored during technical evaluation of the specification.

2.1.1 Purpose

The purpose of this document is to give equipment requirements for the VHF ~~and UHF~~ mobile radios for internal use in Eskom. This is to ensure that the purchased equipment is according to Eskom's particular requirements and conforms to the desired standards. The specification forms part of the enquiry documentation for the establishment of an Enabling Contract with Eskom Telecommunication.

2.1.2 Applicability

This specification must apply throughout Eskom Holdings Limited, its divisions, subsidiaries and entities wherein Eskom has a controlling interest.

2.2 Normative/informative references

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

2.2.1 Normative

- [1] ISO 9001 Quality Management Systems.

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- [2] 240-8648714 Generic Requirement Specification for a Telecommunications Network Management Solution
- [3] EN 300 279 v1.2.1, 1999, ETSI specification: Electromagnetic compatibility and Radio Spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for Private Land Mobile Radio (PMR) and ancillary equipment (speech and/or non-speech).
- [4] EN 300 113 V2.2.1 (2016-12) ETSI specification: Radio Equipment and Systems (RES); Land mobile service; Technical characteristics and test conditions for radio equipment intended for the transmission of data (and speech) and having an antenna connector.
- [5] TS 102 361 ETSI specification: Electromagnetic compatibility and Radio spectrum Matters (ERM); Digital Mobile Radio (DMR) Systems
- [6] IEC 60529, edition 2.1, February 2001: Degrees of protection provided by enclosures (IP code).
- [7] SANS (CISPR / IEC 6100-6-3), 1st edition, February 1999: Electromagnetic compatibility - Generic emission standard - Part 3: Emission standard for residential, commercial and light-industrial environments.
- [8] MPT 1316, 1996, UK Radio Communications Agency (Ofcom) Code of Practice: Selective signalling for use in the Private Mobile Radio Services.
- [9] MPT 1317, 1996, UK Radio Communications Agency specification: Transmission of digital information over Land Mobile Systems.
- [10] MPT 1327, 1997, UK Radio Communications Agency Specification: Signalling Standard for Trunked Private Land Mobile Radio Systems.
- [11] DMR TS 102 361 parts 1-4
- [12] SANS 300086:2014, Electromagnetic compatibility and Radio spectrum Matter (ERM); Land Mobile Service Parties using this document must apply the most recent edition of the documents listed in the following paragraphs.
- [13] ETSI TR 102 398 V1.4.1 (2018-11) Electromagnetic compatibility and Radio spectrum Matters (ERM); Digital Mobile Radio (DMR) General System Design

2.2.2 Informative

- [14] 32-9 Definition of Eskom Documents
- [15] 32-644 Eskom Documentation Management Standard

2.3 Definitions

2.3.1 General

Definition	Description
Adjacent channel selectivity	The capability of the receiver to receive a wanted modulated signal, without exceeding a bit error rate of 10^{-6} , in the presence of an unwanted signal, which differs in frequency from the wanted signal by ± 12.5 kHz
Bandwidth	The extent or limit placed on a continuous range of frequencies, over which the gain does not differ from its maximum value by more than a specified amount
Carrier Frequency	The centre frequency of the radio wave, which is intended to be modulated
Channel spacing	The difference in frequency between the carrier frequencies of two adjacent channels.

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Definition	Description
Co-channel rejection	The capability of the receiver to demodulate a wanted modulated signal, without exceeding a bit error rate of 10^{-6} , in the presence of an unwanted modulated signal, both signals being at the nominal frequency of the receiver
Data Latency	The average time it takes for 1 bit of data to be transmitted and received across an established radio link (i.e. transmitter and receiver in steady state). It is measured from the time the data enters the data port on the transmitting radio to the time that the data exits the data port on the receiving radio.
Duplexer	A device allowing a single antenna to be used for simultaneous transmission and reception on different frequencies.
Inter-modulation response rejection	The capability of the receiver to receive a wanted modulated signal, without exceeding a bit error rate of 10^{-6} , in the presence of two or more unwanted signals with a specific frequency relationship to the wanted signal frequency
Receive to transmit turn-around time	The time between the end of the previous received data transmission, i.e. last data bit received, and the earliest time that a new data bit sent to the data interface is transmitted by the radio.
Regulated business	Eskom Distribution, Transmission and Generation
Transmit attack time	The time taken for a transmitter to reach and maintain an output power level of between 80% and 140% of its steady state power level from an off state, or the time taken for the carrier frequency to remain within ± 1 kHz of its steady state frequency, whichever occurs later .
Transmit to receive turn-around time	The time between the end of a data transmission, i.e. last data bit transmitted, and the earliest time that a new data bit can be received by the radio and is correctly decoded at the data interface
Transmitter release time	The time taken for the output power of a transmitter to decay and remain at a level of 50dB below the steady state power from the initiation of the "transmitter off" function.

2.3.2 Disclosure classification

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

2.4 Abbreviations

Abbreviation	Description
BER	Bit Error Rate
Bps	Bits per second
CCITT	Consultative Committee for International Telephony and Telegraphy
DMR	Digital Mobile Radio
DTMF	Dual Tone Multi-Frequency
EEA	Electronic Engineering Association of UK

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Abbreviation	Description
EIA	Electronic Industry Association
ETSI	European Telecommunications Standards Institute
DCE	Data Communications Equipment
FM	Frequency Modulation
ICASA	Independent Communications Authority of South Africa
IEC	International Electrotechnical Commission
kHz	kilo Hertz
kPa	kilo Pascal
MHz	Mega Hertz
MPT	Ministry of Posts and Telegraph (MPT1327)
MTBF	Mean Time Before Failure
PAX	Private Automated Exchange
Ppm	Parts per million
RF	Radio Frequency
RSSI	Receive Signal Strength Indication
SABS	South African Bureau of Standards
SANS	South African National Standards
SINAD	Signal Noise and Distortion
VHF	Very High Frequency
UHF	Ultra High Frequency

2.5 Roles and responsibilities

Not applicable.

2.6 Process for monitoring

Not applicable.

2.7 Related/supporting documents

This document supersedes Eskom Telecommunications document number ETSP0175.

3. Requirements

3.1 Common Analogue/MPT and DMR requirements

3.1.1 Environment

3.1.1.1 The radio must operate without malfunction and must meet all the required specifications within the environmental limits described in this section. (M)

3.1.1.2 Altitude: 0 to 3500m above mean sea level. (M)

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3.1.1.3 Ambient temperature: -10 °C to +60 °C. (M)

3.1.1.4 Barometer pressure: 75 to 106 kPa. (M)

3.1.1.5 Humidity (maximum):

3.1.1.5.1 10% at -10° C (M)

3.1.1.5.2 95% at +20° C (M)

3.1.1.5.3 75% at +60° C (M)

3.1.2 Construction - Radio casing

3.1.2.1 The radio case must be of tough, high impact plastic or metal extrusion, able to withstand tough handling and usage. The tenderer must state the construction material. (M)

3.1.2.2 The case of the mobile radio must be a minimum of IP54 waterproof and dustproof. The tenderer must state the rating. (M)

3.1.3 Dimensions

3.1.3.1 The Tenderer must clearly state the physical dimensions in mm (length, width and height for both trunk and dash-mount options) and mass of the radios. (M)

3.1.4 General Design

3.1.4.1 The radio must have a backlit display and keypad. (M)

3.1.5 Indications

3.1.5.1 All indications must be unambiguous and easily identifiable. The type of indication (e.g. LCD or LED) must be stated by the Tenderer. (M)

3.1.6 Controls

3.1.6.1 All controls must be unambiguous and easily accessible. All pre-set variable controls must be clearly marked and readily identifiable in the equipment. (M)

3.1.7 Printed Circuit Board (PCB) Design

3.1.7.1 Markings: All printed circuit boards and subassemblies must be permanently marked and identified. All components must be clearly marked and identifiable in all drawings and documentation. (M)

3.1.7.2 Test points: Clearly identified test points must be provided on all units, sub-units and circuit boards for measurements of important parameters without de-soldering. (M)

3.1.7.3 Mounting screws: Mounting screws, where used, must not be self-tapping. Bushes and threaded inserts must be used. (M)

3.1.8 Accessories and spares

3.1.8.1 Accessories and optional items are to be listed. Tenderers must list any optional items that they can provide. (M)

3.1.8.2 Tenderer must list any proprietary testing accessories e.g. cards, adaptor kits etc. and programmers. (M)

3.1.9 Protection against reverse polarity

- 3.1.9.1** The inputs of all equipment that have DC supplies must have full protection against possible reverse connection and be of a self-restoring type. The tenderer must state the method used. (M)

3.1.10 Testing - Routine testing

The following routine tests must be performed on every radio before delivery, in accordance with SANS 300086:2014. The test results must be supplied with the radio. Eskom will bear the costs of the successful test only.

- 3.1.10.1** Carrier Power on all channels. (M)
- 3.1.10.2** Transmit Frequency on all channels. (M)
- 3.1.10.3** Adjacent Channel Power. (M)
- 3.1.10.4** Usable sensitivity on all channels. (M)
- 3.1.10.5** Maximum useful output power (audio). (M)
- 3.1.10.6** Adjacent Channel selectivity and desensitisation ratio. (M)
- 3.1.10.7** Correct operation of EEA encode and decode function. (M)
- 3.1.10.8** Pre-acceptance batch testing: Eskom may, at its discretion, require that batch testing be carried out by SABS before release of radios for delivery. This batch testing will be conducted in accordance with SANS 300086:2014. (M)
- 3.1.10.9** In such cases the radios will only be accepted once a Certificate of Acceptance is received from the SABS. (M)

3.1.11 Service manuals

- 3.1.11.1** Content: Service manuals must include detailed circuit, printed circuit and wiring diagrams, and clear description of the function of all parts of the equipment and the options offered. They must further contain all information required to adjust the equipment fully to its optimum performance specification and must describe the necessary testing procedures. Details of component types, manufacturer's type number and designation etc. must be included in the manual. (M)
- 3.1.11.2** Updating: If any changes in design or manufacture are made to the equipment during the contract period, revised documentation must be supplied to Eskom to update the manuals in use, prior to delivery of equipment of equipment incorporating the new design. (M)
- 3.1.11.3** Two manuals (for each model of equipment offered) in hardcopy format and a softcopy must be supplied to Eskom Telecommunications Technology when the Enabling Contract is established and before any equipment is supplied. Thereafter technical manuals must be offered as an optional item. (M)

3.1.12 Software

- 3.1.12.1** The product must be supplied with PC based configuration software that enables full configuration, programming and diagnostics of all functions of the mobile radio. Software to upgrade any firmware must also be supplied. (M)

3.1.13 Operating system

- 3.1.13.1** The software must at least be compatible with a version of Microsoft Windows™ Operating System less than 2 years old, as well as with another version of Windows™ between 2 and 5 years old. (M)

3.1.14 Install feature

- 3.1.14.1** The software must have an auto-install feature whereby a setup program will prompt for options and the software will automatically be extracted to the appropriate directories with program groups and icons created (for Windows™). (M)

3.1.15 User interface

- 3.1.15.1** The software must be user friendly and menu driven, and comprehensive help files must be provided. Only basic computer knowledge should be required to use the software interface. (M)

3.1.16 Hardware requirements

- 3.1.16.1** The tenderer must specify the minimum computer hardware requirements of the software that is offered and the interface cable must be connected via the USB port. (M)

3.1.17 Saving of configurations

- 3.1.17.1** It must be possible to save and retrieve mobile configurations to/from flash drive. (M)

3.1.18 Software documentation

- 3.1.18.1** All software supplied with the system must be documented comprehensively, with all the features and functions discussed. Included in the documentation must be a list of possible problems and how to solve them. (M)

3.1.19 Software licensing/activation codes

- 3.1.19.1** All software/activation codes must be supplied at no additional cost. The supplier must specify all terms and conditions related to the distribution of the software/activation codes in the offer. (M)
- 3.1.19.2** The radios must be able to be operated with full functionality with software/activation codes supplied. (M)
- 3.1.19.3** Updated software versions to be supplied free of charge. This is to be supplied on a flash drive to the technical representative listed on the contract. This is to be accompanied by the memorandum of change indicating the implications. (M)

3.1.20 Training

- 3.1.20.1** Training courses must be conducted for Eskom radio technicians, which will cover a description of the basic design of the radio, maintenance and first line repair techniques and programming instructions (where necessary). (M)

3.1.21 Maintenance

- 3.1.21.1** The maintenance contract is to be offered as an option and details of proposed contracts given in Schedule A. (M)

3.1.22 Product lifespan

- 3.1.22.1** The tenderer must provide the history and future of the product offered:

3.1.22.1.1 The date the equipment first went into manufacture. (M)

3.1.22.1.2 The date the product will cease to be manufactured. (M)

3.1.22.1.3 When manufacturing ceases how long will spares be available (component level). (M)

3.1.23 Equipment reliability

3.1.23.1 Details of measured MTBF figures of the equipment offered must be provided in Schedule A. Details of predicted MTBF values (including calculations) will be accepted. However, Eskom reserves the right to request a full reliability measurement to be carried out by an independent test authority on selected equipment. (M)

3.2 Technical radio specifications – Analogue and DMR

3.2.1 General

3.2.1.1 Identification: The make of radio and type number must be clearly marked on the equipment. Tenderer must state how this is done. (M)

3.2.1.2 Mode of operation: The radio must operate in half duplex (option full duplex in DMR mode) and simplex mode as required. The tenderer must state which mode of operation is available. (M)

3.2.1.3 Frequency band: The radios must operate in the frequency band 136-174 MHz (VHF) and ~~400-420 MHz (UHF)~~ in accordance with the SA band plan as defined by the ICASA. (M)

3.2.1.4 Channel spacing: The channel spacing between adjacent channels must be 12.5 kHz. (M)

3.2.1.5 Number of channels:

3.2.1.5.1 The radio must be capable of operating on a minimum of 99 channels in the above band (analogue mode). Each channel must be capable of duplex or single frequency simplex operation independent of the other channels. (M)

3.2.1.5.2 The selected channel number must be indicated by means of the position of a switch or LED or LCD display on the radio. (M)

3.2.1.6 Modulation method: The modulation method must be angle modulation. (M)

3.2.1.7 Pre- and De-emphasis: Pre and de-emphasis of the audio in transmit and receive modes respectively must be 6 dB/octave from 300 Hz to 3 000 Hz. (M)

3.2.1.8 Programming of the radio: All programmable functions of the radio must be done with a laptop using a USB or RJ45 connection. The Tenderer must specify the programming method used. (M)

3.2.1.9 Frequency stability: The radio must have frequency stability equal or better than 1.5ppm. (M)

3.2.1.10 Power supply: The radio must operate in the range of 10.8 to 16 VDC and still meet all stated specifications. (M)

3.2.1.11 RF Connector: N-type, TNC and BNC preferred. Tenderer must state the type of RF connector used. (M)

3.2.2 Receiver Analogue mode

The tenderer must state the following receiver specifications for all radios offered (in both VHF ~~and UHF~~):

3.2.2.1 Switching bandwidth: The radio must have a receiver switching range covering the complete frequency band stated in section 3.2.1.3 without degradation. (M)

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- 3.2.2.2** RF Impedance: The RF impedance must be 50 ohms. (M)
- 3.2.2.3** Adjacent channel selectivity: The level should be better than 60db for both VHF ~~and UHF~~ band. The tenderer must state actual levels. (M)
- 3.2.2.4** Audio distortion: The receiver must have an audio distortion < 3% @ 1 kHz 60% modulation. The tenderer must state actual levels. (M)
- 3.2.2.5** Audio bandwidth: This must be between 300Hz and 3000Hz. (M)
- 3.2.2.6** Audio Response: The upper and lower limits are +1dB and -3dB. The tenderer must state actual level. (M)
- 3.2.2.7** Blocking: The level must be greater than 85dB. The tenderer must state actual level. (M)
- 3.2.2.8** Co-channel rejection: The level to be greater than -12dB. The tenderer must state actual level. (M)
- 3.2.2.9** Intermodulation rejection: The level to be greater than 65dB. The tenderer must state actual level. (M)
- 3.2.2.10** Mute Opening: If no squelch control then tenderer must state the pre-set levels. (M)
- 3.2.2.11** Rated Audio: The rated audio must be a minimum of 3W into an internal or external loudspeaker. Tenderer to state actual level (M)
- 3.2.2.12** Channel busy indication: A channel busy indication must be provided in a suitable form (LED or LCD display) to indicate that the channel being monitored is busy. (M)
- 3.2.2.13** Mute/Unmute switch: A mute/unmute switch must be provided on the radio to mute and unmute the receiver. Unmuting of the set using the PTT switch only is unacceptable. (M)
- 3.2.2.14** RX RF signal strength: The radio must display the received RF signal strength numerically within 2-3 dB over a range of -90 to -120 dBm. The tenderer must state how this is displayed (numerically or bar graph) (M)
- 3.2.2.15** Remote loudspeaker: The remote loudspeaker rating must be a minimum of 125% of the audio output. The tenderer must state the actual level. (M)
- 3.2.2.16** Sensitivity: The receiver must be have a sensitivity equal or better than - 115 dBm for 12 dB SINAD. The tenderer must state actual level (M)
- 3.2.2.17** Spurious responses: The radio must have a spurious response greater than 70 dB. The tenderer must state actual levels. (M)
- 3.2.2.18** Hum and noise: The receiver must have a hum and noise > 40 dB @ 12.5 kHz. The tenderer must state the actual level. (M)
- 3.2.2.19** Audio response: Audio response must be flat or de-emphasized and selective per channel. (M)
- 3.2.2.20** Desensitization: The blocking ratio for any frequency within the specified ranges must not be less than 84 dB. The tenderer must state the level. (M)
- 3.2.3 Receiver Digital mode**
- 3.2.3.1** Sensitivity Digital 5%BER: The receiver must be have a sensitivity better than - 116 dBm. The tenderer must state actual levels. (M)
- 3.2.3.2** Selectivity: The selectivity must be better than 60dB. The tenderer must state actual levels. (M)

3.2.3.3 Intermodulation rejection: The rejection must be better than 65dB. The tenderer must state actual levels. (M)

3.2.3.4 BER floor: 10^{-4} . The tenderer must state the actual level. (M)

3.2.4 Transmitter Analogue mode

The tenderer must state the following transmitter specifications for all radios offered (in both VHF ~~and~~ UHF):

3.2.4.1 Switching bandwidth: The radio must have a transmitter switching range covering the entire frequency band stated in section 3.2.1.3 (i.e. 136 - 174 MHz) without degradation. (M)

3.2.4.2 Protection of output circuits: Output circuits must be protected against inadvertent open or short circuiting of the antenna and must be of self-restoring type. The tenderer must state how it is achieved. (M)

3.2.4.3 Load impedance: The transmitter output must work into a 50 ohm load impedance. (M)

3.2.4.4 Time out: Timer The radio must incorporate a time-out timer which prevents continuous transmission for longer than a pre-set time. The tenderer must state the parameters. (M)

3.2.4.5 Busy channel lock out (BCLO): A BCLO feature must be incorporated in the radio (software selectable) to prevent transmission whilst the channel is busy. (M)

3.2.4.6 TX indication: A transmit (TX) indication must be given (LED or LCD) when the radio is transmitting. (M)

3.2.4.7 Audio distortion at 1 kHz with 60% modulation: This should be less than 1.5%. The tenderer must state actual level. (M)

3.2.4.8 Modulation limiting: The modulation must be adjustable. The transmitter must limit the modulation to a maximum of ± 2.5 kHz. (M)

3.2.4.9 FM hum and noise: The transmitter must have hum and noise figure > 38 db. (M)

3.2.4.10 Audio response: The upper and lower limits are +1dB and -3dB. The tenderer must state actual level. (M)

3.2.4.11 RF Power Output: The upper limit to be 25W with incremental setting between 1-25W. The tenderer must state how this is accomplished and the power settings. (M)

3.2.4.12 Duty cycle: The transmitter must have a duty cycle better than 30 % @ maximum power. The tenderer must state the parameters. (M)

3.2.5 Transmitter Digital mode

3.2.5.1 Switching bandwidth: The radio must have a transmitter switching range covering the entire frequency band stated in section 3.2.1.3 (i.e. 136 - 174 MHz) without degradation. (M)

3.2.5.2 Modulation: The tenderer must state what modulation techniques is offered. (M)

3.2.5.3 Adjacent power ratio: This to be 60dBc or better. The tenderer must state the actual level. (M)

3.2.5.4 Transient adjacent channel power ratio: This ratio to be better than 50dBc. The tenderer must state actual level. (M)

3.3 Additional Analogue only Specifications

3.3.1 Selective calling

3.3.1.1 The EEA (Electronic Engineering Association of UK) 5 - tone signalling facility and CCTS must be available as a standard on the radio. (M)

3.3.1.2 Code format: Five tones must be combined into a tone sequence. Any combination must be possible, but to avoid succession, an eleventh tone must be provided for use as a repeat tone (R). This tone must be generated in the sequential tone transmitting equipment whenever the code number contains identical digits in succession. (M)

For Example: 77733 must be transmitted as 7R73R.

GROUP and ALL call must be achieved by use of a group tone (G). After the initial digits are transmitted to select the group, the five tone sequence must be completed by adding group and (where necessary) repeat tones.

For example: A group of 100 units numbered 12300 to 12399 must be called by transmitting 123GR. All calls must be called transmitted as GRGRG.

3.3.1.3 Frequencies: The tone frequencies must be as specified in MPT 1316. (M)

3.3.2 Selective call decoder

3.3.2.1 A decoder must be available in the radio to open the squelch when the predetermined code of the radio is received. (M)

3.3.2.2 Decoder pre-set: It must be possible to pre-set the code to which the radio responds. All five digits of the code must be pre-set independently. (M)

3.3.2.3 Selective calling with open squelch operation: It must be possible to have the option of working in carrier squelch (RFC squelch lift) operation, with signalling still operative i.e. when the predetermined code is received audible alert tones are generated by the radio. (M)

3.3.2.4 Alert tones: Different audible alert tones must be generated by the radio upon decoding an individual call or a group call. (M)

3.3.2.5 Called indication: The radio must give a visible indication (LED or LCD that it has received its unique 5-tone code. (M)

3.3.2.6 Reset button: The radio must incorporate a Reset button accept and reset the called indication. (M)

3.3.2.7 Group and all-call decode facility: The radio must be able to respond to both group and all-call codes in addition to its own unique code. (M)

3.3.2.8 Identification display: The radio must display the received Automatic Number Identification (ANI) decode numerically after receiving its own selective call code. (M)

3.3.3 Selective call encoder

3.3.3.1 An encoder, to enable the radio to selectively call a base station or other mobile radios, must be available in the radio. (M)

3.3.3.2 One button operation: The button to be pressed for calling a base station must also switch on the transmitter for the duration of the transmission of the tones. (M)

3.3.3.3 Encoder/decoder independence: It must be possible to set the codes of the encoder and the decoder independently e.g. to 57843 and decoder to 62109. (M)

3.3.3.4 Operator selectable switches:

3.3.3.4.1 The codes can be pre-set and allocated to a single button. (M)

3.3.3.4.2 The codes must be selected by the operator by means of a keypad either on the radio or microphone. (M)

3.3.3.5 Preamble time: The preamble time, i.e. time allowed between TX initiation of the code transmission and the signal burst, must be internally adjustable. The preamble time range must be as stipulated in Schedule A/B. The use of extended first tone is not acceptable. (M)

3.3.3.6 Identification operation (or Automatic Number Identification – ANI): Identification operation of the encode, i.e. transmission of a predetermined code every time the encode is utilised, must be available as an option and/or all the time the code is transmitted. (M)

3.3.4 Transpond

3.3.4.1 The transpond facility, where the identity code is transmitted as a reply after the correct code is received, is required. The method of implementation must be clearly documented. The radio must transpond upon reception of an individual call, but must not transpond to a group call. (M)

3.3.5 DTMF encode facility

3.3.5.1 A DTMF encode facility must be provided as an option. This is to enable access to the Eskom internal telephone system (PAX) via a telephone interconnect facility. (M)

3.3.5.2 Standard DTMF tones, as defined in CCITT Red Book volume V1 Recommendation Q 23 (5-8), must be used. (M)

3.3.5.3 The Transmitter modulation level must be within $70\% \pm 20\%$ of maximum modulation for the composite signal for each digit. (M)

3.3.6 ~~MPT1327 trunking compatibility~~

~~**3.3.6.1 Compatibility**~~

~~**3.3.6.1.1** The equipment offered in the UHF band must be capable of operating as an MPT1327 outstation, and be fully compatible with all features of the Trunking protocol implemented in Eskom. (M)~~

~~**3.3.6.2 MPT1327 trunking features**~~

~~**3.3.6.2.1** The radio must have a minimum of 32 conventional channels. The tenderer must state the number of channels available. (M)~~

~~**3.3.6.3 Network connection indication**~~

~~**3.3.6.3.1** The radio must have an indication that the user is logged onto the network. (M)~~

~~**3.3.6.4 Automatic call back**~~

~~**3.3.6.4.1** The radio must be able to automatically call a radio unit that has placed a prior unanswered call. (M)~~

~~**3.3.6.5 Pre-set numbers**~~

~~**3.3.6.5.1** The radio must be able to store a minimum of 50 names and numbers. The supplier must state how the data is loaded into the radio. (M)~~

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3.3.6.6 ~~Call Divert~~

~~3.3.6.6.1 The radio must be able to do call divert with acknowledging that the call is being diverted. (M)~~

3.3.6.7 ~~Status information~~

~~3.3.6.7.1 The supplier to state what status info the radio can indicate to the user. (M)~~

3.3.6.8 ~~Short data messages~~

~~3.3.6.8.1 The supplier must state how many alphanumeric characters the radio can send and receive. (M)~~

3.3.6.9 ~~RSSI level~~

~~3.3.6.9.1 The supplier must state how the RSSI level is indicated on the display. (M)~~

3.3.6.10 ~~Ring tones~~

~~3.3.6.10.1 The supplier must state how many different ringtones are available. (M)~~

3.4 Additional DMR only Specifications

This is addition to the specifications list in **Section 3.1**.

The following types of radio are specified:

- 1) Full functionality dashmount with keypad and display
- 2) Full functionality trunkmount (remote head) with keypad and display

3.4.1 Mode of operation

3.4.1.1 The radio must operate in duplex, half duplex (two frequency simplex) and simplex mode as required. (M)

3.4.2 Channel requirements

3.4.2.1 The radio must be capable of operating on at least a minimum number of channels as stated below:

3.4.2.1.1 Tier 1 must have minimum of 100 channels. The tenderer must state the maximum number of channels available. (M)

3.4.2.1.2 Tier 2 must have minimum of 100 channels. The tenderer must state the maximum number of channels available. (M)

3.4.2.1.3 Tier 3 must have minimum of 1000 channels. The tenderer must state the maximum number of channels available. (M)

3.4.2.2 Tenderer must state if any variance in channels when programmed in analogue mode. (M)

3.4.2.3 Each channel must be capable of duplex or single frequency simplex operation independent of the other channels. (M)

3.4.2.4 The selected channel number must be indicated by means of the position of a switch or LCD display on the radio. (M)

3.4.2.5 The DMR Interoperability certificates must be provided for all Tier II and Tier III models tendered (M)

3.4.2.6 The numbering (addressing) must be compatible to Eskom installed network. The radios must be capable of supporting MPT1327/1343 and Nokia ANN. Therefore all sent and received calls are displayed with the correct number (CLI – Calling Line Identification). (M)

- 3.4.2.7** The same numbering scheme must be applicable to the SMS messaging. (M)
- 3.4.2.8** GPS functionality: Send and display position. The tenderer must state whether this functionality standard or an option. (M)
- 3.4.2.9** Emergency call: The tenderer must state if single button operation or alternative means. (M)
- 3.4.2.10** The DMR Mobile Radio must support a minimum of 100 Zones. The tenderer must state maximum number of Zones the radio is capable of. (M)
- 3.4.2.11** The DMR Mobile Radio must support a minimum of 100 Scan groups. The tenderer must state maximum number of Scan groups the radio is capable of. (M)

4. Authorization

This document has been seen and accepted by:

Name and surname	Designation
Cornelius Naidoo	CoE Design Engineering Manager – PTM&C
Lenah Mothata	Senior Manager – Grids
Barry Clayton	Chief Engineer – TX Secondary Plant, Work Planning and Centralised Services
Sikelela Mkhabela	Senior Manager - DX
Prudence Madiba	Senior Manager – GX
Isabel Fick	Senior Manager - Eskom Telecommunications
Maureen Mokone	Senior Manager - GIT
Lloyd Chego	Senior Manager – Group Security

5. Revisions

Date	Rev.	Compiler	Remarks
Oct 2019	2	K. Plasket	Revised
Feb 2015	1	K. Plasket	Revise and reformat/template change to SCOT. Document number changed to 240-87054654
Feb 2012	2	K. Plasket	Reformatted and revised
Jun 1996	1	K. Plasket	Initial document ETSP0175

6. Development team

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

K Plasket Senior Advisor
C Scarr Regional Engineering Head Eskom Telecommunications
J Schutte Senior Engineer

7. Acknowledgements

Not applicable.

Annex A – Schedule A: Schedule of technical compliance

This must be completed by providing technical details of tendered equipment and Tenderer's statement of compliance or non-compliance. The Tenderer's statement of compliance must be supported by additional information of a concise reference to the relevant submitted documents (e.g. file number, section number, page number, paragraph number). A failure to support the clause with the relevant reference might result in non-compliance.

Table A.1: Schedule of technical compliance

Spec. clause number	Description	Eskom's minimum technical requirements	Supplier's statements of compliance
3	Requirements		
3.1	Common Analogue/MPT and DMR requirements		
3.1.1	Environment		
3.1.1.1	The radio must operate without malfunction and must meet all the required specifications within the environmental limits described in this section. (M)	As per description	
3.1.1.2	Altitude: 0 to 3500m above mean sea level. (M)	As per description	
3.1.1.3	Ambient temperature: -10 °C to +60 °C. (M)	As per description	
3.1.1.4	Barometer pressure: 75 to 106 kPa. (M)	As per description	
3.1.1.5	Humidity (maximum):		
3.1.1.5.1	10% at -10° C (M)	As per description	
3.1.1.5.2	95% at +20° C (M)	As per description	
3.1.1.5.3	75% at +60° C (M)	As per description	

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Spec. clause number	Description	Eskom's minimum technical requirements	Supplier's statements of compliance
3.1.2	Construction - Radio casing		
3.1.2.1	The radio case must be of tough, high impact plastic or metal extrusion, able to withstand tough handling and usage. The tenderer must state the construction material. (M)	As per description	
3.1.2.2	The case of the mobile radio must be a minimum of IP54 waterproof and dustproof. The tenderer must state the rating. (M)	As per description	
3.1.3	Dimensions		
3.1.3.1	The Tenderer must clearly state the physical dimensions in mm (length, width and height for both trunk and dash-mount options) and mass of the radios. (M)	As per description	
3.1.4	General Design		
3.1.4.1	The radio must have a backlit display and keypad. (M)	As per description	
3.1.5	Indications		
3.1.5.1	All indications must be unambiguous and easily identifiable. The type of indication (e.g. LCD or LED) must be stated by the Tenderer. (M)	As per description	
3.1.6	Controls		

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Spec. clause number	Description	Eskom's minimum technical requirements	Supplier's statements of compliance
3.1.6.1	All controls must be unambiguous and easily accessible. All pre-set variable controls must be clearly marked and readily identifiable in the equipment. (M)	As per description	
3.1.7	Printed Circuit Board (PCB) Design		
3.1.7.1	Markings: All printed circuit boards and subassemblies must be permanently marked and identified. All components must be clearly marked and identifiable in all drawings and documentation. (M)	As per description	
3.1.7.2	Test points: Clearly identified test points must be provided on all units, sub-units and circuit boards for measurements of important parameters without de-soldering. (M)	As per description	
3.1.7.3	Mounting screws: Mounting screws, where used, must not be self-tapping. Bushes and threaded inserts must be used. (M)	As per description	
3.1.8	Accessories and spares		
3.1.8.1	Accessories and optional items are to be listed. Tenderers must list any optional items that they can provide. (M)	As per description	
3.1.8.2	Tenderer must list any proprietary testing accessories e.g. cards, adaptor kits etc. and programmers. (M)	As per description	
3.1.9	Protection against reverse polarity		

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Spec. clause number	Description	Eskom's minimum technical requirements	Supplier's statements of compliance
3.1.9.1	The inputs of all equipment that have DC supplies must have full protection against possible reverse connection and be of a self-restoring type. The tenderer must state the method used. (M)	As per description	
3.1.10	Testing - Routine testing		
3.1.10.1	Carrier Power on all channels. (M)	As per description	
3.1.10.2	Transmit Frequency on all channels. (M)	As per description	
3.1.10.3	Adjacent Channel Power. (M)	As per description	
3.1.10.4	Usable sensitivity on all channels. (M)	As per description	
3.1.10.5	Maximum useful output power (audio). (M)	As per description	
3.1.10.6	Adjacent Channel selectivity and desensitisation ratio. (M)	As per description	
3.1.10.7	Correct operation of EEA encode and decode function. (M)	As per description	
3.1.10.8	Pre-acceptance batch testing: Eskom may, at its discretion, require that batch testing be carried out by SABS before release of radios for delivery. This batch testing will be conducted in accordance with SANS 300086:2014. (M)	As per description	
3.1.10.9	In such cases the radios will only be accepted once a Certificate of Acceptance is received from the SABS. (M)	As per description	

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Spec. clause number	Description	Eskom's minimum technical requirements	Supplier's statements of compliance
3.1.11	Service manuals		
3.1.11.1	Content: Service manuals must include detailed circuit, printed circuit and wiring diagrams, and clear description of the function of all parts of the equipment and the options offered. They must further contain all information required to adjust the equipment fully to its optimum performance specification and must describe the necessary testing procedures. Details of component types, manufacturer's type number and designation etc. must be included in the manual. (M)	As per description	
3.1.11.2	Updating: If any changes in design or manufacture are made to the equipment during the contract period, revised documentation must be supplied to Eskom to update the manuals in use, prior to delivery of equipment of equipment incorporating the new design. (M)	As per description	
3.1.11.3	Two manuals (for each model of equipment offered) in hardcopy format and a softcopy must be supplied to Eskom Telecommunications Technology when the Enabling Contract is established and before any equipment is supplied. Thereafter technical manuals must be offered as an optional item. (M)	As per description	
3.1.12	Software		
3.1.12.1	The product must be supplied with PC based configuration software that enables full configuration, programming and diagnostics of all functions of the mobile radio. Software to upgrade any firmware must also be supplied. (M)	As per description	

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Spec. clause number	Description	Eskom's minimum technical requirements	Supplier's statements of compliance
3.1.13	Operating system		
3.1.13.1	The software must at least be compatible with a version of Microsoft Windows™ Operating System less than 2 years old, as well as with another version of Windows™ between 2 and 5 years old. (M)	As per description	
3.1.14	Install feature		
3.1.14.1	The software must have an auto-install feature whereby a setup program will prompt for options and the software will automatically be extracted to the appropriate directories with program groups and icons created (for Windows™). (M)	As per description	
3.1.15	User interface		
3.1.15.1	The software must be user friendly and menu driven, and comprehensive help files must be provided. Only basic computer knowledge should be required to use the software interface. (M)	As per description	
3.1.16	Hardware requirements		
3.1.16.1	The tenderer must specify the minimum computer hardware requirements of the software that is offered and the interface cable must be connected via the USB port. (M)	As per description	
3.1.17	Saving of configurations		

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Spec. clause number	Description	Eskom's minimum technical requirements	Supplier's statements of compliance
3.1.17.1	It must be possible to save and retrieve mobile configurations to/from flash drive. (M)	As per description	
3.1.18	Software documentation		
3.1.18.1	All software supplied with the system must be documented comprehensively, with all the features and functions discussed. Included in the documentation must be a list of possible problems and how to solve them. (M)	As per description	
3.1.19	Software licensing/activation codes		
3.1.19.1	All software/activation codes must be supplied at no additional cost. The supplier must specify all terms and conditions related to the distribution of the software/activation codes in the offer. (M)	As per description	
3.1.19.2	The radios must be able to be operated with full functionality with software/activation codes supplied. (M)	As per description	
3.1.19.3	Updated software versions to be supplied free of charge. This is to be supplied on a flash drive to the technical representative listed on the contract. This is to be accompanied by the memorandum of change indicating the implications. (M)	As per description	
3.1.20	Training		

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Spec. clause number	Description	Eskom's minimum technical requirements	Supplier's statements of compliance
3.1.20.1	Training courses must be conducted for Eskom radio technicians, which will cover a description of the basic design of the radio, maintenance and first line repair techniques and programming instructions (where necessary). (M)	As per description	
3.1.21	Maintenance		
3.1.21.1	The maintenance contract is to be offered as an option and details of proposed contracts given in Schedule A. (M)	As per description	
3.1.22	Product lifespan		
3.1.22.1	The tenderer must provide the history and future of the product offered:		
3.1.22.1.1	The date the equipment first went into manufacture. (M)	As per description	
3.1.22.1.2	The date the product will cease to be manufactured. (M)	As per description	
3.1.22.1.3	When manufacturing ceases how long will spares be available (component level). (M)	As per description	
3.1.23	Equipment reliability		

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Spec. clause number	Description	Eskom's minimum technical requirements	Supplier's statements of compliance
3.1.23.1	Details of measured MTBF figures of the equipment offered must be provided in Schedule A. Details of predicted MTBF values (including calculations) will be accepted. However, Eskom reserves the right to request a full reliability measurement to be carried out by an independent test authority on selected equipment. (M)	As per description	
3.2	Technical radio specifications – Analogue and DMR		
3.2.1	General		
3.2.1.1	Identification: The make of radio and type number must be clearly marked on the equipment. Tenderer must state how this is done. (M)	As per description	
3.2.1.2	Mode of operation: The radio must operate in half duplex (option full duplex in DMR mode) and simplex mode as required. The tenderer must state which mode of operation is available. (M)	As per description	
3.2.1.3	Frequency band: The radios must operate in the frequency band 136-174 MHz (VHF) and 400-420 MHz (UHF) in accordance with the SA band plan as defined by the ICASA. (M)	As per description	
3.2.1.4	Channel spacing: The channel spacing between adjacent channels must be 12.5 kHz. (M)	As per description	
3.2.1.5	Number of channels:		

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Spec. clause number	Description	Eskom's minimum technical requirements	Supplier's statements of compliance
3.2.1.5.1	The radio must be capable of operating on a minimum of 99 channels in the above band (analogue mode). Each channel must be capable of duplex or single frequency simplex operation independent of the other channels. (M)	As per description	
3.2.1.5.2	The selected channel number must be indicated by means of the position of a switch or LED or LCD display on the radio. (M)	As per description	
3.2.1.6	Modulation method: The modulation method must be angle modulation. (M)	As per description	
3.2.1.7	Pre- and De-emphasis: Pre and de-emphasis of the audio in transmit and receive modes respectively must be 6 dB/octave from 300 Hz to 3 000 Hz. (M)	As per description	
3.2.1.8	Programming of the radio: All programmable functions of the radio must be done with a laptop using a USB or RJ45 connection. The Tenderer must specify the programming method used. (M)	As per description	
3.2.1.9	Frequency stability: The radio must have frequency stability equal or better than 1.5ppm. (M)	As per description	
3.2.1.10	Power supply: The radio must operate in the range of 10.8 to 16 VDC and still meet all stated specifications. (M)	As per description	
3.2.1.11	RF Connector: N-type, TNC and BNC preferred. Tenderer must state the type of RF connector used. (M)	As per description	
3.2.2	Receiver Analogue mode		

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Spec. clause number	Description	Eskom's minimum technical requirements	Supplier's statements of compliance
3.2.2.1	Switching bandwidth: The radio must have a receiver switching range covering the complete frequency band stated in section 3.2.1.3 without degradation. (M)	As per description	
3.2.2.2	RF Impedance: The RF impedance must be 50 ohms. (M)	As per description	
3.2.2.3	Adjacent channel selectivity: The level should be better than 60db for both VHF and UHF band. The tenderer must state actual levels. (M)	As per description	
3.2.2.4	Audio distortion: The receiver must have an audio distortion < 3% @ 1 kHz 60% modulation. The tenderer must state actual levels. (M)	As per description	
3.2.2.5	Audio bandwidth: This must be between 300Hz and 3000Hz. (M)	As per description	
3.2.2.6	Audio Response: The upper and lower limits are +1dB and -3dB. The tenderer must state actual level. (M)	As per description	
3.2.2.7	Blocking: The level must be greater than 85dB. The tenderer must state actual level. (M)	As per description	
3.2.2.8	Co-channel rejection: The level to be greater than -12dB. The tenderer must state actual level. (M)	As per description	
3.2.2.9	Intermodulation rejection: The level to be greater than 65dB. The tenderer must state actual level. (M)	As per description	
3.2.2.10	Mute Opening: If no squelch control then tenderer must state the pre-set levels. (M)	As per description	

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Spec. clause number	Description	Eskom's minimum technical requirements	Supplier's statements of compliance
3.2.2.11	Rated Audio: The rated audio must be a minimum of 3W into an internal or external loudspeaker. Tenderer to state actual level (M)	As per description	
3.2.2.12	Channel busy indication: A channel busy indication must be provided in a suitable form (LED or LCD display) to indicate that the channel being monitored is busy. (M)	As per description	
3.2.2.13	Mute/Unmute switch: A mute/unmute switch must be provided on the radio to mute and unmute the receiver. Unmuting of the set using the PTT switch only is unacceptable. (M)	As per description	
3.2.2.14	RX RF signal strength: The radio must display the received RF signal strength numerically within 2-3 dB over a range of -90 to -120 dBm. The tenderer must state how this is displayed (numerically or bar graph) (M)	As per description	
3.2.2.15	Remote loudspeaker: The remote loudspeaker rating must be a minimum of 125% of the audio output. The tenderer must state the actual level. (M)	As per description	
3.2.2.16	Sensitivity: The receiver must be have a sensitivity equal or better than - 115 dBm for 12 dB SINAD. The tenderer must state actual level (M)	As per description	
3.2.2.17	Spurious responses: The radio must have a spurious response greater than 70 dB. The tenderer must state actual levels. (M)	As per description	

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Spec. clause number	Description	Eskom's minimum technical requirements	Supplier's statements of compliance
3.2.2.18	Hum and noise: The receiver must have a hum and noise > 40 dB @ 12.5 kHz. The tenderer must state the actual level. (M)	As per description	
3.2.2.19	Audio response: Audio response must be flat or de-emphasized and selective per channel. (M)	As per description	
3.2.2.20	Desensitization: The blocking ratio for any frequency within the specified ranges must not be less than 84 dB. The tenderer must state the level. (M)	As per description	
3.2.3	Receiver Digital mode		
3.2.3.1	Sensitivity Digital 5%BER: The receiver must be have a sensitivity better than - 116 dBm. The tenderer must state actual levels. (M)	As per description	
3.2.3.2	Selectivity: The selectivity must be better than 60dB. The tenderer must state actual levels. (M)	As per description	
3.2.3.3	Intermodulation rejection: The rejection must be better than 65dB. The tenderer must state actual levels. (M)	As per description	
3.2.3.4	BER floor: 10 ⁻⁴ . The tenderer must state the actual level. (M)	As per description	
3.2.4	Transmitter Analogue mode		

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Spec. clause number	Description	Eskom's minimum technical requirements	Supplier's statements of compliance
3.2.4.1	Switching bandwidth: The radio must have a transmitter switching range covering the entire frequency band stated in section 3.2.1.3 (i.e. 136 - 174 MHz) without degradation. (M)	As per description	
3.2.4.2	Protection of output circuits: Output circuits must be protected against inadvertent open or short circuiting of the antenna and must be of self-restoring type. The tenderer must state how it is achieved. (M)	As per description	
3.2.4.3	Load impedance: The transmitter output must work into a 50 ohm load impedance. (M)	As per description	
3.2.4.4	Time out: Timer The radio must incorporate a time-out timer which prevents continuous transmission for longer than a pre-set time. The tenderer must state the parameters. (M)	As per description	
3.2.4.5	Busy channel lock out (BCLO): A BCLO feature must be incorporated in the radio (software selectable) to prevent transmission whilst the channel is busy. (M)	As per description	
3.2.4.6	TX indication: A transmit (TX) indication must be given (LED or LCD) when the radio is transmitting. (M)	As per description	
3.2.4.7	Audio distortion at 1 kHz with 60% modulation: This should be less than 1.5%. The tenderer must state actual level. (M)	As per description	
3.2.4.8	Modulation limiting: The modulation must be adjustable. The transmitter must limit the modulation to a maximum of ± 2.5 kHz. (M)	As per description	

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Spec. clause number	Description	Eskom's minimum technical requirements	Supplier's statements of compliance
3.2.4.9	FM hum and noise: The transmitter must have hum and noise figure > 38 db. (M)	As per description	
3.2.4.10	Audio response: The upper and lower limits are +1dB and -3dB. The tenderer must state actual level. (M)	As per description	
3.2.4.11	RF Power Output: The upper limit to be 25W with incremental setting between 1-25W. The tenderer must state how this is accomplished and the power settings. (M)	As per description	
3.2.4.12	Duty cycle: The transmitter must have a duty cycle better than 30 % @ maximum power. The tenderer must state the parameters. (M)	As per description	
3.2.5	Transmitter Digital mode		
3.2.5.1	Switching bandwidth: The radio must have a transmitter switching range covering the entire frequency band stated in section 3.2.1.3 (i.e. 136 - 174 MHz) without degradation. (M)	As per description	
3.2.5.2	Modulation: The tenderer must state what modulation techniques is offered. (M)	As per description	
3.2.5.3	Adjacent power ratio: This to be 60dBc or better. The tenderer must state the actual level. (M)	As per description	
3.2.5.4	Transient adjacent channel power ratio: This ratio to be better than 50dBc. The tenderer must state actual level. (M)	As per description	

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Spec. clause number	Description	Eskom's minimum technical requirements	Supplier's statements of compliance
3.3	Additional Analogue only Specifications		
3.3.1	Selective calling		
3.3.1.1	The EEA (Electronic Engineering Association of UK) 5 - tone signalling facility and CCTS must be available as a standard on the radio. (M)	As per description	
3.3.1.2	Code format: Five tones must be combined into a tone sequence. Any combination must be possible, but to avoid succession, an eleventh tone must be provided for use as a repeat tone (R). This tone must be generated in the sequential tone transmitting equipment whenever the code number contains identical digits in succession. (M)	As per description	
3.3.1.3	Frequencies: The tone frequencies must be as specified in MPT 1316. (M)	As per description	
3.3.2	Selective call decoder		
3.3.2.1	A decoder must be available in the radio to open the squelch when the predetermined code of the radio is received. (M)	As per description	
3.3.2.2	Decoder pre-set: It must be possible to pre-set the code to which the radio responds. All five digits of the code must be pre-set independently. (M)	As per description	

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Spec. clause number	Description	Eskom's minimum technical requirements	Supplier's statements of compliance
3.3.2.3	Selective calling with open squelch operation: It must be possible to have the option of working in carrier squelch (RFC squelch lift) operation, with signalling still operative i.e. when the predetermined code is received audible alert tones are generated by the radio. (M)	As per description	
3.3.2.4	Alert tones: Different audible alert tones must be generated by the radio upon decoding an individual call or a group call. (M)	As per description	
3.3.2.5	Called indication: The radio must give a visible indication (LED or LCD that it has received its unique 5-tone code. (M)	As per description	
3.3.2.6	Reset button: The radio must incorporate a Reset button accept and reset the called indication. (M)	As per description	
3.3.2.7	Group and all-call decode facility: The radio must be able to respond to both group and all-call codes in addition to its own unique code. (M)	As per description	
3.3.2.8	Identification display: The radio must display the received Automatic Number Identification (ANI) decode numerically after receiving its own selective call code. (M)	As per description	
3.3.3	Selective call encoder		
3.3.3.1	An encoder, to enable the radio to selectively call a base station or other mobile radios, must be available in the radio. (M)	As per description	

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Spec. clause number	Description	Eskom's minimum technical requirements	Supplier's statements of compliance
3.3.3.2	One button operation: The button to be pressed for calling a base station must also switch on the transmitter for the duration of the transmission of the tones. (M)	As per description	
3.3.3.3	Encoder/decoder independence: It must be possible to set the codes of the encoder and the decoder independently e.g. to 57843 and decoder to 62109. (M)	As per description	
3.3.3.4	Operator selectable switches:		
3.3.3.4.1	The codes can be pre-set and allocated to a single button. (M)	As per description	
3.3.3.4.2	The codes must be selected by the operator by means of a keypad either on the radio or microphone. (M)	As per description	
3.3.3.5	Preamble time: The preamble time, i.e. time allowed between TX initiation of the code transmission and the signal burst, must be internally adjustable. The preamble time range must be as stipulated in Schedule A/B. The use of extended first tone is not acceptable. (M)	As per description	
3.3.3.6	Identification operation (or Automatic Number Identification – ANI): Identification operation of the encode, i.e. transmission of a predetermined code every time the encode is utilised, must be available as an option and/or all the time the code is transmitted. (M)	As per description	
3.3.4	Transpond		

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Spec. clause number	Description	Eskom's minimum technical requirements	Supplier's statements of compliance
3.3.4.1	The transpond facility, where the identity code is transmitted as a reply after the correct code is received, is required. The method of implementation must be clearly documented. The radio must transpond upon reception of an individual call, but must not transpond to a group call. (M)	As per description	
3.3.5	DTMF encode facility		
3.3.5.1	A DTMF encode facility must be provided as an option. This is to enable access to the Eskom internal telephone system (PAX) via a telephone interconnect facility. (M)	As per description	
3.3.5.2	Standard DTMF tones, as defined in CCITT Red Book volume V1 Recommendation Q 23 (5-8), must be used. (M)	As per description	
3.3.5.3	The Transmitter modulation level must be within 70% \pm 20% of maximum modulation for the composite signal for each digit. (M)	As per description	
3.3.6	MPT1327 trunking compatibility		
3.3.6.1	Compatibility		
3.3.6.1.1	The equipment offered in the UHF band must be capable of operating as an MPT1327 outstation, and be fully compatible with all features of the Trunking protocol implemented in Eskom. (M)	As per description	
3.3.6.2	MPT1327 trunking features		

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Spec. clause number	Description	Eskom's minimum technical requirements	Supplier's statements of compliance
3.3.6.2.1	The radio must have a minimum of 32 conventional channels. The tenderer must state the number of channels available. (M)	As per description	
3.3.6.3	Network connection indication		
3.3.6.3.1	The radio must have an indication that the user is logged onto the network. (M)	As per description	
3.3.6.4	Automatic call back		
3.3.6.4.1	The radio must be able to automatically call a radio unit that has placed a prior unanswered call. (M)	As per description	
3.3.6.5	Pre-set numbers		
3.3.6.5.1	The radio must be able to store a minimum of 50 names and numbers. The supplier must state how the data is loaded into the radio. (M)	As per description	
3.3.6.6	Call Divert		
3.3.6.6.1	The radio must be able to do call divert with acknowledging that the call is being diverted. (M)	As per description	
3.3.6.7	Status information		
3.3.6.7.1	The supplier to state what status info the radio can indicate to the user. (M)	As per description	
3.3.6.8	Short data messages		

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Spec. clause number	Description	Eskom's minimum technical requirements	Supplier's statements of compliance
3.3.6.8.1	The supplier must state how many alphanumeric characters the radio can send and receive. (M)	As per description	
3.3.6.9	RSSI level		
3.3.6.9.1	The supplier must state how the RSSI level is indicated on the display. (M)	As per description	
3.3.6.10	Ring tones		
3.3.6.10.1	The supplier must state how many different ringtones are available. (M)	As per description	
3.4	Additional DMR only Specifications		
3.4.1	Mode of operation		
3.4.1.1	The radio must operate in duplex, half duplex (two frequency simplex) and simplex mode as required. (M)	As per description	
3.4.2	Channel requirements		
3.4.2.1	The radio must be capable of operating on at least a minimum number of channels as stated below:		
3.4.2.1.1	Tier 1 must have minimum of 100 channels. The tenderer must state the maximum number of channels available. (M)	As per description	

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Spec. clause number	Description	Eskom's minimum technical requirements	Supplier's statements of compliance
3.4.2.1.2	Tier 2 must have minimum of 100 channels. The tenderer must state the maximum number of channels available. (M)	As per description	
3.4.2.1.3	Tier 3 must have minimum of 1000 channels. The tenderer must state the maximum number of channels available. (M)	As per description	
3.4.2.2	Tenderer must state if any variance in channels when programmed in analogue mode. (M)	As per description	
3.4.2.3	Each channel must be capable of duplex or single frequency simplex operation independent of the other channels. (M)	As per description	
3.4.2.4	The selected channel number must be indicated by means of the position of a switch or LCD display on the radio. (M)	As per description	
3.4.2.5	The DMR Interoperability certificates must be provided for all Tier II and Tier III models tendered (M)	As per description	
3.4.2.6	The numbering (addressing) must be compatible to Eskom installed network. The radios must be capable of supporting MPT1327/1343 and Nokia ANN. Therefore all sent and received calls are displayed with the correct number (CLI – Calling Line Identification). (M)	As per description	
3.4.2.7	The same numbering scheme must be applicable to the SMS messaging. (M)	As per description	

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Spec. clause number	Description	Eskom's minimum technical requirements	Supplier's statements of compliance
3.4.2.8	GPS functionality: Send and display position. The tenderer must state whether this functionality standard or an option. (M)	As per description	
3.4.2.9	Emergency call: The tenderer must state if single button operation or alternative means. (M)	As per description	
3.4.2.10	The DMR Mobile Radio must support a minimum of 100 Zones. The tenderer must state maximum number of Zones the radio is capable of. (M)	As per description	
3.4.2.11	The DMR Mobile Radio must support a minimum of 100 Scan groups. The tenderer must state maximum number of Scan groups the radio is capable of. (M)	As per description	

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