

**TRANSTEL**

A Division of Transnet Limited
Registration Number 1990/000900/06

**SPECIFICATION FOR A VOICE
FREQUENCY LINE-BRANCHING UNIT
FOR USE WITH RADIO EQUIPMENT**

**SPC-00647
JANUARY 2007**

Revision 2.00

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I DOCUMENT AUTHORISATION

FUNCTION	NAME	TITLE & DIVISION	SIGNATURE	DATE
Compiled by :	P Chandler	Transmission Engineering	<i>Signed PP P Chandler</i>	19/01/2007
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II DISTRIBUTION

Once updated, a copy of the latest revision will be published in the document management system in use. E-mail to this effect will be sent to the relevant personnel or heads of department.

III DOCUMENT CHANGE HISTORY

ISSUE NO.	DATE ISSUED	ISSUED BY	HISTORY DESCRIPTION
1.00	September 2004	Transmission	New document
2.00	October 2006	Transmission	Converted to ISO standard

IV CHANGES SINCE LAST REVISION

CLAUSE	DESCRIPTION
All clauses	Converted to ISO standard
	Additions / changes and upgrades to the existing specifications to allow the unit to be more universal

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V ABBREVIATIONS, ACRONYMS AND DEFINITIONS

ABBREVIATIONS AND ACRONYMS	DESCRIPTION
AC	Alternating Current
BS	British Standards
CD	Compact Disk
DC	Direct Current
Hz	hertz
ISO	International Standards Organisation
LED	Light Emitting Diode
PTT	Press-to-Talk

DEFINITIONS	DESCRIPTION
E&M	Input and output signalling

VI RELEVANT DOCUMENTATION**APPLICABLE**

The following standard is referred to in this specification :

DOCUMENT NO.	DESCRIPTION	LOCATION
ISO 9000	Quality Management Systems	External
BS 3939	Graphics Symbols for Electrical, Power, Telecommunications and Electronic Diagrams	External

The latest issue of the abovementioned standards shall apply.

RELEVANT

DOCUMENT NO.	DESCRIPTION	LOCATION
SPC-00846	Two-Way Mobile Radiocommunication Equipment (Old number SCEH-54)	Document Control Centre

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1. SCOPE

This specification covers the requirements of Transnet for the supply of line-branching units. The line unit is required to connect line controlled radio repeater and base stations to long distance carrier channel circuits on a 6-wire basis with E and M signalling.

2. COMPLIANCE

- 2.1 Tenderers shall submit their main offers in terms of this specification. Deviations which are of a minor nature, and do not depart materially from this specification will be considered at the discretion of Transnet.
- 2.2 Offers, which include deviations of a minor nature, not departing greatly from the specification, will be considered at the discretion of Transnet.
- 2.3 Tenderers may offer alternatives for consideration. Alternative offers are to be reflected on a separate schedule.
- 2.4 A fully detailed technical description in English explaining the functioning of the individual components, the operation of the items of equipment as well as the procedure to be followed in clearing faults and maintenance.
- 2.5 Drawings and brochures supporting the offer.
- 2.6 Details of deviations from the specifications of Transnet.
- 2.7 The value of imported and local components of complete items are to be stated separately.

3. SERVICE CONDITIONS

- 3.1 The equipment shall be suitable for continuous operation under the following conditions :

Altitude	:	0 to 1 800 metres above sea level.
Ambient temperature	:	-10 °C to +60°C
Relative humidity	:	As high as 95%.
Air pollution	:	Heavily saline laden industrial and locomotive fumes.
Lightning conditions	:	Severe.

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3.2 All component parts, including wiring, shall be manufactured and processed to ensure reliable operation under these conditions.

3.3 All components especially transformers and chokes, shall be suitable for use in a tropical climate.

4. EQUIPMENT REQUIREMENTS

4.1 General Requirements

4.1.1 The unit must be 1U in height and 19" rack mount.

4.1.2 The unit dimensions and external connections are to comply as per annexure A.

4.1.3 The unit must consist of a minimum of four audio and signalling ports.

4.1.4 The unit must be capable of being cascaded with another unit without losing a port.

4.1.5 An engineering handset facility must be made available for the testing of ports and port peripheral equipment individually. The port selection switch must be available on the front panel of the unit.

4.1.6 E and M activity per port must be clearly visible on the front panel of the unit.

4.1.7 The unit must make provision for a range of input and output audio levels per port.

4.1.8 The line branching unit is to provide a means to combine or split 4-wire 600 ohm E&M audio circuits. The combining or splitting of ports may be done by means of physical strappings or via software control.

4.1.9 The unit must provide a busy-channel lockout feature to allow the active port priority over the other ports. If enabled, the first active port must prevent signalling on the other ports from affecting the conference configuration, until it becomes inactive.

4.1.10 Provision must be made for the external connection of a supervisory system to connect/disconnect ports.

4.1.11 The line-branching units shall be housed in a rugged, dustproof cabinet which shall be constructed of impact resistant plastic or metal.

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- 4.1.12 Tenderers shall supply a list detailing the number and types of semi-conductors used in the equipment.
- 4.1.13 All card settings may be performed either by software control or by means of physical jumpers.

4.2 **Supply Voltage**

- 4.2.1 The unit must be capable of operation within specifications with an input supply voltage of between 10 and 60 volts DC.
- 4.2.2 The input supply must be isolated from the branching card circuitry. Strappings must be available to strap the unit earth to station earth.
- 4.2.3 The tenderer shall state the maximum DC current consumption of the complete line-branching unit. The line-branching unit shall provide for internal regulation, over-voltage and reverse polarity protection, etc. of the DC supply. Current consumption of the unit is to be limited to an absolute minimum due to the use of the units at solar-powered station.

4.3 **Audio Circuits**

- 4.3.1 The audio input and output impedance per port must be 600 ohm balanced
- 4.3.2 The audio inputs and outputs must be via 600 ohm isolation transformers.
- 4.3.3 Level adjustment must be provided by means of a multi-turn potentiometer for each individual input and output. Adjustments must be made possible from the rear of the unit.
- 4.3.4 Input and output level setting test points must be made available at the rear of the unit.
- 4.3.5 An option is to be made available per port to only allow audio into that port when E signalling is present on the same port i.e. a gated audio input.
- 4.3.6 The audio circuitry must be capable of operating over an input and output level range of -25 to +5 dBm . Distortion and audio levels to remain within specifications over the entire audio bandwidth of 300 to 3400 Hz .
- 4.3.7 Adjustments must be stable and the performance must be maintained for long periods without recourse to adjustment.

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- 4.3.8 The line-branching unit circuitry shall provide for adequate filtering of any noise and interference on both sides of the voice frequency spectrum (300 Hz to 3 400 Hz) on all ports.
- 4.3.9 Input and output audio must be made available at the rear of the unit via a 9-pin male "D" type connector. Pin designation must be as per Annexure A.

4.4 Signal Inputs (E wire)

- 4.4.1 All signal inputs are to be opto-coupled and capable of being operated by an input signal range of between 10 and 60 volts. The polarity must be bi-directional.
- 4.4.2 Jumpers may be made available in order to ensure that the input signalling current is kept within the required specification.
- 4.4.3 E + and E - pins must be available on the external port connectors.
- 4.4.4 An option must be made available to totally isolate the "E" signalling from the unit and operate over an input voltage range of 10 to 60 volts.

Or

Allow an "E" signalling in the range of 10 to 60 volts positive or negative with respect to the units ground.

Or

Allow the units + Ve supply leg to be used in the signalling path.

4.5 Signal Outputs (M wire)

- 4.5.1 M + and M - output signalling must be made possible via normally open relay contacts thus enabling isolation between the unit and peripheral equipment.
- 4.5.2 On option must be made available via a jumper to allow one of the M legs to be strapped to the units ground.

4.6 Maintenance Port

- 4.6.1 An audio maintenance port must be provided on the front panel to enable service personnel access audio and signalling ports circuits using a standard telephone handset.

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- 4.6.2 Audio levels must be as per port settings.
- 4.6.3 A port selection switch must be made available on the front panel to allow the selection of the ports.
- 4.6.4 Signalling on the selected port must be provided by means of a PTT switch on the handset.
- 4.6.5 A loudspeaker must be fitted on the front panel to monitor inbound or outbound speech on the selected port.

4.7 **Auxiliary Port**

- 4.7.1 An auxiliary port must be provided at the rear of the unit to facilitate the connection of a "High Site Management System" which will be used for the remote switching of the audio and signalling ports of the unit as well as the relaying of alarm outputs from the unit.
- 4.7.2 The alarm outputs must be made possible via normally open relay contacts thus enabling isolation between the unit and the peripheral equipment.
- 4.7.3 Port switching inputs are to be opto-coupled and capable of being operated by an input range of between 10 and 60 volts. The polarity must be bi-directional.
- 4.7.4 Allow the units +Ve or ground to be used in the input switching circuitry.
- 4.7.5 A 15-pin high density socket to be used. Connector pin outs as per Annexure A

5. **QUALITY OF MATERIAL**

- 5.1 Preference will be given to manufacturers who guarantee that they comply with the provisions of the code of practice for quality management systems as set out in ISO 9000.
- 5.2 Tenderers must note that the technical personnel of Transnet will carry out inspections to determine whether the code of practice has been adhered to.
- 5.3 Tenderers must submit details of procedures they intend to adopt to comply with ISO 9000.
- 5.4 Materials which may, under the influence of heat, light or pressure, decompose or liberate elements or compounds likely to corrode or affect other materials or cause electrolytic corrosion will not be acceptable.

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- 5.5 Mounting screws, where used, must not be self-tapping. Bushes and threaded inserts must be used.
- 5.6 All covers, jacks, sockets etc. must be provided with adequate seals.
- 5.7 Indication lamps must be rated for reliable long life and must be protected against surges where necessary. Pilot indicator lamps must be light emitting diode (LED) types.
- 5.8 Printed wiring boards must be of epoxy glass fibre laminate or better. Phenolic paper or bakelised paper boards are not acceptable.
- 5.9 Printed wiring boards must be properly washed and, if necessary, neutralised after the etching process so that no hygroscopic crystals remain in the board or printed wiring.
- 5.10 Printed wiring boards must be guaranteed not to promote or permit the growth of fungi under any conditions.
- 5.11 Printed wiring boards must be fitted with robust plugs and sockets or another approved manner of connecting the boards reliably to the wiring. Edge connectors may be used provided that :
- 5.11.1 A suitable tolerance for the correct fitting of the board between guides and the wiring socket can be guaranteed.
 - 5.11.2 Sufficient contact area is provided to guarantee reliable contact.
 - 5.11.3 Sufficient contact pressure is provided to ensure contact but not to remove precious metal from the contacts.
 - 5.11.4 In the final protective coating of the boards, no varnish or other protective material is permitted to cover the contacts.
 - 5.11.5 After 500 insertions and withdrawals, there must be no noticeable deterioration of the contacts of either the board or socket.
- 5.12 All printed wiring board sockets, plugs or edge connectors must be gold plated or better.
- 5.13 Heavy components must not be mounted on printed wiring boards unless it can be guaranteed that the board will stand up to severe handling without fracturing with the components so mounted.
- 5.14 No unmarked and/or untested components may be used.
- 5.15 Only new components must be used.

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- 5.16 All subassemblies and printed circuit boards must be permanently marked with an identification code.
- 5.17 Test points must be provided on all units, subunits and printed circuit boards for the measurement of all important circuit characteristics without the unsoldering of wires. Such test points must be clearly marked and identified in the equipment.
- 5.18 All wiring and terminations between subassemblies must be identified.
- 5.19 No printed circuit board must have terminations to points other than the edge of the printed circuit board.
- 5.20 No termination must have more than one conductor per solder joint.
- 5.21 Soldering direct to the chassis of any equipment will not be permitted. All chassis terminations must be made with soldering tags.
- 5.22 All pre-set variable controls must be clearly marked and readily identified in the equipment.
- 5.23 Terminations on printed circuit boards must not be made direct to the printed wiring. Where edge connectors are not used, termination to printed wiring must be made via terminal posts.
- 5.24 Where different metals are used in conjunction with each other, tenderers must explicitly guarantee that no electrolytic corrosion will occur under operating conditions.
- 5.25 The equipment must be solid state throughout.
- 5.26 All components used must be types, which can be readily obtained from local stocks.
- 5.27 The equipment must be built in such a manner that faulty modules can be easily and quickly detected, removed and replaced, but steps must be taken to minimise unnecessary movement of plug-in modules on a trial and error basis when locating faults.
- 5.28 Solid-state devices are to be so constructed that they may be easily tested for correct functioning without having to disturb wiring.
- 5.29 The number of component types must be kept to a minimum consistent with good design of the equipment.
- 5.30 Solid-state boards must be provided on a plug-in or other approved basis so that they can, when necessary, be readily removed for repairs.

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- 5.31 Full details of the types of lamps and lenses offered must be furnished with the tender.
- 5.32 The functions of all controls, switches, etc. must be clearly engraved or otherwise permanently marked by means of approved symbols in English.
- 5.33 All components must be suitably rated for the function they have to perform without interference to neighbouring material.
- 5.34 Resistors and restive components must not rise in temperature so that mounting boards or markings thereon are burnt or discoloured.
- 5.35 Fuses must be rated to give adequate protection to the circuit served while not rupturing prematurely.
- 5.36 The equipment lay-out must be planned to facilitate fault clearance and maintenance.
- 5.37 All components must be clearly marked and must be capable of easy reference to circuit diagrams and handbooks to be supplied with the equipment.
- 5.38 Equipment using plug-in modules must be fitted with guides for the insertion of modules. It must not be possible to incorrectly insert a module.
- 5.39 The mechanical construction of the equipment will be tested in accordance with specification SPC-00846, Section 10.
- 6. TECHNICAL HANDBOOKS**
- 6.1 Technical handbooks shall be clearly printed in English. Photostat copies will not be acceptable.
- 6.2 The technical handbooks shall be packed with the equipment.
- 6.3 Each set of handbooks shall include the following :
- 6.3.1 Operating instructions.
- 6.3.2 Complete maintenance instructions.
- 6.3.3 Complete and detailed alignment procedures.
- 6.3.4 A detailed technical description of the equipment.
- 6.3.5 Complete circuit diagrams, drawings and photographs of the equipment. The photographs and drawings shall clearly indicate component/module location on printed circuit boards etc. All component numbers shall be clearly shown.

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- 6.3.6 A list of parts, giving the values of all components, i.e. resistors, capacitors, integrated circuit numbers for each schematic drawing.
- 6.3.7 Detailed printed circuit board wiring diagrams showing components numbers and positions.
- 6.3.8 Voltage levels, current values, test points etc., shall be clearly indicated on circuit diagrams and printed circuit board layouts.
- 6.3.9 Complete circuit diagrams of individual modules shall be included.
- 6.4 All symbols and notations used on drawing and circuit diagrams shall preferably comply with the requirements laid down in BS 3939. Where symbols and notations do not comply with these requirements, each drawing shall be accompanied by a legend clearly detailing BS 3939 equivalents.
- 6.5 Transnet reserves the right to reproduce in whole or in part, by any means whatsoever, any technical handbook or instruction manual supplied by the successful Contractor. Any such reproductions will be for the sole use of Transnet.
- 6.6 A copy of the entire technical manual must be available on CD.
- 7. ACCEPTANCE TESTS**
- 7.1 Transnet will conduct acceptance tests on the equipment. The equipment will not be accepted until these tests have been completed and it has been confirmed that the equipment supplied is fully in accordance with the requirements of the specification and/or the stated claims of the tenderer as accepted by Transnet.
- 7.2 The tenderer shall agree to rectify any defects at no cost to Transnet, where the equipment does not meet the tender requirements and/or the stated claims of the supplier as accepted by Transnet.
- 8. GUARANTEE**
- 8.1 Notwithstanding anything contained in the specifications and documents included in this specification, the tenderer shall guarantee the satisfactory operation of the complete system and accept liability for maker's defects which may appear in the equipment for a period of twelve (12) months after acceptance by Transnet. The tenderer shall clearly state the guarantee terms.
- 8.2 If any urgent repairs have to be carried out during the guarantee period by Transnet, the Contractor shall inspect such repairs to ensure that the guarantee is unaffected.

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- 8.3 The tenderer shall note that repairs required to be done in terms of the guarantee will need to be effected at the various sites. Tenderers shall state how they propose to meet this requirement.

9. MAINTENANCE AND SERVICE

- 9.1 The tenderer shall give full particulars of the maintenance, spare parts and service facilities, which will be available in the Republic of South Africa. The names and addresses of the persons concerned shall be furnished.
- 9.2 Transnet will not consider tenders from tenderers who cannot provide an efficient spares and maintenance service.

10. TENDER REQUIREMENTS

- 10.1 The tender shall be submitted in duplicate.
- 10.2 The tenderer shall submit quotations for all the equipment listed in the Schedule of Requirements (including the optional items).
- 10.3 The tenderer shall agree, if so requested by Transnet, to submit a sample of the line-branching unit. A sample of this equipment shall be made available within seven (7) days from the date of request at the following address :
- Chief Executive
(Transtel)
33 Hoofd Street
Forum III, Braampark
BRAAMFONTEIN
- 10.4 The successful tenderer shall forward one complete set of technical handbooks, covering all items of equipment to be supplied, printed in English, within six (6) weeks after the official order is received, direct to :
- Chief Executive
(Transtel)
PO Box 30877
BRAAMFONTEIN
2017
- 10.4.1 The balance of the technical handbooks shall be packed with the equipment.
- 10.5 Each item of equipment offered should be numbered so that it can be readily identified by cross-reference to the technical literature covering the equipment which shall be submitted with the tender.

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- 10.6 Technical literature, pamphlets, photographs and technical specifications covering the equipment offered shall be submitted with the tender. No alterations shall be made to the equipment manufacturer's technical specification sheets. Where the tenderer's statement of compliance is in variance with the manufacturer's technical specifications, the differences shall be fully explained.
- 10.7 The successful tenderer shall provide any special technical instructions with regard to the proper installation of the equipment supplied and any special testing methods.
- 10.8 Any matters in this specification which are not understood must be discussed with Transnet's engineers before the closing date of the tender.

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ANNEXURE A : TECHNICAL SPECIFICATION

1. General		
a	Measurements (mm)	83(W) x 55(D) x 44(H)
b	Mounting method	19" rack mount
c	Colour	Seaman Grey
d	Name	Owl III
2. Power		
a	Requirements	For 12 volt input. Operating range 10,8 to 15,6 volts
	(Linkable)	For 24 Volt input. Operating range 21,6 volt to 30,5 volts
		For 48 Volt input. Operating range 43,2 volts to 56,8 volts
b	Current Consumption max	3 Watts
c	Unit Ground	Negative
d	Input connector type	2 Pin Molex
3. Line Inputs		
a	Number of Ports	4
b	Impedance	600 Ohm Balanced
c	Level	-25 dBm to +5 dBm
d	Bandwidth	300 - 3400 Hz
e	Return Loss	Better than - 25 dB
4. Line Outputs		
a	Number of Ports	4
b	Impedance	600 Ohm Balanced
c	Level	- 25 dBm to + 5 dBm
d	Bandwidth	300-3400 Hz
e	Response	Within 0,5 dB of quoted range
f	Distortion	< 0.1 % over entire level range @ 1 kHz
g	Crosstalk	> 60 dB relative to 0 dBm input
h	Common-mode rejection ratio	≥ 60 dB at 1 kHz

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5. Signalling Input "E" lead		
a	Input leads (Options) (Linkable)	Isolated 10 to 60 volts 10 to 60 volts positive or negative w.r.t unit ground
b	Voltage range (Linkable)	As per specification 2(a) above
c	Current range	Not to exceed per port 10 mA for reliable switching.
6. Signalling Output "M" lead		
a	Type	Voltage free contacts normally open
b	Current handling	0,5 ampere
7. Fusing		
a	Input power supply fuse	20 mm Glass fuse 1 ampere
b	Output power supply fuse	20 mm Glass fuse 500 mA
8. Auxiliary Port		
a	Input Port Switching	Isolated 10 to 60 volts Bi-directional
b	Output power fail alarm	Voltage free contacts normally open
9. External Connector Types		
a	Remote Port Switching	Socket 15 pin D-Range Hi-Density
b	Four Wire E + M	Socket 9 pin D-Range
c	DC Input power	2 Pin Molex Socket
10. Programming Port / Engineering Handset		
a	Type	RJ12 Telephone socket. Note: Engineering handset socket could be used.
b	Location	Front panel

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11.DB9 Connector Pin outs	
Pin No.	Description
1	RX Line VF (Audio input A Leg)
2	TX Line VF (Audio output A Leg)
3	Ground
4	"E" Lead (Return leg)
5	"M" Lead Out (Common)
6	RX Line VF (Audio input B Leg)
7	TX Line VF (Audio output B Leg)
8	"E" Lead + (Active Leg)
9	"M" Lead Out (Normally Open)

12.Auxilliary Port	
1	Port 1 Switching (Active Leg)
2	Port 1 Switching (Return Leg)
3	Port 2 Switching (Active Leg)
4	Port 2 Switching (Return Leg)
5	Port 3 Switching (Active Leg)
6	Port 3 Switching (Return Leg)
7	Port 4 Switching (Active Leg)
8	Port 4 Switching (Return Leg)
9	Power Fail Alarm (Normally Open)
10	Power Fail Alarm (Common)
11	Unit Ground
12	Unit + Vcc

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