

CONTRACT DATA

A contract between
SENTECH, Sender Technology Park, Radiokop, Octave Road, Honeydew,
and

**SUPPLY AND SUPPORT OF TV BROADCASTING TRANSMITTERS AND OFR'S COVERING
DVB-T2, T2 LITE, DAB+ AND T-DMB [1W TO 20KW AS APPLICABLE PER CATEGORY] TO
SENTECH SOC LTD FOR A PERIOD OF THREE (3) YEARS.**

Bid Number: SENT-031-2023-24

Contents

Part C1: Agreements and contract data

Form of Offer and Acceptance

Contract Data provided by the Sentech

Contract Data provided by the Supplier

Part C2: Pricing Data

Part C3: Scope of Work

Conditions of Contract (available separately)

PART C1: AGREEMENTS AND CONTRACT DATA –

Form of Offer and Acceptance Offer

Sentech, identified in the acceptance signature block, has solicited offers to enter into a contract for the supply and support of Broadcasting Transmitters and Transposers covering DVB-T2, T2 lite, DAB+ and T-DMB [1W to 20kW as applicable per category] on a 3-year supply contract as and when required.

The Bidder, identified in the offer signature block, has examined the documents listed in the Tender Data and addenda thereto as listed in the Bid schedules, and by submitting this offer has accepted the conditions of the Bid.

By the representative of the Bidder, deemed to be duly authorized, signing this part of this form of offer and acceptance, the Bidder offers to perform all of the obligations and liabilities of the Bidder under the Contract including compliance with all its terms and conditions according to their true intent and meaning for an amount to be determined in accordance with the conditions of contract identified in the Contract Data.

THE OFFERED TOTAL OF THE PRICES INCLUSIVE OF APPLICABLE TAXES; (in the Bids applicable currency).

_____ (amount in words);

_____ (amount in figures)

NB: The Bid shall be evaluated on the unit price for 1 to 5 units per category in the pricing table (Table 1) in ZAR based on the spot ROE on date of evaluation.

This offer may be accepted by Sentech by signing the acceptance part of this form of offer and acceptance and returning one copy of this document to the Bidder before the end of the period of validity stated in the Tender Data, whereupon the Bidder becomes the party named as the Bidder in the conditions of contract identified in the Contract Data.

Bidder's Signature(s) _____

Signed by the Bidder at _____ **on this the** _____ **day of** _____ **20** _____

Name(s) _____

Capacity _____

Address (Domicillium)

Acceptance

By signing this part of this form of offer and acceptance, Sentech accepts the Bidder's offer. In consideration thereof, Sentech shall pay the Bidder the amount due in accordance with the conditions of contract identified in the Contract Data. Acceptance of the Bidder's offer by the signature by Sentech shall form an agreement between Sentech and the Bidder upon the terms and conditions contained in this agreement and in the contract that is the subject of this agreement.

The terms of the contract, are contained in:

Part C1 Agreements and contract data, (which includes this agreement)

Part C2 Pricing data

Part C3 Scope of work.

and drawings and documents or parts thereof, which may be incorporated by reference into Parts C1 to C3 above.

Deviations from and amendments to the documents listed in the Tender Data and any addenda thereto as listed in the Bid schedules as well as any changes to the terms of the offer agreed by the Bidder and the employer during this process of offer and acceptance, are contained in the schedule of deviations attached to and forming part of this agreement. No amendments to or deviations from the said documents are valid unless contained in this schedule of deviations.

Failure to fulfil any of these obligations in accordance with those terms shall constitute a repudiation of this agreement.

Sentech's Signature(s) _____

Signed by Sentech at _____ **on this the** _____ **day of** _____ **20** _____

Name(s) _____

Designation _____

SENTECH SOC LIMITED,
Sender Technology Park
Octave Road, Radiokop
Honeydew
Johannesburg

Date _____

Upon acceptance by Sentech of the Bidder's offer, a contract will come into existence.

SCHEDULE OF DEVIATIONS

Notes:

- 1 The extent of deviations from the Bid documents issued by the Sentech before the Bid closing date is limited to those permitted in terms of the conditions of Bid.
- 2 A Bidder's covering letter shall not be included in the final contract document. Should any matter in such letter, which constitutes a deviation as aforesaid, become the subject of agreements reached during the process of offer and acceptance, the outcome of such agreement shall be recorded here.
- 3 Any other matter arises from the process of offer and acceptance either as a confirmation, clarification or change to the Bid documents and which it is agreed by the Parties becomes an obligation of the contract shall also be recorded here.
- 4 Any change or addition to the Bid documents arising from the above agreements and recorded here shall also be incorporated into the Contract.

1. **Subject** _____

Details _____

2. **Subject** _____

Details _____

3. **Subject** _____

Details _____

4. **Subject** _____

Details _____

By the duly authorised representatives signing this schedule of deviations, Sentech and the Bidder agree to and accept the foregoing schedule of deviations as the only deviations from and amendments to the documents listed in the Tender Data and addenda thereto as listed in the Bid schedules, as well as any confirmation, clarification or changes to the terms of the offer agreed by the Bidder and Sentech during this process of offer and acceptance.

It is expressly agreed that no other matter whether in writing, oral communication or implied during the period between the issue of the Bid documents and the receipt by the Bidder of a completed signed copy of this Agreement shall have any meaning or effect in the contract between the parties arising from this agreement.

Contract Data

Part one - Data provided by Sentech given in all contracts

1. The *Purchaser* is

SENTECH SOC LIMITED,

Sender Technology Park

Octave Road

Radiokop

Honeydew

Johannesburg

2. General

The National Treasury General Conditions of Contract for goods and services (NT GCC, 2010) or General Conditions of Contract for Works (2015) as issued by National Treasury and the Construction Industry Development Board of the Republic of South Africa apply, respectively.

The goods are specified in the Scope of Work. The Special Conditions of Contract (SCC) are stipulated in the Tender Data.

3. Goods information:

The *Goods Information* is in the document called "Scope of Work" and in the documents and drawings referred to by it.

4. Terms of Delivery

The *Terms of Delivery* are contained in the General Conditions of Contract (GCC) and Special Conditions of Contract.

5. Language

The *language* of this contract is English.

6. Governing Laws and Jurisdiction

The Contract shall be governed by and interpreted according to the laws of the Republic of South Africa.

In the event of a conflict between or inconsistency in the laws applicable in the various provinces of the Republic of South Africa, the law as applied and interpreted in the Gauteng Province shall prevail.

The parties irrevocably submit to the exclusive jurisdiction of the South Gauteng High Court, Johannesburg in respect of any action or proceeding arising from this Bid.

This Bid and all contracts emanating there from will be subject to the General Conditions of Contract issued in accordance with Treasury Regulation 16A published in terms of the Public Finance Management Act, 1999 (Act 1 of 1999). The Special Conditions of Contract are supplementary to that of the General Conditions of Contract. Where, however, the SCC are in conflict with the GCC, the SCC shall prevail.

7. Sub-contracting post award

A Bidder awarded a Bid may only enter into a subcontracting arrangement with the approval of Sentech. The successful bidder may not subcontract more than 25% of the value of the contract to any other enterprise that does not have an equal or higher B-BBEE status level of contributor than the Bidder concerned, unless the contract is subcontracted to an EME that has the capability and ability to execute the subcontract.

8. Transformation Plan

A transformation plan is a record of activities an entity intends to undertake to improve its BBBEE Level through Ownership, Management and Control; Skills Development; Enterprise and Supplier Development and Socio-Economic Development.

Sentech reserves the right to request a BBBEE transformation plan with clearly defined timelines and milestones if the recommended bidder does not meet Sentech's transformation goals. These milestones

must be achieved over the term of the contract. This transformation plan shall be submitted within 10 working days from the written request, failing which Sentech reserves the right to withdraw its appointment of the preferred recommended Bidder.

9. Warranty

The warranty period is 12 months after Delivery.

10. Payment

The method and conditions of payment are contained in the Tender Data, GCC and SCC.

The interest on late payment is 0 % per complete week of delay.

11. Currency

South African registered businesses that purchase equipment overseas and quote in foreign currency will be required to provide Sentech a 6-month forward cover contract on appointment. The 6 months forward cover will be re-negotiated and renewed every 6 months should the contract term on this tender be longer than 6 months.

12. General - Prices

Unless approval has been obtained from Sentech, no adjustment in contract prices will be made.

Applications for price adjustment must be accompanied by documentary evidence in support of any adjustment.

13. Price Negotiations

Sentech reserves the right to negotiate market related prices. If market-related prices are not agreed to, Sentech reserves the right to cancel the Bid.

14. Liabilities indemnities and insurance

Insurance is required from the Bidder in respect of delivery and transportation where applicable.

15. Disputes

Should any dispute, disagreement or claim arise between the parties ("the dispute") concerning this Agreement, the parties shall try to resolve the dispute by negotiation. This entails one party inviting the other party to meet and attempt to resolve the dispute within fourteen (14) days from the date of the written invitation.

If the dispute has not been resolved by such negotiation as referred to in this clause above, the Parties shall submit the dispute to the Arbitration Foundation of Southern Africa ("AFSA") for administered mediation, upon the terms set out by the AFSA secretariat.

Failing such resolution, the dispute shall be resolved by arbitration in accordance with the rules and procedures of AFSA by an arbitrator appointed by AFSA. Where the arbitration route is followed, the dispute must be adjudicated within Johannesburg in the English language and finally resolved in accordance with the rules of AFSA, by an arbitrator or arbitrators appointed by that Foundation.

The provisions of this clause shall not preclude any party from obtaining relief from a Court of competent jurisdiction. To this extent, the Parties hereby consent to the jurisdiction of the South Gauteng High Court, Johannesburg, South Africa. The provisions of this clause shall continue to be binding on the Parties, notwithstanding any termination or cancellation of this Agreement.

16. Termination

Sentech shall have the right, at its sole and exclusive discretion, upon written notice to the Bidder, to terminate this Agreement, in whole or in part should the Bidder fail to perform any of its obligations or deliver any deliverable timeously or should Sentech not be satisfied with the quality of any service/s in terms of this Agreement, to the satisfaction of Sentech.

Sentech shall furthermore have the right, as a result of such termination, to appoint a third party to perform the obligations of the Bidder in terms of the Agreement and the Bidder indemnifies Sentech against all costs incurred by Sentech in appointing such third party to fulfil the obligations of the Bidder.

Sentech shall have the right, at its sole and exclusive discretion, to terminate this Agreement, at any time, upon 30 (thirty) days' written notice to the Bidder.

17. Contract Term

This contract will run for a period of **36** months.

18. Supplier Due Diligence

Sentech reserves the right to conduct supplier due diligence at any time pre, during and post the contract period. This may include announced or unannounced site visits.

19. Cession

Sentech shall be entitled to cede, delegate, assign, charge, transfer or otherwise dispose of this Agreement or any rights or obligations therein in whole or in part, upon prior written notice to the Bidder.

20. Monitoring and Evaluation

The service delivery and performance of the Bidder will be monitored and evaluated by Sentech at all relevant times. In the event that the Bidder defaults in any manner or form, Sentech reserves the right to blacklist the Bidder on the National Treasury Database of Prohibited Suppliers and Tender Defaulters, and to take such further steps as may be warranted in the circumstances which steps shall be determined at Sentech's sole and exclusive discretion.

21. Protection of Personal Information Act No. 4 of 2013 ("POPI")

Sentech is POPI compliant and the Bidder will ensure that it conducts itself within the prescripts of the prescribed legislation.

Should Sentech need to collect Personal Information by law or in consideration of the Tender, and the Bidder fail to provide the Personal Information when requested, Sentech may refuse to accept the relevant services from the Bidder, and the Bidder will be notified in this event.

By agreeing to the terms of this Agreement, the Bidder voluntarily authorizes Sentech to process its' personal information (including its' name, credit card & banking details, physical address, telephone numbers, reference letters & any other information it has provided to Sentech) for purposes of Tendering and contracting.

The Bidder consents to the transfer of such personal information to third parties.

This consent is effective immediately and will endure until the relationship between the Bidder and Sentech has been terminated.

The Bidder indemnifies and holds Sentech harmless against any loss, whether direct or indirect, arising out of the failure to process any of its' personal data in accordance with applicable laws.

22. Delay damages

As stipulated in the Special Conditions of Contract.

Sentech's Representative is

Name: Mr. Zunaid Adams

Address: **SENTECH SOC LIMITED,**

Sender Technology Park
Octave Road,
Radiokop, Honeydew
Johannesburg

Tel No. 0114714400

Sentech's Representative is the Executive: Legal and Regulatory.

Contract Data

Part two - Data provided by the Bidder

Statements given in all contracts

The Bidder is:

Name _____ Address _____

a company / close corporation / partnership duly incorporated in accordance with the laws of the Republic of South Africa.

PART C2: PRICING DATA

Price List

Select and indicate factory/design power levels closest to indicated levels shown in tables!

Table 1A: Equipment prices and delivery times

Table 1A: DVB-T2 and T2Lite TRANSMITTERS and OFR's					
Description	1-5 Units	6 to 10 Units	11-20 units	Delivery Time ARO	Delivery Rate (Units/Month)
2Wrms					
UHF Transmitter					
UHF OFR					
10Wrms					
UHF Transmitter					
UHF OFR					
25Wrms					
UHF Transmitter					
UHF OFR					
50Wrms					
UHF Transmitter					
UHF OFR					
100Wrms					
UHF Transmitter					
UHF OFR					
250Wrms					
UHF Transmitter					
UHF OFR					
500Wrms					
UHF Transmitter					
1kWrms (dual exciter)					
UHF Transmitter					
2kWrms (dual exciter)					
UHF Transmitter					
3kWrms (dual exciter)					
UHF Transmitter					
5kWrms (dual exciter)					
UHF Transmitter					
10kWrms (dual exciter)					
UHF Transmitter					
20kWrms (dual exciter)					
UHF Transmitter					

Table 1B: Equipment prices and delivery times

Table 1B: DAB+ and T-DMB TRANSMITTERS and TRANSPOSERS [MFN and SFN]					
Description	1-5 Units	6 to 10 Units	11-20 units	Delivery Time ARO	Delivery Rate (Units/Month)
2Wrms					
VHF Transmitter					
VHF Transposer					
VHF OFR					
10Wrms					
VHF Transmitter					
VHF Transposer					
VHF OFR					
25Wrms					
VHF Transmitter					
VHF Transposer					
VHF OFR					
50Wrms					
VHF Transmitter					
VHF Transposer					
VHF OFR					
100Wrms					
VHF Transmitter					
VHF Transposer					
VHF OFR					
250Wrms					
VHF Transmitter					
VHF Transposer					
VHF OFR					
500Wrms					
VHF Transmitter					
1kWrms (single exciter)					
VHF Transmitter					
1kWrms (dual exciter)					
VHF Transmitter					
2kWrms (dual exciter)					
VHF Transmitter					
3kWrms (dual exciter)					
VHF Transmitter					
5kWrms (dual exciter)					
VHF Transmitter					
10kWrms (dual exciter)					
VHF Transmitter					
20kWrms (dual exciter)					
VHF Transmitter					

Tenderers will provide a single basic unit price (DDP, Senttech Stores) fixed for the contract duration, for a unit compliant with paragraph 17 of the Tender Data Document, for each column, but will be evaluated on the unit price for 1 to 5 units. Options that do not form part of the standard product offering e.g., spare modules, SLA (during and after warranty), N+1, etc. to be quoted separately and will not form part of the price adjudication.

Options and Option keys are to be quoted separately and individually. This information will not form part of the price evaluation but will be considered during the unit evaluation.

Table 3: Spare units & spare parts

Table 3: Spare units (Provide prices of units indicated below, specify any other unit/s deemed necessary as spare parts/components, copy/duplicate this page if more space should be required)			
Description	New unit Price	Refurbished unit Price	Delivery Time ARO Comments
Transmitter Controller (For all different units)			
	New unit	Refurbished	
Exciter (If exciter consists of slotted cards, list cards)			
	New unit	Refurbished	
Combiner (All transmitter powers, where applicable)			
	New unit	Refurbished	
Amplifier (For all different units)			
	New unit	Refurbished	
Exciter switcher (For all different units)			
	New unit	Refurbished	
Liquid pumps (For all different units)			
	New unit	Refurbished	
Heat exchanger fans (For all different units)			
	New unit	Refurbished	
Amplifier power supply (For all different units)			
	New unit	Refurbished	
Amplifier internal combiner (For all different units)			
	New unit	Refurbished	
Other (Specify)			
	New unit	Refurbished	

Table 4: TCO Model

Table 4: TCO Model: DVB-T2 and T2Lite TRANSMITTERS and OFR's [MFN and SFN]					
Description	Unit price	TCO per unit per annum Service & Maintenance	TCO per unit per annum Operational Costs	TCO per unit per annum Power consumption	Total cost
50Wrms					
OFR					
100Wrms					
OFR					
1kWrms					
UHF Transmitter					
5kWrms					
UHF Transmitter					

Signature of tenderer: _____

PART C3: SCOPE OF WORK

SENTECH'S GOODS INFORMATION

The requirement for the Supply and Support of TV Broadcasting Transmitters and OFR's covering DVB-T2, T2 lite, DAB+, 5G Broadcast and T-DMB [1W to 20kW as applicable per category] on a 3-year supply contract as and when required, which arises from the need to provide terrestrial Digital TV broadcast Services to Sentech customers as and when required.

Mandatory criteria are to be found in paragraph 18.1 of the Tender Data Document and must be adhered to proceed to the next stage.

Bidders will be awarded points for the Functional Criteria of the equipment they are offering per paragraph 18.2 of the Tender Data Document.

All Bidders with a score of at least 100 points out of a possible 125 points will be short listed to go through to the next stage being Price and Preference, subject to a risk assessment which may include, but is not limited to, practical evaluation.

Glossary of Terms

Abbreviations	Descriptions
OFR	On Frequency Repeater
VHF	Very High Frequency
MIB	Management Information Base
UHF	Ultra-High Frequency
SNMP	Simple Network Management Protocol

Document B

Technical specification TECHNICAL REQUIREMENTS

1. INTRODUCTION

The transmission systems detailed in this Tender enquiry will be used to implement DVB-T2, T2 Lite, DAB+, 5G Broadcast and T-DMB terrestrial transmission systems in South Africa (VHF and UHF bands).

Guaranteed delivery times of the transmitters will be of great importance to Sentech's planning and will thus be an important aspect of tender adjudication.

These transmitters will be installed in existing television/FM transmitting stations and will operate into a broadband transmitting antenna already in use, via channel combining equipment as and if required.

The transmitters will be operated on a completely unattended basis and the essential requirement is thus for equipment of high reliability, stability, adjustment and full web interface remote control functionality. Maintenance visits will be kept to a minimum and the transmitter will be expected to remain within its specified performance tolerance for periods of six months at least.

The transmitters to be supplied in response to this tender enquiry must be of modern design, making maximum use of solid-state devices. The equipment offered shall be fully compliant with the relevant ETSI standards and any recognised additions or extensions thereto.

Emphasis will be placed on the expected operational lives of the solid-state devices and all components used in the transmitter, especially considering the combination of high ambient temperatures and altitude at the transmitting sites.

Sentech's engineering staff will carry out the installation and commissioning of transmitters covered by this tender enquiry and the tender price is to be based solely on the supply of the equipment as specified.

Tenderers are to provide clear and unambiguous answers to each, and every clause contained in this Tender Specification. In the event of non-compliance with a particular clause, the Tenderer shall indicate the extent of deviation from the stated specification.

2. SCOPE OF WORK

The extent of work covered by this tender includes the design, manufacture, factory testing, packaging, and delivery to Sentech's freight forwarder.

Tenderers should have their own designed exciters operating in the transmitter, exciters sourced from a third party, expose Sentech to unnecessary risk should the third-party manufacturer close.

3. GENERAL TECHNICAL REQUIREMENTS

3.1. Transmitter configurations

For transmitters with output power below 500W, a single exciter will be utilised. For transmitters of 500W and above, dual exciters will be utilised. The dual exciters will operate in passive reserve with paralleled banks of solid-state power amplifiers in active

reserve operation. These configurations might change depending on customer requirements.

Preference will be given to configurations using separate power supplies for each amplifier module or combinations of amplifier modules. Amplifier power supplies should be modules that are easily replaceable in case of failure.

Baseband Inputs: Automatic seamless switching functionality must be included.

Liquid cooling technology shall be used to cool high power transmitters. For low power, air cooling will be used. If, however, different “new” cooling technology becomes available, it will be considered during the tender evaluation period.

In all cases, the installation space in the transmitter rooms is limited so that minimum floor occupation and sensible layout of the transmitters will be of great importance.

Entry points for mains power cables and cooling pipes may be cabinet top or bottom, depending on site design. Conversion from top to bottom entry and vice versa should be simple without adding additional components.

Preference will be given to systems where all modules are fully controlled by the transmitter controller. Full remote control via a web browser and SNMP functionality is essential.

Standardization of equipment is of high importance to Sentech - it is therefore important for equipment to utilize the same modules where possible, and the use of software configurations and/or license keys to convert from e.g., T2 to T2 Lite. Conversion should be simple by means of module changes and software configurations to excisers. For transposers, only software reconfigurations should be done to convert between different standards.

3.2. Power Amplifier Design

RF amplifiers should be wideband in the VHF band and in the UHF band. They should also be easily interchangeable between transmitters running on different frequencies.

- 3.2.1. When amplifiers are designed to run in Doherty mode, indicate the different groups/bands it is working in the UHF band, also state if Doherty can be “bypassed”. Provide a detailed description of how to change between the different groups/bands in the manual or separate bulletin.
- 3.2.2. Automatic or manual phase and gain adjustment procedures should be clearly described in a step-by-step format.
- 3.2.3. RF FET replacement procedures should be described in detail, including bias current adjustments.

The following detail should be described:

- Number of amplifiers in each configuration
- Nominal output power per amplifier
- Number of pallets per amplifier and typical current drawn from each power device

With respect to 3.2.1, 3.2.2 and 3.2.3, it is possible and well understood that special software/programs might be a requirement to do adjustments in circuitry as mentioned. To maintain equipment in this environment, it is of utmost importance that any software/program be included in the transmitter price and not been offered as an option

or withheld from this offer. In some instances, specialised tools might be required to perform the work, these tools should be offered as an option in the bid.

Any software/program needed in the above, should be compatible with all Windows based operating systems and should not need extensive set-up procedures to install or to operate. Preference will be given to typical web browser type of interfaces.

3.3. Band Pass Filter

All equipment offered in response to this Tender specification shall be equipped with the necessary band pass filter, if deemed necessary by the manufacturer. Such filter shall be specified as a separately priced option. Tenderers shall provide out-of-band radiation spectral masks, with and without the output filter in circuit.

3.4. Superfluous Equipment

Tenderers are to note that any equipment, which is normally part of a particular transmitter format, and which is **not** required for the operation of the system as specified in this tender, must be removed before delivery. This is to ensure that the failure of such superfluous equipment does not cause an unnecessary transmitter failure. These changes are to be specifically indicated in the handbooks.

3.5. Monitoring Points

3.5.1. Each transmitter shall be equipped with output monitoring points as follows: -

- On each of the final power amplifiers,
- After the amplifier output combiner,
- After the band pass output filter

3.5.2. The output monitor points must be calibrated and shall be fed from directional couplers with a directivity of at least 30dB.

3.5.3. The source impedance of such monitoring points shall be 50 ohms unbalanced and the output levels as high as appropriately possible, but not exceeding ten (10) milliwatts (0.707 Volts).

3.6. Frequencies used in South Africa

The VHF and UHF channels and frequencies used for terrestrial television broadcasting in South Africa are as listed in paragraph 4.4.4, Table 1 & 2.

In the case of the UHF band, four 8 MHz channels have been assigned to each station and their grouping and frequency separation is as follows: -

	N,	N + 4,	N + 8,	N + 12
E.g.	21,	25,	29,	33
	32,	36,	40,	44

In the case of the VHF band, three 8 MHz channels have been assigned to each station and there are three possible channel groupings:

	N,	N+3,	N+6
E.g.	4,	7,	10

At any transmitter station VHF/UHF frequencies, grouped as above, will be utilised for analogue broadcasting. Digital broadcasting may use any channel, including adjacent channels (see also section 4.4).

3.7. Standards (Information available at: <http://www.etsi.org>)

The equipment offered in response to this tender specification shall comply with the current version [as at time of tender] of the following ETSI standards/guidelines: -

3.7.1. DVB

- a) ETSI EN 302 755
Framing structure, channel coding and modulation for a second-generation digital terrestrial television broadcasting system [DVB-T2]
- b) ETSI TS 102 773
Modulator interface [T2-MI] for a second-generation digital terrestrial television broadcasting system [DVB-T2]
- c) ETSI TR 101 290
Measurement Guidelines for DVB Systems
- d) DVB Doc A133
Implementation Guidelines for a second-generation digital terrestrial television broadcasting system [DVB-T2]

3.7.2. DAB+ & T-DMB

ETSI EN 300 401 V2.1.1 (2017-01)

3.7.3. 5G Broadcast

ETSI TS 103 720 - 5G Broadcast System for linear TV and radio services; LTE-based 5G terrestrial broadcast system.

3.8. Microprocessor Control Systems

Tenderers are required to provide detailed information on the operation of microprocessor control systems used in the transmitter offered. A specific response is required on:

- 3.8.1. Will the Transmitter remain on air should the controller fail?
- 3.8.2. The extent to which bypassing of the control system is possible if it should fail.
- 3.8.3. What counter measures are taken in the system design to ensure that the control systems will not “lock up” due to power supply disturbances?
- 3.8.4. What methods are used during factory testing to simulate power disturbances to the transmitter?

3.9. On-Frequency Repetition for SFN

Tenderers are requested to describe their product offer/s in terms of on-frequency repetition for the establishment of SFN (Single Frequency Networks). Aspects requiring emphasis: Echo cancellation performance and maximum possible output power versus TX/RX antenna isolation.

4. TRANSMITTER RADIO FREQUENCY (RF) PERFORMANCE FOR DTT SYSTEMS

4.1. Type of Modulation

COFDM, according to ETSI EN 302 755

4.2. Radio Frequency Output Power and Voltages

The transmitter output power shall be measured into a dummy load connected to the transmitter output connector. The voltage reflection coefficient of the load shall not exceed 3% over the entire 8 MHz channel.

All probes and channel band pass/rejection filters shall be in circuit for this measurement. The transmitter shall have reached its normal operating temperature.

4.2.1. The signal power of a terrestrial DTT signal, or wanted power, is defined as the mean power of the signal as would be measured by way of a thermal power sensor.

The mean RF power output **after** filtering shall be rated power.

4.2.2. Preference will be given to output amplifier configurations designed for high redundancy. Tenderers are to indicate, in table form, the loss in output power with loss of one or more power amplifier modules and power supplies.

4.2.3. Faulty amplifiers and power supplies should be easily identifiable and preferably be exchangeable without interrupting transmitter operation.

4.3. RF Circuit Impedance

All inputs, outputs and inter-circuit connections must have an impedance of 50 ohm, unbalanced.

All co-axial components such as reflectometers, and probe bodies, shall have a voltage reflection coefficient not exceeding 3% throughout the specified channel.

4.4. Frequency Stability and Adjustment

4.4.1. Stability

The transmitter shall maintain a frequency stability of 10^{-7} over a six (6) month period, without an external frequency reference.

4.4.2. External Reference Input

The transmitter shall provide inputs for external 10 MHz reference and a 1 pulse per second [1pps] inputs.

4.4.3. Frequency Adjustment

Only systems using proprietary synthesisers with the possibility of selecting any channel and offset in band IV and V, without replacements of components will be considered.

Tenderers must give a detailed step by step description when the transmit channel needs to be changed

4.4.4. Frequency Bands and Channels as used in South Africa.

Table 1

VHF channels and frequencies

Ch	Freq. (MHz)	Ch	Freq. (MHz)	Ch	Freq. (MHz)
4	174 - 182	7	198 - 206	10	222 - 230
5	182 - 190	8	206 - 214	11	230 - 238
6	190 - 198	9	214 - 222	13	246 - 254

Note: DAB+ using VHF frequencies up to channel 13F (239,200MHz)

Table 2

UHF channels and frequencies used for DVB T2 & T2 Lite

Ch	Freq. (MHz)	Ch	Freq. (MHz)	Ch	Freq. (MHz)
21	470 - 478	33	566 - 574	45	662 - 670
22	478 - 486	34	574 - 582	46	670 - 678
23	486 - 494	35	582 - 590	47	678 - 686
24	494 - 502	36	590 - 598	48	686 - 694
25	502 - 510	37	598 - 606	49	694 - 702
26	510 - 518	38	606 - 614	50	
27	518 - 526	39	614 - 622	51	
28	526 - 534	40	622 - 630	52	
29	534 - 542	41	630 - 638	53	
30	542 - 550	42	638 - 646	54	
31	550 - 558	43	646 - 654	55	
32	558 - 566	44	654 - 662	56	

5. SYSTEM PERFORMANCE

5.1. General Requirements

In this sub-section, Sentech will detail the measurements as required for a DVB T2 system. The measurement parameters have been extracted from "Measurement Guidelines for DVB Systems", ETSI TR 101 290. Exciter T2-MI input shall be Asynchronous Serial Interface (ASI) and GBE.

For Sentech's consideration of the offered transmitter, the Tenderer shall include the following information in his Tender reply: -

- 5.1.1. Acceptance test procedure.
- 5.1.2. Details on the number of physical layer pipes [PLP] that can be accommodated in SFN shall be provided by the Tenderer.
- 5.1.3. A sample of a typical factory acceptance test report, which would be prepared for each DVB-T2 transmitter or SFN Gap filler/Transposer.
- 5.1.4. The transmitter shall operate alongside three (3) co-sited PAL I/Nicam services. Tenderers are to describe the performance of their offered transmitter with respect to the spectral masks shown in ETSI EN 302 755 for different combinations of FFT/normal/extended carrier mode.

- 5.1.5. With reference to the linearity characterisation measurement, the transmitter offered shall achieve an in-band intermodulation specification of better than -42dB. A spectrum analyser plot of the measured result must be furnished to indicate compliance. Tenderers shall additionally measure the intermodulation performance at 1dB, 2dB and 3dB below nominal power of the transmitter.

5.2. DVB-T2 System Measurements

The Tenderer shall complete the following measurements on each of his offered equipment classes and provide the results:

- 5.2.1. RF frequency accuracy (precision).
- 5.2.2. Phase noise of local oscillators.
- 5.2.3. RF output power.
- 5.2.4. RF spectrum.
- 5.2.5. Linearity characterisation (shoulder attenuation).
- 5.2.6. I/Q analysis, including: -
 - Modulation Error Ratio (MER).
 - Carrier Suppression of Centre Carrier (CS).
 - Average Amplitude Imbalance (AI).
 - Average Quadrature Error (QE).
 - Maximum Quadrature Error per carrier.
 - Constellation diagram.
- 5.2.7. Overall signal delay.
- 5.2.8. Crest Factor (at full rated power output).

6. SPURIOUS EMISSIONS

The transmitter shall comply with the following spurious level measurements, done at nominal power output. The method of measurement used by the Tenderer should be clearly stated.

Spurious level in band $f_c \pm 3.8$ MHz
Specification: -70dBc

Spurious level at $f_c \pm 3.8$ MHz to ± 12 MHz
Specification: -60dBc

Spurious level at $f > f_c \pm 12$ MHz
Specification: -60dBc

Harmonic Levels

Second and third-order harmonic products shall be -70dBc. This is to be measured in a 1 MHz bandwidth at nominal power.

7. SECURITY AND PROTECTION

7.1. Safety of Personnel

- 7.1.1. The transmitters supplied in terms of this specification must comply with the following safety requirements: -

IEC **60215**: 2016 "Safety Requirements for Radio Transmitting Equipment".

7.1.2. A mains power isolator shall be provided in the cabinet, at the power-input point. Only a single mains power connection into each cabinet is allowed. (Safety regulation in SA)

7.1.3. All terminals and/or wiring, carrying dangerous voltages, shall be adequately shrouded/insulated to prevent bodily contact by personnel.

7.2. DC and AC Over-Current and Over-Voltage Protection

All stages of each transmitter, as well as its associated equipment, such as cooling equipment must be adequately protected against overload and fault conditions. Circuit breakers must be used instead of fuses wherever possible. Fuses must however be fitted on the DC supply lines to the amplifier devices.

7.3. Reflected Power Protection

Transmitters must be equipped with effective protection against abnormal VSWR conditions. The facilities shall be as follows: -

7.3.1. Directional couplers shall be used to measure the reflected power and shall have a directivity of at least 30dB and a coupling factor sufficient to provide a signal of sufficiently high level to prevent unstable and/or spurious operation of the associated electronic tripping circuits by stray RF or other electrical pick-up.

The output signal from the directional coupler shall be at radio frequency and shall be brought out from the coupler via a standard co-axial socket, e.g. "BNC", "N", etc. This requirement is to facilitate adjustment of the directivity of the coupler by the connection of measuring equipment.

7.3.2. Adjustment of the Reflected Power Tripping Circuits. The VSWR protection/tripping circuits shall be so designed that they can be set to operate at any VSWR with a minimum of 1,33:1.

The adjustment of these circuits shall not be dependent on the physical adjustment of the coupling factor of the directional couplers, but rather by electronic means, thereby ensuring that the couplers themselves remain optimised for directivity.

- 7.3.3. A recycling type of Reflected Power protection system allowing three output power restorations before finally locking out shall be provided. Each reflected power tripping circuit shall be provided with a manual “reset” push button mounted on the transmitter front panel. The transmitter shall also provide the necessary indication facilities as described in Section 11.

7.4. Protection of Solid-State Devices

All solid-state devices used in the transmitter must be protected as follows:

- 7.4.1. Against damage due to overheating when operated at the power level appropriate to the rated output of the whole transmitter, within the environmental conditions specified in this document.
- 7.4.2. Against the effects of voltage transients because of lightning or network switching, on the incoming supply.
- 7.4.3. Against the effects of incoming voltage transients, as in 12.3, but coupled inductively to other circuits within the transmitter, i.e., via cable-to-cable inductive coupling.
- 7.4.4. Against the effects of lightning transients coupled into the transmitter via its input and/or output connections.
- 7.4.5. Against all steady state and signal over-currents and over-voltage protection including fuses.
- 7.4.6. Against damage due to the failure of any other stage or individual solid-state device of a stage.

Note: Tenderers must submit their circuit design solutions/descriptions in respect of items 7.4.1 to 7.4.6 respectively when tendering.

7.5. Electrical Transient Protection

Sentech attaches the utmost importance to transient protection strategy, which must be thoroughly integrated with the complete transmitter. Tenderers are required to comment on the electrical transient protection measures in their equipment.

7.6. Protection against Loss of Mains Power Phase(s)

The transmitter must be fully protected from damage and/or incorrect operation due to the loss of one or more phases, asymmetry, and voltage variation of the incoming three-phase mains power supply.

7.7. Harmonic distortion

Measurements in terms of mains harmonics generated within the transmitter power supply circuits shall be measured and the results revealed. The total harmonics shall not exceed 6%.

7.8. Precautions against Fire

All wiring insulation and all other electrical and mechanical insulating materials must be flame retardant. The spirit of this clause is that, in the event of a fire breaking out in the transmitter, the fire should not spread to other components of the transmitter or to the building housing the equipment.

7.9. External Connection(s) to the Interlocking System

Terminals must be provided in the transmitter to allow for the series connection of external contacts in the interlocking system. Opening of these contacts must cause complete transmitter shutdown.

8. EQUIPMENT SIZE, APPEARANCE, AND LAYOUT

8.1. Size

The transmitters will generally be installed in existing buildings. Small physical size is thus of great importance.

To qualify for adjudication, tenders must include detailed, dimensioned drawings and photographs showing the mechanical arrangements of the equipment offered. Details of ventilation-/liquid cooling arrangements, RF and electrical monitoring points must be shown.

All dimensions are to be given in metric form. The weight of the equipment must also be stated.

8.2. Appearance

Tenderers are required to describe the colour scheme used for their equipment.

8.3. Layout

The RF feeder connection point shall be mounted on top of the transmitter cabinet for high power transmitters. Mains power and inlet cooling access shall be at either the top or the bottom of the cabinet (customer-selectable). Equipment with interconnecting points on the front panel will not be considered.

Rear access for installation and maintenance purposes is acceptable. Side access for installation and maintenance is generally not acceptable as equipment racks will be arranged side by side, with existing operational equipment.

9. METERING

9.1. Voltage-Current

Voltage, current and RF power metering shall be provided for the tuning, operation, and maintenance of the equipment.

9.2. RF Power

Forward and reflected RF output power shall be individually metered on this transmitter. The RF power meters are to be calibrated in watts.

Reflected power meter scales shall be such that even small-reflected powers can be accurately read off the meter. State increment steps from zero.

Calibration of a RF power meter shall be done electronically and not by varying the coupling factor of the directional coupler feeding it.

9.3. Transistor Current

Separate transistor current metering will be required for each RF power transistor in every solid-state power amplifier.

10. COMPONENTS AND SPARE PARTS

10.1. Semiconductors

All semiconductor devices shall be of the silicon type, suitably protected against voltage transients. The ratings of these devices must be conservatively chosen and the performance or operation of the equipment in which they are installed must not depend on the critical selection of replacements.

Circuits shall not incorporate semi-obsolete semiconductor devices. Tenderers shall ensure that all semiconductor devices shall be commercially available for a period of at least fifteen years, after delivery of the transmitter.

10.2. Resistors and Capacitors

All resistors and capacitors must be operated well within their manufacturer's maximum ratings and temperatures and be suitable for continuous full power operation of the transmitter. State the electrolytic capacitors used in the bias circuits of the amplifier stages specification (Temp). By means of the mathematical equation, calculate, using real temperature values from a transmitter operating at nominal output power, the lifespan of the electrolytic capacitors.

10.3. Continuity in Supply of Components

The Tenderer is required to guarantee continuity of supply of spare parts for all parts and components used in the equipment for a minimum period of fifteen years after final equipment delivery. This includes all solid-state devices. In the event of any items or sub-assemblies becoming obsolete, or unobtainable, during the fifteen-year period, the manufacturer of the equipment, i.e., the successful Tenderer must accept technical and financial responsibility for both the design modifications and the supply of suitable equivalent items or sub-assemblies. Sentech reserves the right to negotiate with the short-listed manufacturers the possibility to stock a bonded store in South Africa to cut down on meantime to repair, carrying some spare modules, such as populated PC boards etc.

10.4. Connector Systems

10.4.1. The following connector systems are to be used: -

- Intermediate frequencies: 50ohm, "BNC", "SMA" or "SMB".
- RF, low power: 50ohm, "N" type.
- RF, high power: 50ohm, suitably dimensioned EIA flanged connectors.
- Asynchronous Serial Interface / T2-MI: 75-ohm BNC

10.4.2. Tenderers are to state the types of RF connectors used in the RF circuitry of their equipment, e.g., directional couplers, band pass filter, co-axial cavity input/output, etc.

10.4.3. All modules of the same type used in transmitters supplied during the contract period and all spare modules procured during this period must be mechanically and electrically compatible and directly interchangeable.

10.5. Support

After-sales support will be an important adjudication criterion. Tenderers are to clearly indicate their proposed support scheme a) during the warranty period and b) after expiry of the warranty period.

- 10.5.1. The performance of the equipment and all components provided in accordance with this tender shall be guaranteed for a period of at least two years after commissioning.
- 10.5.2. The availability of equipment and units for expanding the network shall be guaranteed for a period of at least ten years after commissioning.
- 10.5.3. The availability of replacement units, spares, materials, and technical and maintenance support services shall be guaranteed for a period of at least ten years after commissioning.
- 10.5.4. The level of skill and experience of technical and maintenance support person(s) shall be such that the cause of any problem shall be determined within a twenty-four-hour period after Sentech reporting it to the successful Tenderer.
- 10.5.5. The successful Tenderer shall bear all the costs related to provision of alternate solutions should there be any major design change or stoppage of production.
- 10.5.6. To avoid unnecessary charges, the successful Tenderer shall screen all units marked for Return Material Authorisation (RMA) in South Africa prior to returning equipment to OEM. This will highlight any “no fault found” units at a very early stage, which may have been returned due to other issues such as incorrect cabling, and to identify any damaged or inoperable units that may be attributed to poor handling, incorrect installation or general misuse. This facility will allow Sentech to inspect and discuss any such issues in a local environment which would normally only be possible at the OEM premises outside the country.
- 10.5.7. The Tenderer shall specify the turn-around time for faulty equipment repairs and adhere to same.
- 10.5.8. The Tenderer shall provide typical repair costs for equipment outside of the warranty period.
- 10.5.9. End of Sale (EOS), End of Life (EOL) and End of Support OEM announcements for individual products and software shall be communicated timeously to Sentech indicating the risks and options for replacement.

11. Monitoring and Supervisory Facilities

11.1. Monitoring Points

- 11.1.1. The equipment shall be provided with monitoring facilities which the manufacturer regards as necessary for the alignment, testing, maintenance and operation of the transmitter or sections thereof.
- 11.1.2. If any additional software is required to download data or to repair/maintain the equipment locally, it must be included with the Transmitter price at no extra cost to Sentech.

11.2. Display Facilities

11.2.1. Each transmitter shall be comprehensively equipped with all the local displays, remote viewing, and control facilities, e.g., web browser and SNMP, required for correct operation, software upgrading and supervision of all its stages and sections.

11.2.2. All fault conditions and system status lights shall be equipped with a memory or logging system so that all indications are retained after short and even long term, mains power failure.

11.2.3. At least the following indicator light facilities are to be provided, as appropriate:

- "Manual/Local" or "Remote" control.
- Reflected Power trip.
- All voltage and current overload trips.
- All over-temperature trips.
- Interlocking system not closed.

11.3. Remote Control and Remote Monitoring Facilities

Local and remote monitoring via web interface and SNMP version 2 and upgradeable to later versions should be fully described by the Tenderer. Local and Remote control of equipment via web interface is essential. RF measurements, such as MER or shoulder attenuation will be an advantage.

Only single IP connection with a single IP address to a transmitter system will be accepted.

12. STATION POWER SUPPLY

12.1. Type and Stability

The station will normally be connected to a public supply grid, with an on-site diesel alternator providing emergency standby power.

Either of these supplies will be as follows: -

Three phase, 400 volts line, 230 volts phase, 50Hz, four-wire line system.

The neutral point of the incoming mains supply transformer secondary winding will be connected to the station earth.

The mains voltage variation will not exceed +10% and -15% with respect to 400 volts.

The mains frequency variation will not exceed $\pm 2\%$ with respect to 50Hz.

At certain stations, distortion of the mains supply voltage waveform may occur due to the use of thyristor equipped systems on the power line. The transmitter must still comply with the specifications of this tender enquiry under these conditions of supply.

Tenderers shall state the Total Harmonic Distortion (THD) generated in the equipment.

12.2. Mains-borne Surges and Transients

12.2.1. Each transmitter, including its isolation transformer, fans and pumps shall be equipped with internal protection against mains-borne surges and lightning and/or switching transients, of at least 2000 volts peak. All such incoming mains supply connections to the transmitter must be protected. Tenderers are to describe their protection circuits in detail.

12.2.2. All transmitter circuit breakers, including those for the cooling pumps, must be correctly rated for the starting and working currents of the unit being fed. This rating should consider the effects of mains surges as in 12.3.1. Spurious tripping of circuit breakers due to any cause(s) is inadmissible.

12.3. Load kVA and Power Factor Rating

Tenderers are to submit, when tendering, the input current per phase and the power factor of the transmitter at nominal output power.

The inrush current and duration of inrush current must also be stated so that Sentech can select appropriate mains power circuit breakers.

12.4. Connection to transmitter equipment

Multiple mains power connections into a single equipment cabinet is illegal in South Africa. A single mains connection via an appropriate isolator switch is required, even for multi transmitter configurations in a single cabinet.

Preference will be given to energy efficient systems. Tenderers will need to clearly state efficiency of transmitter systems.

13. OPERATIONAL, ENVIRONMENT AND COOLING

13.1. Climatic Conditions

The transmitter covered by this specification must maintain the performance specified in this document, when operated continuously and at full power, in any worst natural combination of the following climatic conditions: -

13.1.1. Altitude

At any altitude up to 2800m above mean sea level. Specify if there are any degradation above 2400m.

13.1.2. Temperature

At any ambient room temperature, i.e., cooling air inlet temperature from -5°C to +45°C.

13.1.3. Relative Humidity

Between 0% to 95% non-condensing

13.2. Cooling Systems

A modern liquid cooling system shall be employed to achieve reliable long-term performance of high-power transmitters, within the specifications of this tender, when the equipment is operated in the most adverse combination(s) of the climatic conditions specified in 13.1. The entire cooling system must operate in a “fail safe” mode. The equipment must continue to operate at full power within specification and without any heat-induced short or long-term component damage under the environmental conditions in 13.1 above, even if the control system, a pump, or a heat exchanger fan should fail. Since heat exchangers will typically be installed outdoors and pump units indoors, these systems shall be physically separate from each other. For low power air cooling shall be used.

13.3. Painting

No untreated metal surfaces shall be permitted. Items not galvanised or otherwise protected, shall be painted as appropriate.

13.4. Heat Balance

Tenderers shall provide a schematic drawing, detailing the “heat balance” for their equipment at rated transmitter output, modulated with a Pseudo-Random Binary Sequence (PRBS) or program as a test signal. Such a drawing must include the following data: -

- a) The total power into the transmitter.
- b) The proportion of (a) dissipated as heat.
- c) The proportion of (b) lost in the transmitter hall.
- d) The expected temperature differential of the liquid [high power] or air [low power] between input and exhaust.

Liquid cooling systems normally have modules such as exciters and power supplies that are still air cooled. The above requirements are also needed for such systems.

All cooling plates/heat sinks shall be positioned in/on the equipment so that optimum heat transfer is obtained and so that the heat given off by the heat sink does not flow into/onto other parts or sections of the equipment.

14. HANDBOOKS AND TEST REPORTS

14.1. Language

Two complete sets of printed handbooks and one set on CD or DVD, written only in the English language, must be supplied with each transmitter supplied in respect of this tender document.

14.2. Content

The handbooks are to include a comprehensive description of all equipment and auxiliary equipment, its detailed circuitry, all circuit diagrams, a parts list as specified below and all other mechanical and electrical drawings necessary for the installation, operation, and maintenance of the transmitter. Printed circuit board layout diagrams are to be supplied.

Every handbook supplied must contain a comprehensive part list containing every part and/or component used in the equipment.

The list is to include all relevant details of the components such as: -

- The electrical value (e.g., resistance in ohms).
- The tolerance where applicable.
- The Tenderer's part number, which must be a unique number, assigned to every different component in the list.
- The part/component manufacturers type number.

The successful tenderer will be required to supply Sentech with any relevant electrical and mechanical data and drawings, as required for the final design of a station layout.

Tenderers are to Note: -

Detailed information and drawings specified above, must also be provided for all other equipment which is not manufactured by the Tenderer himself, but is part of the transmitter delivery. Unless the abovementioned handbooks have been delivered to Sentech, the transmitter delivery will be deemed to be incomplete, even though the transmitters may have been put into scheduled service.

Sentech reserves the right to examine a full set of handbooks, prior to, and during factory acceptance of the tendered equipment.

14.3. Test Reports

A completed factory test report must be provided for each transmitter delivered. The test report is to show compliance with the contracted performance of the transmitter and Sentech will accept the normal factory test report used by the Tenderer, provided that this is agreed to in advance. Sentech reserves the right for its engineers to take part in some, or all, of these tests.

The cost of all of the above-mentioned handbooks and test reports are to be included in the tender price and are to form part of the contract price.

15. DELIVERY

15.1. Delivery Schedule

The delivery sequence, operating frequencies and required ex-factory delivery dates, for the transmitters covered by this tender, will be finalised upon order placement after contract negotiations by the successful Tenderer.

Tenderers are reminded of the comments in section 1 of this document relating to the importance of guaranteed delivery.

15.2. Packaging

15.2.1. For costing purposes, packaging for sea freight should be assumed.

15.2.2. Sentech regards the protection and packaging of equipment during shipment as a matter of the utmost importance and the manufacturer will be responsible for the thorough packing of all equipment.

15.2.3. The method of packing must be such that the ingress of sea air, moisture, rain and pollutants is prevented. The packing crates must be extremely strong so that no damage due to rough handling during trans-shipment can occur. Special precautions are required to adequately fix heavy items to the bottom of the crates. Desiccants are to be packed with the equipment. Tenderers will also be held responsible for the satisfactory packing of all equipment supplied by their sub-contractors.

15.2.4. The transmitter for each station must be separately packed and crated, and the crate(s) must clearly show the station name and port of destination, as per the official order. Equipment for more than one station must not be packed in a common box, crate, or container.

15.2.5. Sentech will require discussing the transportation method with the successful Tenderer and the Sentech nominated shipping agent before consignment.

16. TRAINING

Training of personnel on new technology equipment is of utmost importance to Sentech. Training must be in the manufacturers' factory, where all course material must be provided to Sentech personnel.

It may be required of the tenderer to present training to Sentech staff on the offered equipment. Training must include the following:

- Equipment construction, design, operation, and configuration, e.g., SFN operation
- Fitment/removal of physical components in the rack
- Demonstration to change frequency of amplifiers running in Doherty mode
- Gain & phase adjustment
- FET/pallet replacement in amplifier's final stage
- Equipment installation including pre-start-up checks
- Maintenance and repair of equipment modules, where possible to component level

17. SERVICE LEVEL AGREEMENT

The successful tender shall enter into a service level agreement with SENTECH. This agreement will address the following:

- Cost of repair of faulty equipment
- Turnaround time for equipment repairs
- Critical spares availability
- OEM specialist support

End of Contract Data