

## **CONTRACT DATA**

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

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**APPOINTMENT OF A SERVICE PROVIDER TO SUPPLY AND SUPPORT OF VHF FM  
RADIO BROADCASTING TRANSMITTERS & RE-BROADCAST RECEIVERS TO  
SENTECH SOC LTD FOR A PERIOD OF THREE (3) YEARS**

**Bid Number: SENT-061-2023-24**

## **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 of VHF FM Radio Broadcasting Transmitters & Re-Broadcast Receivers.

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 Tender 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 36 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

#### Table 1: Equipment prices and delivery times

Tenderers will provide a single basic unit price (DDP, Sentech Stores) fixed for the contract duration, for a unit compliant with paragraph 18 of the Tender Data Document, for each column, but will be evaluated on the unit price for 1 to 5 units (Column B). Options that do not form part of the standard product offering e.g., built-in RDS, spare modules, SLA (during and after warranty), N+1, etc. to be quoted separately and will not form part of the price adjudication.

Table 1: FM Transmitter and Receiver

Table 1: FM Transmitters and Receivers					
Description	1-5 Units	6 to 10 Units	11-20 units	Delivery Time ARO	Delivery Rate (Units/Month)
<b>Re-Broadcast Receiver</b>					
<b>Transmitters</b>	<b>1-5 Units</b>	<b>6 to 10 Units</b>	<b>11-20 units</b>	<b>Delivery Time ARO</b>	<b>Delivery Rate (Units/Month)</b>
25W					
50W					
100W					
250W					
500W					
1kW Single Exciter					
1kW Dual Exciter					
1kW (1+1)					
2kW Single Exciter					
2kW Dual Exciter					
2kW (1+1)					
3kW Single Exciter					
3kW Dual Exciter					
3kW (1+1)					
5kW Dual Exciter					
5kW (1+1)					
10kW Dual Exciter					
10kW (1+1)					
20kW Dual Exciter					
20kW (1+1)					

Select and indicate factory/design power levels closest to levels shown in the table above.

Note: Variants of each transmitter type offered e.g., translator (TX including RX), must be clearly identified.

Table 2: Optional Pricing information to be completed (If Applicable)

Options 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.					

Pricing information to be provided for every variant/category of equipment offered

## **PART C3: SCOPE OF WORK**

### **SENTECH'S GOODS INFORMATION**

The requirement for VHF FM Radio Broadcasting Transmitters arises from the need to provide FM Radio 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 according to paragraph 18.2 and 19.2 of the Tender Data Document.

All Bidders with scores of at least 90 points out of a possible 110 points and 110 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
FM	Frequency Modulation
VHF	Very High Frequency
MIB	Management Information Base
RDS	Radio Data System
SNMP	Simple Network Management Protocol

## **1. INTRODUCTION**

The VHF FM Radio Broadcast Transmitter Systems detailed in this tender enquiry will be used by Sentech at several transmitting stations throughout South Africa. Guaranteed delivery times of the transmitters will be of great importance to Sentech's planning and will thus be an important aspect of the tender adjudication and subject to penalties.

The equipment will be installed at stations which, in addition to transmitting VHF FM radio services, typically radiate many VHF and/or UHF television programmes.

The VHF FM radio transmitters will operate into existing wideband antenna systems via channel combining systems.

The transmitters will be operated on a completely unattended basis and the essential requirement is thus for equipment of high reliability and ease of maintenance. Maintenance visits will be kept to a minimum and the transmitters will be expected to remain within their specified tolerance limits for a period of at least twelve (12) months after proper setup.

Emphasis will be placed on the expected operational life of the high-power solid-state devices and all components, especially considering the environmental factors as set out in section 13 of this document.

The installation and commissioning of these transmitters will be carried out by Sentech's engineering staff, and the tender price is to be based solely on the supply of equipment as specified.

Tenderers are to provide clear and unambiguous answers to each clause contained in this tender specification. In the event of non-compliance with a clause, the tenderer shall clearly indicate the extent of deviation from the stated specification.

Tenderers are also reminded that they shall, as part of their reply, submit detailed supply records with contact references of the actual type of equipment which is being offered. The tenderer may also elect to supply a recent user report of the actual product, if he so wishes.

## **2. SCOPE OF WORK**

**2.1.** The extent of work covered by this specification includes the design, manufacture, factory testing, packaging, and delivery (ex-works) of a range of VHF FM radio broadcast transmitter systems as may be required by Sentech during the envisaged contract period.

**2.2.** The transmitters' operating frequencies and other pertinent configuration details will be supplied to the successful tenderer together with the applicable purchase order(s) that may flow from the envisaged contract during its validity period.

## **3. GENERAL TECHNICAL REQUIREMENTS**

### **3.1. Stereo transmission system**

Sentech adopted European Telecommunication Standard (ETS), therefore, the equipment covered by this specification will transmit in Band II i.e., 87.5MHz to 108.0MHz and use the FM stereophonic transmission standard specified in: CCIR Recommendation ITU-R BS.450-4 (10/2019), ETSI EN 302 018 V2.1.1 (2017-04) and ETSI ETS 300 384.

The maximum permissible frequency deviation of the transmitter will be  $\pm 75\text{kHz}$  and the pre-emphasis standard applicable in South Africa is 50 $\mu\text{s}$ .

### **3.2. Transmitter configuration**

The system configuration of each transmitter shall utilise either single exciter or dual exciters in passive reserve operation; N+1 system as an alternative to dual exciter configurations; and paralleled banks of solid-state power amplifiers in active reserve operation.

Tenderers shall, in addition to providing detailed block diagrams of their systems offered, also provide detailed information on the following criteria:

- 3.2.1. Provision shall be made for bypassing critical power splitters and combiners, to maintain transmitter availability (at reduced power), in a failure situation.
- 3.2.2. Redundancy of critical components (such as power supply modules and cooling fans) shall be evident.
- 3.2.3. Amplifiers must ideally be hot-pluggable, meaning that the modules must be removable and replaceable without interrupting the broadcast service.
- 3.2.4. Modules and units shall be easily accessible, allowing for maintenance/repair actions to be carried out in the shortest possible time, whilst remaining on-air as far as possible.
- 3.2.5. Redundancy in the ventilation system should allow for maintenance and repair actions of the cooling blowers and other moving parts, without creating lengthy and unnecessary breaks in transmission.

### **3.3. Protection methods**

Prospective tenderers must state the methods used to protect and isolate the various parallel amplifier stages from one another.

### **3.4. System impedances**

The characteristic impedances of all equipment shall be as follows:

- 3.4.1. Audio frequency: 600Ω balanced
- 3.4.2. Composite: 10kΩ and/or 50Ω balanced
- 3.4.3. Radio frequency: 50Ω unbalanced

### **3.5. Band pass filter**

All equipment offered in response to this tender enquiry shall be equipped with the required band pass or harmonic filter (low pass filter), as appropriate, and the power rating shall be specified at the output of such filter. Spurious emissions shall comply with the stipulations in section 6 of this document.

### **3.6. Microprocessor control systems**

Tenderers are required to provide detailed information on the operation of micro-processor control systems used in the transmitters offered. A specific response is required on:

- 3.6.1. The extent to which bypassing of the control system is possible if it should fail and the extent of risk the transmitter is exposed to under such condition.
- 3.6.2. What counter measures are taken in the system design to ensure that the control system will not lock up (hang) due to power supply disturbances.

- 3.6.3. What methods are used during factory testing to simulate power disturbances to the transmitter.
- 3.6.4. If N+1 system configurations are offered, the complete control system hereof shall be described in detail by the Tenderer.

## **4. EXCITER REQUIREMENTS**

### **4.1. Standard Requirements**

- 4.1.1. Exciters offered in response to this tender enquiry shall be completely solid state and broadband, of modern design, especially in terms of their ability to cope with aggressively processed audio.
- 4.1.2. Exciters will have built in Stereo Encoders
- 4.1.3. Exciters will have built in RDS Encoders

### **4.2. Basic requirements**

Programme inputs will be by means of:

- 4.2.1. Baseband input sources covering audio frequencies from 30Hz to 15kHz.
- 4.2.2. Composite input sources (derived from a broadcast audio processor or off-air rebroadcast receiver) covering frequencies from 30Hz to 100kHz; or
- 4.2.3. Digital input sources (such as AES EBU).

### **4.3. Stereo encoder**

- 4.3.1. It must be possible to locally select and/or deselect the 50µs pre-emphasis circuitry into or out of the signal path.
- 4.3.2. Tenderers are to describe the peak deviation limiting capabilities of the encoder.
- 4.3.3. The performance of the stereo encoder shall meet or exceed the specifications stipulated in section 6 of this document.

### **4.4. Baseband inputs**

- 4.4.1. The input impedance of the exciter mono input as well as the left and right channels of the stereo encoder shall be 600Ω balanced for all frequencies from 30Hz to 15kHz.
- 4.4.2. The input impedance of the composite input must be selectable between shall be either 10kΩ or 50Ω. The composite input terminal shall accept all frequencies from 30Hz to 100kHz.

### **4.5. Baseband auxiliary inputs/outputs**

- 4.5.1. Tenderers must state whether their exciters have provision for combining auxiliary sub-carriers such as RDS, SCA and DARC, with the composite stereo signal.
- 4.5.2. Tenderers shall comment on the measure of protection afforded to the auxiliary sub-carriers, when combined with the composite programme in the modulator of the exciter.
- 4.5.3. The Exciter shall provide a 19kHz reference signal at the rear panel of the exciter for use by external RDS generators. Modulation levels shall be adjustable via the user interface.

#### **4.6. Adjustable input levels**

Provision must be made for the following level adjustments, if these adjustments are not possible, explain in detail:

- 4.6.1. Audio input level/s into the stereo encoder
- 4.6.2. Composite output level from the stereo encoder
- 4.6.3. Composite input level into the exciter's modulator section
- 4.6.4. Auxiliary inputs into the modulator circuitry

#### **4.7. Local oscillators**

- 4.7.1. The local oscillator signal must be generated by a frequency synthesiser.
- 4.7.2. The frequency stability of the final output frequency must be within  $\pm 150\text{Hz}$  of the specified output frequency over a period of six (6) continuous months and taking into consideration the environmental conditions the transmitter will be subjected.
- 4.7.3. The synthesiser must be capable of being set to any transmitting frequency from 87.5MHz to 108.0MHz in steps of 10kHz.
- 4.7.4. The exciter must mute the output until the carrier is locked on the desired frequency.
- 4.7.5. Tenderers shall provide a detailed block diagram of their exciter.

#### **4.8. Harmonics**

The output of the exciter must be fed to the remainder of the transmitter by means of a low pass filter. The harmonic level at the exciter output must be at least 60dB below the exciter's fundamental output.

### **5. TRANSMITTER RADIO FREQUENCY PERFORMANCE**

#### **5.1. Type of modulation**

Frequency modulation; F3E Monophonic, F8E Stereophonic

#### **5.2. Radio frequency output power, voltages, and impedance**

The transmitter output power shall be measured into a dummy load connected to the transmitter's output connector. The voltage reflection coefficient of the dummy load shall not exceed 3% over the full extent of the FM frequency band.

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

- 5.2.1. The transmitter output power shall be measured with a high-power wattmeter. The measurement inaccuracy shall be less than 5%.
- 5.2.2. The transmitter output power should not vary by more than 0.5dB under normal operating conditions (as described in section 13 of this document).



- 5.2.3. Preference will be given to output amplifier configurations designed for high redundancy. Tenderers are to indicate the reduction in output power with the loss of one or more power amplifier modules and/or power supplies.
- 5.2.4. Faulty amplifiers and power supply modules must be easily identifiable and preferably exchangeable without interrupting transmitter operation.
- 5.2.5. All RF inputs, outputs and inter-circuit connections must have an impedance of 50Ω unbalanced.
- 5.2.6. All braided co-axial cables are to be double screened.

## **6. TRANSMITTER SYSTEM PERFORMANCE**

### **6.1. General requirements**

- 6.1.1. Each transmitting system's performance shall be measured using the dummy load previously described.
- 6.1.2. A high-quality modulation analyser, complete with stereo encoder, shall be used to evaluate the performance of the transmitter. Tenderers must specify the test instrument setup used to characterise their transmitter.
- 6.1.3. All tests are to be performed with pre-emphasis switched off, unless otherwise stated.

### **6.2. Baseband performance**

- 6.2.1. Unweighted signal-to-noise ratio
  - a. Pre- and de-emphasis are to be in circuit for this test.
  - b. The transmitter deviation shall be  $\pm 47\text{kHz}$  at 400Hz (including the pilot deviation of 7kHz at an input level of +6dBm into the left and right channels.
  - c. The unweighted audio signal-to-noise ratio shall be greater than 65dB.
  - d. The above specification shall apply to both monaural and stereophonic modes of operation and additionally with an RDS injection level of 4kHz.
- 6.2.2. Frequency response
  - a. Pre- and de-emphasis shall not be in circuit for this test.
  - b. The frequency response when test signals are injected into each stereo encoder input must be within  $\pm 0.2\text{dB}$  of the level at 400Hz, from 30Hz to 15kHz

- c. The frequency response when test signals are injected into the composite (or multiplex) input, must be within  $\pm 0.15\text{dB}$  of the level at 400Hz, from 30Hz to 100kHz. Additionally, the -3dB roll-off point of the composite frequency response should also be stated.

#### 6.2.3. Common mode rejection ratio (CMRR)

Tenderers are to state the CMRR for the following cases:

- a. Monaural input of the exciter
- b. Composite and auxiliary input/s, and
- c. Left/Right inputs of the stereo encoder

#### 6.2.4. Total harmonic distortion (THD)

- a. Pre- and de-emphasis out of circuit.
- b. The transmitter deviation shall be  $\pm 40\text{kHz}$  for all frequencies from 30Hz to 100kHz. The modulating signal in this instance shall be applied to the composite signal input of the exciter.
- c. The total harmonic distortion shall be less than 0.2% for all frequencies from 30Hz to 100kHz.
- d. The above specification shall also apply to the monaural and decoded stereo performance of the transmitter.
- e. Tenderers must also provide proof of the THD performance for deviation values of  $\pm 20\text{kHz}$  and  $\pm 75\text{kHz}$  respectively, at modulating frequencies from 30Hz to 100kHz.

#### 6.2.5. Intermodulation distortion (IMD)

- a. Pre- and de-emphasis out of circuit.
- b. SMPTE method  
Two tones of 60Hz and 7kHz at a 1:1 ratio (equal amplitude) shall be applied to the composite input terminal of the exciter. The resultant deviation shall be  $\pm 40\text{kHz}$ .
- c. CCIF method  
Two tones of 14kHz and 15kHz at 1:1 ratio (equal amplitude) shall be applied to the composite input terminal of the exciter. The resultant deviation shall be  $\pm 40\text{kHz}$ .
- d. In both cases the resultant distortion shall be less than 0.25%. Tenderers shall perform the same measurements at deviation values of  $\pm 20\text{kHz}$  and  $\pm 75\text{kHz}$ . These results shall be included in the tender reply.

- e. The above specification (0.25%) shall also apply to the monaural and decoded left and right audio channels.

#### 6.2.6. Stereo separation

- a. Pre- and de-emphasis out of circuit.
- b. The transmitter deviation shall be  $\pm 47\text{kHz}$  for all frequencies from 30Hz to 15kHz (including the pilot deviation of 7kHz). The modulating tones applied to the stereo encoder shall be at +6dBm.
- c. The resulting leakage of the left channel into the right channel (and vice versa) shall be more than 45dB below the wanted level of +6dBm for all frequencies from 30Hz to 15kHz.

#### 6.2.7. Linear crosstalk

- a. Pre- and de-emphasis out of circuit.
- b. The transmitter deviation shall be  $\pm 47\text{kHz}$  for all frequencies from 30 Hz to 15 kHz (including the pilot deviation of 7kHz). The modulating tones applied to the stereo encoder shall be at +6dBm.
- c. The resulting linear crosstalk (i.e., main to sub-channel and vice versa) due to amplitude and phase matching of the left and right channels, shall be more than 45dB below the wanted level of + 6dBm for all frequencies from 30 Hz to 15 kHz.

#### 6.2.8. Asynchronous AM noise

The non-synchronous amplitude modulated noise modulation, for zero frequency modulation of the carrier, must be less than 0.3% or -50dB.

#### 6.2.9. Synchronous AM

The synchronous amplitude modulation depth due to frequency modulation of the carrier to  $\pm 75\text{ kHz}$  shall be less than 1% or minus 40dB.

#### 6.2.10. Additional exciter measurements

Tenderers may, at their own discretion, provide relevant additional measurement results not specifically called for in this tender enquiry.

### 6.3. Spurious emissions

- 6.3.1. The spurious emissions of each transmission system shall conform to all sections of CCIR Recommendation 329-4, Geneva, 1982 and all revisions thereof. Appropriate measuring techniques, as described in this recommendation, may be used.

- 6.3.2. The spurious emission performance of the transmitter shall not be impaired significantly by its operation into reactive load impedances, such as those presented by star-point or diplexer-type combiner arrangements.

## **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: -  
International Electro-Technical Commission, Publication 215-1, parts 1 and 2, viz.  
"Safety Requirements for Radio Transmitting Equipment" and any subsequent revisions hereof.
- 7.1.2. A mains power isolator shall be provided, at the power-input point.
- 7.1.3. All terminals and/or wiring, carrying dangerous voltages, shall be adequately shrouded/insulated to prevent bodily contact by personnel.
- 7.1.4. Stray magnetic and electric fields shall be within the specified limits as per the relevant CISPR documents.

### **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. Passive components such as power dividers, dummy loads and power combiners shall not require elaborate protection systems and shall be sufficiently rated to operate safely under worst-case conditions. 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 another 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. The directional couplers of the supplied transmitters shall precede the harmonic/bandpass filter.
- 7.3.3. The reflected power protection / tripping circuits shall be so designed that they can be set to operate at any VSWR in the following range: -1,1:1 to 1,6:1.  
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.

- 7.3.4. A recycling type of reflected power protection system allowing three/multiple output power restorations before finally locking out is preferred. Each reflected power tripping circuit shall be provided with a manual “re-set” in the transmitters’ control system. 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 and the type of protection fully described: -

- 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 voltage transients, incoming as in 7.4.2, 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-voltages.
- 7.4.6. Against damage due to wrong tuning or wrong alignment of any circuit or stage.
- 7.4.7. Against damage due to the failure of any other stage or individual solid-state device of a stage.

Note: Tenderers must submit their design solutions in respect of items 7.4.1 to 7.4.7 respectively when tendering.

#### **7.5. Electrical transient protection**

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, or voltage variations of the incoming three-phase mains power supply.

#### **7.7. 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.

#### **7.8. Electrical connections to an external interlock 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 cooling, electrical and RF service 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 must describe the colour scheme used for their equipment.

#### **8.3. Layout**

All wiring and RF connections to and from the equipment must be stated and typical drawings of such connections must be included in this tender.

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

### **9. METERING**

#### **9.1. Voltage-current**

Voltage, current and RF power metering shall be provided for the tuning, operation and maintenance of the equipment. The metering of all phase-voltages of the incoming mains supply is included in this category.

#### **9.2. RF power**

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

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. RF Transistor currents**

Separate RF transistor/pallet current metering must be available on the front display or via the WebGui.

#### **9.4. Exciter modulation/deviation metering**

Visual metering indications for all carrier deviations should be available at all times.

## **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 and tenderers shall ensure that all semiconductor devices shall be commercially available for a period of at least fifteen years after delivery of the transmitters.

### **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. The maximum operating temperature rating of electrolytic capacitors must be adequate for the environmental conditions specified in this document for the lifespan (15 years) of the equipment.

### **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. Detail can be discussed as and when required.

### **10.4. Connector systems**

10.4.1. The following connector systems are to be used:

- a. Audio frequencies: Cannon-type XLR-3-31
- b. Composite: 50  $\Omega$  or 75  $\Omega$  BNC, isolated from chassis ground
- c. RF < 1kW: 50  $\Omega$  N-type
- d. kW to 5 kW: 1 5/8" EIA flange or suitable size proven by supplier
- e. 10 kW 20 kW: 3 1/8" EIA flange or suitable size proven by supplier

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

10.4.3. Sentech reserves the right to negotiate with the successful tenderer to provide any RF connector system adapters, which Sentech deems necessary, as part of the scope of delivery of the equipment supplied and included in the equipment price.

## **11. MONITORING AND SUPERVISORY FACILITIES**

### **11.1. Monitoring points**

- 11.1.1. All transmitters shall be provided with monitoring points at low level RF including all inputs and outputs as is reasonably feasible. These points shall be marked with the coupling factor and shall be easily accessible.
- 11.1.2. The monitoring points shall be de-coupled from the operating circuits so that the connection of test equipment, such as a spectrum analyser or low-level demodulator, does not interfere with the normal operation of the equipment.
- 11.1.3. All software required to off-load data or to operate the equipment from a remote location must be included with the transmitter at no extra cost.
- 11.1.4. Any remote interface units must be fully described, including security options. These units, if available, must be quoted as an option.

### **11.2. Visible Indication**

- 11.2.1. Equipment must have clear and visible indication of the transmitter status under normal operating condition.
- 11.2.2. Status, warning, and fault conditions must be logged for future reference.
- 11.2.3. All data influencing the operation of the transmitter must be available

### **11.3. Remote control and monitoring facilities**

Information as described above, SNMP (Version 2 and higher) must be available for any NMS system to successfully scrutinise the equipment remotely, this must include remote control capability.

## **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 normally exceed +10% or -15% with respect to 400 volts. Equipment must have built-in protection in case these limits are exceeded.

The mains frequency variation will not normally 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. Normal operation must resume after restoration of supply.

### **12.2. Mains-borne surges and transients**



- 12.2.1. Each transmitter, 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 system, 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 12.2.1. Spurious tripping of circuit breakers due to any cause is inadmissible. Harmonics generated from within the transmitter onto the AC circuits must be taken into consideration. These harmonics should not exceed 6%.

### **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 full output power.

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

The transmitter manufacturer shall state the AC to RF efficiency specifications with the transmitter operating at full power.

## **13. OPERATIONAL ENVIRONMENT AND COOLING**

### **13.1. Climatic conditions**

The transmitters covered by this specification must maintain the performance specified in this document, when operating 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.

#### **13.1.2. Temperature**

At any ambient room temperature, i.e., cooling air inlet temperature from 0°C to +44°C. It is understood that derating of these values is possible with higher altitudes.

#### **13.1.3. Relative Humidity**

Between 0% to 95% non-condensing.

### **13.2. Cooling systems**

Each transmitter must be equipped with the necessary cooling system to achieve reliable long-term performance. Tenderers are required to describe the cooling philosophy/design used in their equipment.

### **13.3. Ducting**

13.3.1. Tenderers are not required to supply any inlet or exhaust ducts for the transmitters covered by this tender enquiry.

13.3.2. Tenderers must provide details of the air duct flanges fitted with their offered transmitters

13.3.3. All flexible duct couplings (that couple onto the transmitter and blowers) required for the installation of the transmitter shall be supplied with the equipment.

**13.4. Blower capacity**

The capacity of all fans and blowers shall be such that sufficient air is passed through the transmitter including its air filters. In particular the maximum temperature differential between the inlet and exhaust air shall not exceed 10°C.

**13.5. Heat balance**

Tenderers shall provide a schematic drawing, detailing the “heat balance” for their equipment at rated transmitter output into the antenna.

**13.6. Acoustic noise**

The acoustic noise level when measured at sea level at any point situated 1 meter away from the transmitter and 1.5 meters above floor level shall not exceed 50dB(A).

**14. HANDBOOKS AND TEST REPORTS**

**14.1. Language**

One set of manuals, written only in the English language, must be supplied with each transmitter supplied in respect of this tender document. Additionally, soft copies of the manuals must be provided on a memory stick.

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

14.2.1. The electrical value (e.g., resistance in  $\Omega$ ).

14.2.2. The tolerance where applicable.

14.2.3. The Tenderer's part number, which must be a unique number, assigned to every different component in the list.

14.2.4. The part/component manufacturers type number.

The successful tenderer will be required to supply Sentech with any relevant electrical and mechanical data and drawings.

Tenderers should take 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.

#### **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, if this is agreed to in advance. Sentech reserves the right for its engineers to take part in some, or all, of these tests.

### **15. DELIVERY**

#### **15.1. Delivery Schedule**

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. 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 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.

15.2.2. The transmitter for each station must be separately packed and crated, and the crate(s) must clearly show the station name, serial numbers of crated equipment 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.

15.2.3. Sentech will require discussing the transportation method with the manufacturer and Sentech's nominated shipping agent before consignment.

## **FM Re-Broadcast Receiver – Technical Specifications**

### **1. Introduction**

The FM Re-Broadcast Receiver Systems detailed in this tender enquiry will be used by Sentech at several transmitting stations throughout South Africa. Guaranteed delivery times of the Receivers will be of great importance to Sentech's planning and will thus be an important aspect of the tender adjudication and subject to penalties.

Receivers will be installed at stations which, in addition to transmitting VHF FM radio services, typically radiate many VHF and/or UHF television programmes.

Receivers will operate on a completely unattended basis and the essential requirement is thus for equipment of high reliability.

Tenderers are to provide clear and unambiguous answers to each clause contained in this tender specification. In the event of non-compliance with a clause, the tenderer shall clearly indicate the extent of deviation from the stated specification.

Tenderers are also reminded that they shall, as part of their reply, submit detailed supply records with contact references of the actual type of equipment which is being offered. The tenderer may also elect to supply a recent user report of the actual product, if he so wishes.

### **2. Extent of work**

The extent of work covered by this specification includes the design, manufacture, factory testing, packaging, and delivery (ex-works) of a range of FM Re-Broadcast Receiver systems as may be required by Sentech during the envisaged contract period.

### **3. Unit requirements/features**

The following features should be included:

- 3.1. Dual receivers with pre-set station allocations.
- 3.2. Two RF Inputs isolated from each other.
- 3.3. Selectable IF Bandwidths: From 56kHz to 311kHz
- 3.4. RDS encoder for RDS re-insertion
- 3.5. Stereo Regeneration
- 3.6. IP based web streaming
- 3.7. Headphone Socket: 6.35mm (stereo) on the front
- 3.8. MPX diversity switching
- 3.9. De-Emphasis (with enable/disable option) on. Line Outputs: 50µs
- 3.10. Front panel Monitoring and Control
- 3.11. General Purpose Input/Outputs (GPIO) for telemetry monitoring and control
- 3.12. Audio Muting with Squelch threshold adjustable down to at least 80µV

### **4. RF Input Specifications**

- 4.1. RF Input Tuning Range: User selectable, 87.5 MHz to 107.9MHz in  $\leq 100$ kHz steps.
- 4.2. Antenna RF Input must be 50  $\Omega$  (N-Type or BNC).

### **5. Outputs (Program)**

- 5.1. MPX Outputs: Two low impedance, independently adjustable outputs (BNC)
- 5.2. Digital: AES3 (XLR) with adjustable level
- 5.3. Analogue: Two active balanced (XLR) with adjustable levels

#### 5.4. Failover Audio Backup from memory.

### 6. Stereo Performance

- 6.1. Stereo Crosstalk from 40Hz to 15kHz referenced at +6dBu:  $\geq 45\text{dB}$  on analogue, digital and MPX outputs (RMS detected, De-emphasis switched OFF)
- 6.2. Unweighted RMS detected Stereo Signal to Noise Ratio (1mV RF Input, an audio level of +6dBu as reference and de-emphasis switched ON):
  - 6.2.1.  $\geq 60\text{dB}$  at 1mV RF Input signal for stereo analogue audio line outputs
  - 6.2.2.  $\geq 75\text{dB}$  at 1mV RF Input signal for AES digital audio line outputs
- 6.3. ITU-R 468 Weighted Stereo Signal to Noise Ratio (1mV RF Input, an audio level of +10.6dBu as reference and de-emphasis switched ON):
  - 6.3.1.  $\geq 60\text{dB}$  at 1mV RF Input signal for stereo analogue audio line outputs
  - 6.3.2.  $\geq 75\text{dB}$  at 1mV RF Input signal for AES digital audio line outputs
- 6.4. Total Harmonic Distortion (Stereo) at  $\pm 75\text{ kHz}$  deviation with De-emphasis switched OFF:  $\leq 0.5\%$  (-46dB) THD on analogue, digital and MPX outputs (measured with 25kHz audio filter)
- 6.5. Phase difference between stereo audio outputs:  $\leq 2^\circ$  from 40Hz to 15kHz

### 7. Frequency Response of outputs

- 7.1. Frequency Response for composite MPX output:  $\leq \pm 0.5\text{dB}$ , 100Hz to 57kHz
- 7.2. Frequency Response for Audio Line Outputs (Analogue and Digital):  $\leq \pm 0.5\text{dB}$ , 40Hz to 15kHz measured at an audio level of 0dBu

### 8. 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 (Not Java based).

### 9. AC Supply

- 9.1. Voltage: 230 V (IEC connector)
- 9.2. Frequency: 50 Hz

### 10. Operational, Environment Cooling and size

#### 10.1. Climatic Conditions

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

##### 10.1.1. Altitude

At any altitude up to 2800m above mean sea level.

##### 10.1.2. Temperature

At any ambient room temperature, i.e., cooling air inlet temperature from  $0^\circ\text{C}$  to  $+45^\circ\text{C}$ .

##### 10.1.3. Relative Humidity

Between 0% to 95% non-condensing

#### 10.2. Dimensions

19" (483mm) wide by 1U high to fit in standard equipment rack

**End of Tender Document**