PRASAR BHARATI
(BROADCASTING CORPORATION OF INDIA)
ALL INDIA RADIO
(TELECOM CELL)
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SPECIFICATIONS COVER SHEET

TITLE	:	Specification for Digital C-Band RN Terminal
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PRASAR BHARATI
(BROADCASTING CORPORATION OF INDIA)
DIRECTORATE GENERAL: ALL INDIA RADIO
(TELECOM DIVISION)

Specification C-Band Digital RN Terminal

1. INTRODUCTION :

The AIR broadcasting stations spread throughout the country are required to relay certain programmes which are originated from Delhi and from other Regional Stations in State Capitals. In order to link Delhi and Capital Stations etc. with other stations, for the purpose of these relays, AIR uses Satellite Radio networking through INSAT series of Satellites.

The RN Receive Terminals located at Air Stations act as Ground Terminals, to receive C-Band transmissions through satellite. These programmes thus downlinked, are fed to the transmitters for broadcast purposes.

Present specifications are for providing complete C-Band Digital RNT for AIR Stations(s).

Sections below give details of the scope of SITC and specifications of these Receive terminal. The networking through satellite is in SCPC mode. Details of the networking & INSAT system parameters are also furnished at Annexure-A to enable tenderers to design & offer appropriate system compatible with the existing setup.

2. Schedule of Items to be supplied at each AIR Station:

I) MANDATORY ITEMS-
(for SITC of complete set of C-Band RNT at AIR stations given in 2.a)

Sl. No	**Equipment**	**Qty./stn.**	
2.1	6 Meter Parabolic Dish Antenna along with Earthing System, Lightning arrestor, feed and accessories	1 set	7.1,7.2a
2.2	a) LNBC C-Band	3 Nos.	7.3
	b) 50M length Low loss cable with connectors--- 2Nos	1 Set	7.2 b
	c) L band line amplifier	3 Nos.	7.4
2.3	L-Band Digital Receiver	4 Nos..	7.5
2.4	Full size wired rack(42U) with jack strip and tag block	1 No	
2.5	L band 1:4 power divider with only one port dc pass(2 nos.) alongwith other accessories like connectors and integration material	1 set	----
2.6	Laptop	1 no.	7.6
2.7	Installation and Commissioning of the System at site	1 Job	
2.8	Inspection as per approved ATP	1 Job	Annex. B
	OPTIONAL ITEMS-		
2.9	2 days training	1 Job	3.9
2.10	Low loss cable Per meter length (to be quoted separately)		
2.11	Spares	One set	

II) List of equipment (supply only) at Srinagar, Hyderabad &Chandigarh**:**

i) L-Band Digital Receiver -4 Nos. each

ii) L band 1:4 power divider- 2 nos. each

2.a List of Stations where Complete set of RN Terminal is to be provided:

1.	Changlong	Arunachal
2.	Khonsa	Arunachal
3.	Daporijo	Arunachal
4.	Bomdila	Arunachal
5.	Goalpara	Assam
6.	Karimgang	Assam
7.	Lumding	Assam
8.	Dawki	Meghalaya
9.	Tuipang	Mizoram
10.	Champhai	Mizoram
11.	Kolasib	Mizoram
12.	Wokha	Nagaland
13.	Phek	Nagaland
14.	Udaipur	Tripura
15.	Nutan Bazar	Tripura
16.	Mehboobnagar	A.P.
17.	Suryapet	A.P.
18.	Dehradun	Uttarakhand
19.	Banda	UP
20.	Lakhimpur Kheri	UP
21.	Maunath Bhanjan	UP
22.	Balurghat	W.B.
23.	Coochbehar	W.B.
24.	Chinsurah	W.B.
25.	Rajkot	Gujarat

2.b List of Stations where only L-Band Digital Receivers are to be provided:

1. Srinagar 2. Hyderabad 3. Chandigarh

3. SCOPE

3.1 The scope of this tender in general includes supply of the equipment as per specifications, technical requirements and quantities as detailed in the tender, after acceptance testing as per Acceptance Test Procedure (ATP).The installation and commissioning of C-Band receive terminal at designated AIR site shall be carried out by the supplier. Scope of the work includes supply of complete C-Band Receive system, its installation, Testing and commissioning.

3.2 After acceptance of the tender, the tenderer shall provide detailed plans of supply of material and testing as per ATP.

3.3 The indenter shall provide the necessary space for the installation of the equipment, layout plan of the cable and location of the parabolic dish antenna.

3.4 The complete installation of RN Terminal at designated AIR site, including ground leveling, required foundation for the PDA and construction of platform shall be carried out by the tenderer.

3.5 During the installation of the equipment supplier shall be responsible for safety and security of his material and personnel. At the same time the supplier will also ensure that no damage to AIR material and personnel is caused. There shall be no disruption of running services at the Station during installation and commissioning.

3.6 The tenderer shall ensure that the equipment offered fully incorporate the standard features for safety and protection including shielding from EMI.

3.7 The supplier will have to supply the equipment ,arrange for its testing as per Acceptance Test Procedure and provide facilities and equipment to carry out the testing .The installation and commissioning of the C-Band receive terminal at designated AIR site will be carried out by the supplier .A draft copy of the Acceptance Test Procedure is attached in Annexure B.

3.8 Pre dispatch Inspection will be carried out at Supplier/Integrator's premises by the Engineers(s) of All India Radio. The supplier shall put up all the equipment for test on the test bench at supplier/integrator premises before the AIR Representative and shall provide, without any extra charges, electric energy, consumable materials, tools, testing instruments, labour and assistance of every kind for carrying out acceptance tests. All the individual factory test reports of the complete lot of the equipment shall be made available to the inspecting authority before inspection.

Complete specifications and details will be checked and all parameters values will be measured. Typical details are enclosed in draft ATP, The inspection will be carried out on those lines.

Prior intimation for carrying out Inspection at Works is to be given by the Supplier to the Indenter at least 6 weeks in advance. Inspection charges if any are TO BE QUOTED SEPARATELY.

3.9 Supplier shall arrange two days' training at each designated AIR site to AIR Personnel on Operation & Maintenance of the equipment.

3.10 Delivery period for SITC for all the items shall be **six months** after placing the order.

4. LOCATION FOR SITC OF RN TERMINAL EQUIPMENT:

The C-band Receive terminal will be supplied and installed at designated site(s) as per details given at 2.a & 2.b.

5. GUARANTEE & RELIABILITY:

In addition to standard guarantee and warranty clauses mentioned in the tender, the tenderer/supplier will ensure the following:

-The equipment offered should be capable of continuous round the clock operation.

-It shall be field proven, of state of art technology and based on industry standard.

6. GENERAL CLAUSES:

i) Warranty and guarantee clause will be as per the terms and conditions specified in the commercial section of the tender in this respect.

ii) The tenderer shall quote all the optional items.

iii) The supplier shall provide the list of clients where they have supplied the same kind of the system.

iv) The supplier may be asked to demonstrate the working of the complete quoted system or some of the equipment, if required.

7. TECHNICAL SPECIFICATION FOR DIGITAL RECEIVE TERMINAL

The Digital Receive terminal should conform to the following technical specifications:-

7.1 Specification for 6 M C- BAND PDA

Electrical Specification:

1)	Diameter	Diameter should be 6 Meter(nominal) should meet the technical requirements mentioned below.
2)	Frequency Range	3.7-4.2 GHz
3)	Receive gain at 4GHz	≥46 db
4)	Receive G/T	Better than 24.5 db/ K
5)	Pointing Accuracy	Better than $\pm 0.25^0$
6)	Side Lobe Level/GAIN pattern	As per ITU-RS-580-V or its latest amendment.
7)	Tracking mode	Manual (motorised may be quoted as optional). The Antenna should have calibrated marking for Elevation & Azimuth angle indication.

Mechanical Specification:

Sl No	Parameter	Specification
1	Reflector Structure:	The reflector should be made of perforated aluminum sheet mounted as panels/segments over reflector supporting structure. The reflector supporting structure should be made from aluminum or steel tubes/angles and mounted over trusses emanating from the central hub.
	i) Reflector Material:	Perforated Aluminum sheet with thickness of at least 2.0mm
	ii) Coated with:	Non metallic anti corrosive paint to avoid concentration of heat at focal point (mention the paint used)
	iii) Reflector supporting structure:	Should be made from Aluminum /Steel material. It should be coated with anti corrosive paint
2	Antenna Stand:	
	Mount:	Kingpost
	Material:	Heavy duty, made with hot dip Galvanized steel and coated with anti corrosive paint.
4	Steerability:	
	Elevation:	15° to 85°
	Azimuthal:	≥ ± 55°(continuous, without change of mount position
5	Wind Load:	
	Operational:	80 KM/Hr
	Survival:	150 KM/Hr
6	**I)** Environmental :	
	Temperature:	0° to +50°C
	Relative Humidity:	95% non condensing at 40°C
	Rain:	Up to 10 cm/hr

NOTE: The tenderer (as per drawings and recommendations by the original manufacturer of the antenna) will provide Foundation of antenna. One no of proper earth pit will have to be provided for earthing the lightening arrester of the antenna. The resistance of earth pit should be 1 ohm or less.

7.2a) DETAIL OF THE FEED

i)	Type of Mounting	Prime Focus. The provision for adjustment of the feed from the ground itself should be made. It should have calibrated polarization angle indication and adjustable smoothly for optimization.
ii)	Ports	Two (Orthogonal)
iii)	Polarisation	Linear (adjustable, ± 90°)
iv)	Freq. Range	3.7 - 4.2 GHz
v)	Return loss at Centre freq.	≥ 17 dB
vi)	Connector	Wave-guide WG229G
vii)	Cross-Polarization discrimination	≥ 30 db

NOTE: Feed of C-Band antenna would be two port(orthogonal). One LNBC would mount over each of the port. At a time only one LNBC output would be connected to the input of power divider/L band line amplifier. The other LNBC mounted over orthogonal port will serve as cold standby. Arrangement should be provided so that by rotating the feed by 90^0, the standby LNBC could be brought into the circuit.

7.2.b) Cable

Only good quality professional grade cable with connectors at both ends shall be quoted with following specifications

i) Cable Loss (with F connectors at both ends) $\leq$ 3.5 dB/100 feet at 1500 MHz

ii) Impedance 75 Ω

7.3 Professional grade C- BAND L.N.B.C.

a)	Input frequency	3700 – 4200 MHz
b)	Input impedance	50 Ω
c)	Input connector	WR 229 G Flange
d)	Output frequency	950 - 1450 MHz
e)	L.O. Stability	PLL, better than $\pm$ 2 PPM
f)	Noise temperature	≤ 35°K
g)	Conversion gain	≥ 55 dB
h)	Phase Noise 1 KHz 100 KHz	 -60 dBc/Hz -80 dBc/Hz
i)	Output impedance & Connector	75 Ω ; F (Female)
j)	Power supply	+ 15 V to + 24 V through output connector

7.4 L BAND LINE AMPLIFIER

	Features : a) Capable to handle power requirement. b) Provision for wall mount installation	
1.	Frequency of operation	950 - 1450 MHz
2.	Input level	- 80 dBm to -50 dBm
3.	Input and Output Impedances	75 Ω
4.	Input/ Output return loss	≥ 8dB
5.	Noise figure (Typical)	≤ 10 dB
6.	Gain	≥20dB
7.	Gain flatness (Over entire band)	$\pm$ 2 dB
8.	Operating voltage (Through centre conductor of the RF cable)	+14V to 24 VDC

7.5 DIGITAL SATELLITE RECEIVER WITH L- BAND INPUT

The digital receiver should confirm to the standard & specs of the existing digital radio networking system. It should be possible to control/set receiver through front panel as well as through laptop. One no. digital receiver shall have to be submitted to AIR within one month of opening of technical bids for testing compatibility in the existing setup.

i)	**Input** a) Freq. Range b) Freq. Step Size c) Impedance d) Signal Level	 950 – 1450 MHz Resolution ≤ 25 KHz Local (remote control optional) 75 Ω -25 dBm to -70 dBm
ii)	Demodulation	QPSK
iii)	Channel change time	≤1 sec
iv)	FEC decoding	a) Rate 1/2, 3/4 Viterbi b) Rate ½ Sequential (Selectable Rate preferred)
v)	Audio coding	ISO/MPEG-I/Layer-2
vi)	Data rates (Selectable)	64, 128, 192, 256 & 384 kbps (QPSK)
vii)	Modes	Mono, Dual mono & stereo
viii)	**Audio output** a) Impedance b) Level (Maximum) c) T.H.D. (@256kbps; 1 KHz) d) Audio signal bandwidth e) Frequency response f) Signal to Noise ratio g) Dynamic range h) Cross-talk ratio i) Audio output channels j) Digital audio output	 ≤ 600 Ω + 12 dBu (adjustable) ≤ 0.2% (at +8 dBu output) 20 Hz to 20 KHz 1.0 dB(p-p) (20 Hz to 20 KHz) @ 0 dBu O/P. ≥ 75 dB (at 256kbps,Eb/No ≥9 dB, +12 dBu) ≥ 80 dB ≥ 75 dB w.r.t. +12 dBu input in Encoder Two mono/one stereo AES/EBU standard professional
ix)	Threshold Eb/No	≤ 5.5 dB (QPSK)
x)	B.E.R. Immunity at 128 kbps, QPSK, Vit ½ at Eb/No 5.5 dB.	1x 10^{-5} for no subjective loss in quality
xi)	Audio Sampling Rate	48 KHz (24, 32, 44.1 KHz Optional)
xii)	Auxiliary data channel a) Data rate b) Interface	 ≥ 4.8 Kbps RS 232
xii)	Supply for LNBC	Provision for + 15 V to + 24 V through IF/RF connector to compatible LNBCs

7.6 Laptop

Specifications: Laptop shall be rack mountable.(sliding) and shall be of reputed make. It shall be used for control and setting of the operational parameters for Digital SCPC Receivers on the downlink monitoring side.
The operating system should be Pre loaded Genuine licensed Windows Vista(TM) along with Recovery CD media including all drivers etc., Fully loaded configuration. The License shall be in the name of consignee.

7.7 GENERAL/ENVIRONMENTAL

a) Outdoor Unit

Operational Wind Speed	Upto 80 kmph
Survival Wind Speed	Upto 150 kmph
Ambient Temperature	0°C to +50°C
Relative Humidity.	95% at 40°C Non condensing

b) Indoor Unit (Digital Receiver)

Ambient Temperature	0 to 40°C
Relative humidity	95% at 40°C.
Power Supply	230V ± 10%

7.8 GENERAL REQUIREMENTS:

1. The RN terminals comprising of C Band Antennae, C band LNBCs and Digital Receivers, etc. will have to be supplied as complete integrated unit) including interconnection of the sub-systems, supply of accessories and other materials necessary for proper installation, operation, maintenance and trouble free service.

2. Tenderer are required to provide proper climbing arrangement for repairing/maintaining LNBC and feed mounted on the Antenna. .

3. The distance of indoor and out-door units could be around 50-60 M. So provision should be made accordingly. The rate for the RF cable may also be quoted per meter basis so that additional length as per actual requirement may be ordered later. For ranking purposes, an averge of 50m lenth is considered.

4. The technical bid of the tenderer should contain, apart from the technical compliance statement, all original data sheets of the manufacturer in support of the technical compliance statement. The tenders containing only technical compliance statement without the original data sheet/pamphlets of the equipment offered in full are likely to be rejected.

5. A comprehensive schedule of material offered should be attached with the offer in the same format as price bid minus price.

6. The tender/offer should include following details:

i) Sufficient information should be furnished with the tender to assess full merits/demerits of the offer.

i) Apart from printed technical data/specs of this equipment, Block schematic of the sub-system, including the photograph etc. should be attached with the offer.

ii) A complete schedule of equipment, accessories and option etc. should also be appended with the tender.

7. List of essential spares giving quantities and cost may also be given alongwith the offer.

8. Maintenance support in terms of spare units/components be ensured for atleast 10 years.

9. **Technical Pamphlet**: The supplier will provide **original equipment manuals** for installation, operation and maintenance for all the item of the Digital RN receive Equipments as per details below:-

- 2 Sets for each location
- 2 Sets each for Zonal office concerned
- 1 set each for Director General: All India Radio, R&D & STI(T)

7.9 INSTALLATION & COMMISSIONING

Installation will include mounting of all the equipments within the wired racks, hoisting of the parabolic dish antenna, routing of the wave guide/RF cable from the PDA to indoor system and providing earth pits as per AIR Specifications (earth resistance of less than one ohm) at site. Racks and all the equipment must be earthed.The workmanship of the entire Installations shall be of high professional standard. PDA foundation will be done by the tenderer as per the design given by its OEM and as per soil bearing capacity, which will be conducted by the successful tenderer through authorized agencies and got certified and a copy of the report submitted for record.

The firm shall have to arrange all the installation material required for installation and insure all the personnel associated in the installation work at their own cost. Installation schedule has to be intimated at least 3 weeks in advance.

Complete Installation at the station shall thereafter be offered for Site Acceptance Test and Inspection at site shall be conducted by the representatives of AIR.

The successful tenderer shall make good all damages to the purchaser's buildings, property, equipment, article and departmental personnel during the course of installation and throughout the guarantee period.

The successful tenderer shall indemnify and hold harmless the purchaser, against all claims in respect of damages to buildings, property, articles, situated nearby not belonging to the purchaser, and public personnel arising from the erection of the PDA during the course of such erection or mounting and throughout the guarantee period.

The successful tenderer shall indemnify and hold harmless the purchaser against claims in respect of injury to any personal howsoever arising from the erection of the PDA in the course of such erection or mounting and throughout the guarantee period.

The successful tenderer shall fully discharge all obligations under the Indian Workmen's Compensation Act in so far as it affects the workmen under his employment.

The tenderer shall be responsible for safe erection of the PDA and other accessories etc. The tenderer shall take all necessary safety measures and precautions during the SITC.Installation work shall be got done at site under the supervision of qualified representative of the firm.

Annexure-A

AIR – RN SYSTEM PARAMETERS

Type of Receive Terminals

C-Band	Size	6M
	Polarisation	Linear H/V

System Characteristics:

Mode	SCPC
RN Channel Band-Width	350 KHz(Digital 256 kbps)

Digital System:

Modulation	QPSK
FEC	½, Convolutional coding and Sequential/Viterbi decoding
Base-Band Compression	ISO MPEG – I layer-II Selectable Rates
Base-Band	20 Hz – 20 KHz
Modes	Mono, Dual mono, Joint stereo Voice/Data Channel

INSAT SYSTEM DETAILS

Satellite Locations: Different locations from 55ºE to 105ºE (Presently 55º, 74º, 83º, 93.5º)

CXC-Band Transponder

Uplink Freq. Band	5925 – 6425
Downlink Freq. Band	3700 – 4200
Sat. EIRP	38 dBw
S.f.d.	-85 dBw/m²
Polarisation	
Uplink	Linear H/V
Downlink	Linear V/H

Annexure-B

DRAFT ACCEPTANCE TEST PROCEDURE

INTRODUCTION

New C-band Digital receive terminal to be installed at designated AIR site is to be tested to ascertain the performance of the terminal before final acceptance.

SCOPE

This document describes the test procedure for link level measurement of C Band RN receive terminal. Details of the operating parameters and setting at which measurements are to be carried out are given in subsequent sections.

OBJECTIVE OF LINK LEVEL MEASUREMENTS

Digital C-Band transmit (uplink) is already operational at CES Delhi. The down link testing is to be carried out based on these parameters.

Detail measurements of the downlink receive system would consist of following:

- RF measurements
- Baseband measurements
- To test the received audio qualitatively
- Endurance test

These measurements would be carried out in real time coordination with CES, Delhi for the C-band Digital transmit system .

TEST EQUIPMENTS

The test equipment are required to be arranged by the supplier.

(a) Spectrum Analyzer
(b) Audio signal generator
(c) Audio analyzer

SET-UP & PRE-CHECKING:

Following points may be checked up before the measurements are carried out:

(i) Check for the items supplied, serial no., quantity as per order including manuals etc.
(ii) Individual operational controls of units, settings, levels should be set up as per details given in the manual and subsequent sections. The functioning of controls and displays may be checked.
(iii) The receive system, after installation, is to be lined up for satisfactory downlink audio reception and functioning of the system.
(iv) Test and measuring equipment may be checked up and be kept switched on at least 15-20 minutes to allow them to stabilize before measurement.
(v) Arrangements for communication with CES Delhi for real time coordination and testing be made.

LINE UP & TESTING

ANTENNA LINE UP AND TESTS: The receive antenna is to be optimised for best down link reception using bacon signal. Optimisation for all i.e. Azimuth, elevation and polarisation be done for best results. Readings of bacon signal be noted and beacon reception print out be taken. C/No for bacon should be better than 67dbHz.

DIGITAL RECEIVERS :

The measurements detailed below will have to be done in real time coordination with CES,AIR, BH, Delhi.

The transmit side parameters will be set by CES Delhi. The transmission signal parameters will be communicated from Delhi and the receiving station will note down the readings on receive side.

I. RF MEASUREMENTS

Following measurements are to be taken:

Received Signal level:

Check the received signal level of pure carrier on spectrum analyser and note down the reading. Similarly check for same carrier on other port of feed. Note observation. This difference is crosspole discrimination.

Eb/No, C/No, BER measurement:

Vary modulator output level in steps of 1 dbm and note down the C/No at the receive end on spectrum analyser. The corresponding Eb/No and BER values may be noted down by giving the commands EB and RB respectively to the Receiver through laptop. The threshold at which the receiver starts to loose Audio synchronisation is to be noted.

Serial No:
(Data rate 256 Kbps, Coding-Vit 1/2)

S.No.	MODULATOR OUTPUT (dbm)	C/No (dB-Hz)	Eb/No (dB-Hz)	BER	Remarks

II. BASE BAND MEASUREMENTS:

Linearity:

Vary the input to the Encoder in the uplink side from -8 dBm to +8 dBm in steps and note the output on the analyser, which is connected to the receiver. Carry out measurements for both channels and note down the results.

Linearity: (Test Signal 1 KHz)

	Input Level	Output Level
	Left Channel	Right Channel
(a) -8 dbm (b) 0 dbm (c) +8 dbm		

Frequency Response:

Feed a 0 dbm reference signal at 1 KHz to the Encoder. Vary the frequency of the signal from 20 Hz to 20 KHz in steps and note down the output level of the signal at the receive end.

Frequency Response (0 dbm, 1 KHz reference)

S.No	Frequency (Hz)	Left Channel	Right Channel	Remarks

SNR, THD and Cross Talk:

Feed a +8 dBm, 1KHz test signal at the Encoder and measure output level, THD, SNR and cross talk in respect of both channels.

Input: 1 KHz, +8 dBm

S.No.	Channel	Output (dBm)	THD (%)	SNR (dB)	Cross Talk (dB)	Remarks
	Left					
	Right					

III Subjective Listening:

Listen to the received programme for satisfactory audio quality. Subjective Listening comments may be given

IV. Endurance Test

In addition to the above tests, the system is to be kept "ON" for 48 hours and any degradation/ malfunctioning of the RN Terminals, is to be noted. Variation in signal level, heating of components, particularly the working of LNBC, drift in L-Band output freq. of LNBC etc. are to be checked and noted.