

**PRASAR BHARATI
DIRECTORATE GENERAL: ALL INDIA RADIO
(PLANNING & DEVELOPMENT UNIT)**

**Specifications Document for SITC of New Captive Earth Station at AIR Silchar,
Dehradun, Tiruchirapalli, Dharwad and Madurai.**

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**PRASAR BHARATI
DIRECTORATE GENERAL : ALL INDIA RADIO
(TELECOM DIVISION)

TC/SPEC/104/2011/CES-New

Subject : Specification for the New Captive Earth Station at AIR Silchar, Dehradun, Tiruchirapalli, Dharwad and Madurai.

INTRODUCTION :

AIR requires Captive Earth Stations (CES) to uplink its Radio programmes for distribution in its network through satellite. The Captive Earth Station under reference is to be installed at the AIR Silchar, Dehradun, Tiruchirapalli, Dharwad and Madurai. The programmes uplinked by this CES will be received by other AIR stations with their Radio Networking (Receive) Terminals (RNT) and used either for recording or for retransmission through their terrestrial transmitters. A Representative diagram of CES is placed at Annexure-I.

SECTION -A

1. BILL OF MATERIAL

Mandatory items per site: for AIR Silchar, Dehradun, Tiruchirapalli, Dharwad and Madurai.

Sl. No.	Item	Quantity	Reference
1.	a)6.1M (Nominal) Parabolic, Motorised Antenna with controller and 4-port linear motorized feed and accessories. b)Foundation work for PDA as per OEM drawing	1 Set.	Section B-1
2.	50W C-band Solid State Power Amplifier (1+1) in Hot Stand by configuration with auto-changeover unit along with Dummy-load and power measuring accessories..	1 Set	B-2
3.	Synthesized IF to C-Band Up-converter 1+1 with auto-changeover Unit.	1 Set	B-3
4.	Digital Encoder (1+1) Digital IF Modulator (1+1) with auto-changeover Unit	1 Set 1 Set	B-4 B-5
5.	Inter-facility links including Wave guides, couplers, IF Combiner, adopters, cables and other accessories for Antenna connection to SSPA etc. Elliptical Wave Guide (40 meters) shall be included. (cost per meter shall also be quoted for elliptical wave guide).	1 Set	B-6
6.	Wired racks for housing digital base band, IF and RF Equipments including their changeover units etc.	3 Nos.	B-7
7.	Cables connectors and other accessories including Audio Distribution Amplifier, Power splitter etc. for integration of the complete system.	1 Set.	B-8
8.	Dehydrator	1 No.	B-9
9.	Receiving system: i. C-Band LNBC ii. Professional IRD iii. Interconnecting cables connectors & accessories along with L Band Splitter. iv. L Band Line Amplifier	2 Nos. 4 Nos. 1 Set 2 Nos.	B-10 B-12 B-11,13 B-14
10.	Load sharing UPS 2x5 KVA (Rack Mount Type)	1 Set.	B-15
11.	a)Automatic on-line control and performance measurement and health monitoring system b)Network Management System	1 Set	B-16
12.	Laptop with licensed OS and LaserJet Printer	1 set	B-17
13.	Installation, Testing & Commissioning of CES System at Site including NOCC Test.	1 Job	B-18

14.	Inspection	1 Job	A-8
15.	Digital Transmission Analyzer	1 No.	B-19
16.	Spectrum Analyzer	1 No.	B-20
17.	Manuals	1 set	A-10
18.	Details of any other items, required for complete integration of the system.		
19.	Operation & Maintenance Training at Site	1 Job	A-9

Optional Items:

Sl. No.	Item	Quantity	Reference
1.	OEM Recommended Spares as required	1set	A12,B-21

2. QUANTITY:

Total Quantity for CES is five no's, one each for AIR Silchar, Dehradun, Tiruchirapalli, Dharwad and Madurai.

3. LOCATION FOR SUPPLY & INSTALLATION:

CES five no's is to be Supplied, Installed, Tested and commissioned one each at AIR Silchar, Dehradun, Tiruchirapalli, Dharwad and Madurai.

4. SCOPE:

The scope of this tender includes supply of the equipment as per specifications, technical requirements and quantities as detailed in the tender along with Installation, testing and commissioning of the equipments as per mutually accepted ATP. NOCC clearance at each site shall also be arranged by the tenderer. This is mandatory. Inspection of site shall be carried out by AIR after receipt of NOCC clearance.

5. Eligibility:

The bidder shall have proven experience of carrying out SITC of Earth Station. Bidders shall provide documentary proof (with attested copies of certificate from client including contact details like Telephone nos. and E-Mail address) of successfully carrying out at least one work of SITC.

Bids without the above valid documents shall be liable for rejection without any further Communication.

6. Schedule of Material:

A comprehensive schedule of material offered shall be attached with the offer as mentioned in Section A-1 in the same format as price bid minus the price. Price against each item as indicated in Section A-1(Bill of Material) shall be mentioned separately item wise for mandatory as well as optional items.

7. Compliance

The compliance from original equipment manufacturer only will be considered. While complying to the specifications, it may be noted that just mentioning 'complied' will not suffice. Compliance should be supported by proper data/documentation and should substantiate the specifications. In compliance statement each specification item complied, reference of compliance documents page no. etc. should be indicated.

One no. of Encoder, digital receiver and modulator shall have to be submitted within one month of opening of technical bids, for testing its compatibility.

Each page of the datasheet/specification shall be duly signed, with seal, by both the OEM and tenderer. The full name, Postal and Telephone contact details including E-Mail address of the person signing on behalf of OEM must be indicated on at least one of the pages. Bids not complying with the above shall be rejected.

8. Inspection: Inspection of the equipment and testing of the installed SITC of the equipment shall be done as per mutually accepted and approved Acceptance Test Procedure (ATP). Draft ATP is annexed.

a) Pre-dispatch Inspection:

Pre-dispatch Inspection of the equipments shall be carried out at Integrator's works by the Engineers(s) of All India Radio. The expenses towards to and fro journey, DA and lodging as per Govt. of India norms will be borne by Prasar Bharati. The performance certificate along with measurements taken on all equipments (duly certified by OEM) is required to be submitted by the tenderer before inspection at their premises.

During the Pre-dispatch inspection, supplier shall put up all the equipments for test on the test bench at integrator premises before the AIR representative and shall provide electric energy, consumable materials, tools, testing instruments, and assistance of required 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 for each equipment will be checked and all parameters/values will be measured as per ATP. Typical details are enclosed in draft ATP. Detail ATP shall be submitted by the vender/OEM and after mutual discussion it shall be approved and inspection shall be carried out on these lines. Three weeks prior intimation for carrying out inspection at Works is to be given by the supplier to the indenter. Inspection charges, if any, are to be quoted separately in the commercial bid.

b) Site Inspection:

After completion of Installation of all the equipments at the Station, final inspection of the installation at the Station will be carried out by the representatives of AIR for certifying the Installation. This inspection will include visual examination of the installation, overall performance measurements, link level measurements and any other measurement/ examination considered necessary by AIR. At least seven working days' prior notice shall be given by the supplier for conducting final Site Acceptance test. The tenderer shall be required to submit NOCC clearance before inspection.

9. Training

The tenderer shall provide three days training to AIR Engineers on setting up, configuration, operation and maintenance of the equipment at each Station.

In addition to above 5 days training in each zone (Total five zones) for AIR engineers on Operation, Maintenance and Servicing of equipment will be required to be arranged. The expenses on to & fro journey and DA etc. for the trainees will be borne by AIR.

10. Manual/Documentation & Test Certificates:

Manual: [Two each for the station, Two for directorate, one each for Zonal office, one for STI (T) and one for R&D]. Each manual shall consist of following.

- a) Manual for operation, configuration, maintenance of each equipment, sub system, NMS, accessories and complete integrated link along with drawings and wiring diagram for the system. (both hard & soft copies)
- b) Test procedures for parameters measured at subsystem and integrated system levels.
- c) Test records/reports of all the measurements performed for each equipment and integrated system.

11. Delivery Period:

The Delivery Period for SITC and handing over of complete installation for all the sites shall be eight(8) months from the date of A/T.

12. SPARES

Tenderer must quote separately essential spares as recommended by the OEM, including their quantities and cost (per unit). The cost of spares shall not be counted for deciding the commercial ranking of tenders. Various RF modules like transmitter, receiver, interface units, Audio Encoder-Decoder modules, Multiplexer-Demultiplexer modules, Power supply modules, and any item which is to encounter more wear and tear etc must be quoted as spares along with other units.

13. GENERAL REQUIREMENTS:

a. Technical/General details

i) The tenderer, in order to enable the indenter to carry out the full technical evaluation of the tender, should give all the details required to ascertain full merits and demerits of the technical offer. Apart from printed technical data/specs of the equipment from the OEM, Block schematic upto the sub-system, interconnection and wiring diagram should be given.

ii) The equipment offered shall be of renowned make, well established and field proven. All the equipments should conform to the power supply and environmental requirement as detailed in para A-14.

iii) The tenderer may be asked to demonstrate the equipment to show compliance to AIR's specification at the technical evaluation stage. The tenderer shall furnish the list of the customers along with contact details (including Telephone No's, E-Mail) where similar equipment has been supplied by the tenderer/manufacturers. In the absence of such list, tender may be rejected.

iv) This equipment shall be of state-of-art technology, capable for 24 Hx365 days operation. It should be incorporated with standard feature of safety and protection.

v) Installation & Commissioning at respective stations shall be carried out without any disruption of AIR/Doordarshan Services. This may require installations at some sites to be carried out even during night hours for which adequate arrangements will have to be made by the supplier at no extra cost to the indenter.

vi) The tenderer shall ensure that the equipment offered fully incorporate the standard features of safety and protection including shielding from EMI/RFI as the receive end of the Link will be installed at high power transmitter site.

vii) Provision of RF cable and associated materials as per site requirement shall be made. The rates of RF cables may be quoted on per meter basis. However, the offer will be ranked on the basis of a notional cable length of 100 meters each at both ends.

viii) Apart from printed technical data/specs of the equipment, Block schematic upto the sub-system, interconnection and wiring diagram, photograph etc. must also be attached with the offer.

ix) Successful bidder may conduct site survey at all the Stations, if felt necessary, to ascertain the conditions at Stations for facilitating installation of indoor equipments, hoisting of Dish antenna on the tower, routing of the cable, length of the RF cable, etc.

Minor changes at site, if any, necessitated due to site conditions shall have to be taken care of by the supplier during installation without any extra cost to the indenter.

x) After Acceptance of the tender, the successful tenderer shall also provide detailed plans of supply of material, testing and commissioning as per ATP.

xi) During the installation of these equipment, supplier shall be responsible for safety and security of his material and personnel. At the same time the supplier shall also ensure that there is no damage to AIR material and personnel. The successful tenderer shall make good all damage to the purchaser's buildings, property, equipment, article and departmental personnel arising from the erection of the tower and/or mounting of antenna on tower in the course of such erection or mounting and throughout the guarantee period.

xii) 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 tower and/or mounting of antenna on tower in the course of such erection or mounting and throughout the guarantee period.

xiii) 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 tower and/or mounting of antenna on tower in the course of such erection or mounting and throughout the guarantee period.

xiv) 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.

xv) The tenderer shall be responsible for safe erection or work on the tower and other accessories etc. The tenderer shall take all necessary safety measures and precautions during the SITC work. The firm shall have to arrange all the installation material required for installation and insure all the personnel climbing the towers at their own cost. Any fixtures, clamps or mounting accessories needed for hoisting the dish on the tower has to be arranged by the firm. Tower work shall be got done at site under the supervision of qualified representative of the firm

xvi) Maintenance support including availability of spares for RF equipment and baseband equipment is to be ensured for at least 10 years from the date of supply. Details of the same should be mentioned in the tender. If at any stage during next ten years the manufacturer proposes to stop production of these equipment and spares, supplier shall intimate AIR in

advance to enable AIR to stock the critical items of spares for the life of the equipment

xvii) The tenderer shall mention the source of supply (with proper authorization) for major and critical components/spares so that no difficulty is encountered later on in procuring the spares for maintenance/repair of these equipment.

xviii) All the equipments shall carry a warranty for 12 Months from the date of acceptance of installation at site against any manufacturing defects and failures.

xix) All optional items mentioned in the tender must be quoted. Failing this, the tender would be liable to be rejected. However, these items would not be considered for ranking purpose.

xx) The tenderer/firm must have a well equipped & established service center in India. The complete address and contact details of the Service centers in India, duly certified by the OEM, shall be indicated. The firm/tenderer must ensure repairs within 72 hours at site & in case the equipment can not be repaired at site then the firm shall bear all the charges including to & fro freight charges to repair the equipment within or outside the country during the warranty period.

For all equipments after sales service is to be ensured for post warranty period also for 10 years.

14. Environmental & power supply

a) Ambient Temperature (for outdoor units) :
-30°C to + 40°C – For Srinagar (Hill Stations)
-10°C to + 50°C –For other Stations

b) Relative Humidity : Upto 95% non condensing at 40°C

c) Safety/features : Standard features for safety & protection have to be built in /incorporated for both personnel/equipment.

d) Power supply : 230VAC±10%, single phase, 48-52 Hz.

SECTION - B**TECHNICAL SPECIFICATIONS**

1. **6.1M (Nominal) PARABOLIC DISH ANTENNA WITH MOTORISED CONTROL FOR AZIMUTH, ELEVATION AND POLARISATION/ FEED ANGLES AND FOUR PORT LINEAR MOTORISED C- BAND FEED WITH TRF.**

(A) ELECTRIC SPECIFICATIONS		
a)	Type	King Post, Elevation over Azimuth
b)	Nominal Diameter	6.1 Meter
c)	Frequency Range	
	a) Transmit	5.850 to 6.425 GHz
	b) Receive	3.700 to 4.200 GHz
d)	Antenna gain (mid band)	i) Transmit : ≥ 49 dBi ii) Receive : ≥ 46 dBi
e)	Antenna G/T	≥ 26 dB/K
f)	Antenna Beam width	
	i. 3 dB Beam width	≤ 0.6 degree
g)	Side lobes (Transmit and Receive)	As per ITU-R Rec. S.580-V (or latest amendments)
Note : Antenna radiation pattern conformity to ITU-R standard & X-pole of feed system shall be got cleared by the supplier from NOCC/DOT before the completed installation is offered for acceptance for commissioning by AIR).		
h)	Feed and Feed Port	4 Port feed Transmit VLP/HLP Receive HLP/VLP
i)	On axis Cross polarization isolation	≥ 30 dB
j)	Trans-Receive Isolation	≥ 80 dB
k)	Feed insertion loss	
	i) Transmit	≤ 0.2 dB
	ii) Receive	≤ 0.25 dB
l)	Feed mount type	Cassegrain
m)	VSWR (Return loss)	
	a) Transmit ports	$\leq 1.30 : 1$ (17 dB)
	b) Receive ports	$\leq 1.30 : 1$ (17 dB)
n)	Output wave guide flange interface	CPR – 137 G
	a) Transmit ports	CPR – 229 G
	b) Receive ports	
o)	Power handling capacity	≥ 500 W CW

(B) Mechanical Specifications		
p)	Antenna orientation	Motorized version for AZ, EL & POL/Feed Alignment along with Manual override.
q)	Antenna steerability a) Elevation b) Azimuth c) Polarization adjustments	15° to 90° (continuous) ± 50° (continuous) ± 90° (continuous) (Scale(s) to be provided for indication)
r)	Wind Speed a) Operational b) Survival	70 kmph 110 kmph
s)	Lightening Protection	Provision for Lightening arrester for antenna.
© MOTORISED CONTROL OF ANTENNA		
a)	Controls required	Azimuth, Elevation and Polarisation/Feed.
b)	Front panel Angle indications	Azimuth, Elevation and Polarisation/Feed.
c)	Safety requirements	i) Limit switches to interlock in each direction of travel. ii) Emergency 'stop' control. iii) Provision for grounding/Earthing.
d)	Antenna Controller should have	i) The facility for auto-pointing. ii) Capable of storing co-ordinates for at least 5 parking slots. iii) Facility for motor operation in continuous and step mode.
e)	Input power requirement	3 phase 400V±5% /single phase 230±10% VAC, 50±2 Hz.
f)	System interconnect cabling	Shielded cable as per requirement up to a max. length of 1500 ft.

Installation of PDA will include hoisting of the parabolic dish antenna, routing of the wave guide/RF cable on cable tray from the PDA to indoor system. Providing of earth pits as per AIR Specifications (earth resistance of less than one ohm) for equipment rack, PDA, lighting arrester etc. at site. Foundation of PDA will be done by the tenderer as per the design given by its OEM and as per soil bearing capacity. Test of soil will be conducted by the successful tenderer through an authorized agencies and got certified from a Govt Engineering college and copy of the report shall be furnished.

2. 50W C-BAND SOLID STATE POWER AMPLIFIER (SSPA)(1+1) WITH AUTO CHANGE-OVER UNIT FOR S.S.P.A. ALONG WITH DUMMY LOAD.

SSPA shall be of compact and composite construction, lightweight and rack mounted with front access for operation and control, etc. It shall be offered along with its inbuilt/ associated power supply unit. It shall also have front panel meter to monitor Forward power, VSWR alarm, Reverse power and indications for status, alarm, faults, over temperature, etc. The SSPA should have its own cooling arrangements and should not require any external cooling.

a)	Type	:	SSPA
b)	Rated continuous o/p power: (P1dB)	:	+ 46 dBm
c)	Input Freq.	:	5850 – 6425 MHz
d)	Gain Frequency Response:	:	± 0.6 dB over any 40 MHz
e)	Saturated output power	:	50 W
f)	Gain	:	≥ 46 dB
g)	R.F. level control	:	0-20 dB continuous
h)	Gain stability over full temp.range	:	: ± 1.5 dB
i)	Input VSWR	:	≤ 1.3 : 1
j)	Output VSWR	:	≤ 1.3 : 1
j)	Phase Noise	:	Should meet IESS 308/309
k)	Harmonic	:	Better than : - 50 dBc (at rated output)
l)	Spurious (in band)	:	Better than : - 60 dBc (at rated output)
m)	S.S.P.A. standby operation:	:	1 + 1 hot redundancy auto change- over with manual over ride.
n)	Mounting	:	19" Rack
o)	Two tone inter-modulation : at 3dB total back off from 1 dB compression point	:	-25 dBc or better
p)	Monitoring	:	RF Sample output port
q)	RF input connector	:	N female
r)	RF output	:	CPR137
s)	Operating temp. range	:	0° to +50°C

3. SYNTHESIZED IF TO C- BAND UPCONVERTER (1+1) WITH AUTO CHANGEOVER UNIT

It should be possible to operate the upconverter manually. The upconverter should not require a PC or a controller for normal operation and control. Any interface required for operation in 1+1 hot standby mode with auto changeover shall be included in the offer.

- | | | | |
|----|----------------------------|---|---|
| a) | Input Frequency | : | 52 MHz to 88 MHz |
| b) | Output Frequency | : | 5850 MHz to 6425 MHz |
| c) | Frequency setting | : | Synthesized, 125 KHz step size |
| d) | Frequency stability | : | Better than $\pm 1 \times 10^{-8}$ over temp. 0° to 50°C & $\pm 1 \times 10^{-9}$ or better per day |
| e) | Input impedance | : | 75 Ω |
| f) | Output Impedance | : | 50 Ω |
| g) | Input level | : | -15 dBm nominal |
| h) | Input connector | : | BNC-F |
| i) | Input Return loss | : | 19 dB or better |
| j) | P1 dB Output level | : | +10 dBm or more |
| k) | Overall Conversion gain | : | 30 dB or more |
| l) | Gain control | : | 30dB in steps of 0.2 dB or smaller. |
| m) | Gain Slope | : | ± 0.05 dB/MHz |
| n) | Output Return loss (VSWR): | : | 19 dB or better ($\leq 1.25 : 1$) |
| o) | Amplitude / Gain stability | : | ± 0.25 dB per day at constant temp. |
| p) | Type of conversion | : | Dual conversion spectrum non-inverted |
| q) | Third order IMD Product | : | -40 dBc with two equal carriers at 10 dB total output Back off from P1 dB. |
| r) | Phase noise | : | -70 dBc/Hz, 100 Hz away from carrier
-80 dBc/Hz, 1 KHz away from carrier
-100 dBc/Hz, 1 MHz away from carrier |
| s) | Spurious (in band) | : | -60 dBc below carrier (un-modulated) |
| t) | Standby operation | : | 1 + 1 hot redundancy, auto change-over with manual over ride feature. |
| u) | Mounting | : | 19" Rack |

- v) Test Port : IF and RF
- w) Remote Interface : R S232/ RS485 for parameter setting
- x) Front Panel Indications : Power, Standby, Fault, Remote/Manual
- xi) Operating temp. : 0 to +50°C

4. AUDIO BASE BAND DIGITAL ENCODER

ENCODER

Design Standards	
The system shall be designed to meet the international standards for digital broadcasting by satellite known as the MPEG-2 DVB-S / DVB-S2 standards selectable without any hardware changes. It should be possible to provide programme specific information, service name, language description and other related routine data. The system should have a open access to the transmitted service.	
The Encoder should support following features: (as per EN 300 421 standards)	
BISS Mode 1 and BISS-E	
Video Inputs is not required	
Output via ASI Stream	
Audio Inputs	
The encoder shall be capable of accepting AES/EBU and Balanced analog XLR inputs. AES/EBU and Balance analog XLR, 2 stereo or 4 mono channels, Expandable up to 4 stereo Channels.	
Input freq. range	20Hz to 20KHz
Sample rate	48.0 kilo samples/second
Data rate	64-256 kbps (MPEG-1, layer 2 Audio) selectable per channel
Audio Compression	MPEG1 layer 2
DATA INPUT	
Auxiliary Data Multiplexing	
The encoder shall be capable of the transmission of broadcast data signals and audio.	
Physical Interface (Connector)	D type or MPE (RJ45) connector
Electrical Interface	RS-232C or IP
Data Rate	up to 38.4 kb/s, asynchronous
Synchronous Serial Data Input	
Physical Interface (Connector)	subminiature 'D' type
Electrical Interface	RS-422

5. DIGITAL IF MODULATOR(1+1) with Auto Changeover Unit

Modulator is to be DVB S/S2 compliant	
ASI Inputs	2 nos.
Compliance	1. Backward compatible mode. (Should be capable of operating on both DVB-S & DVB-S2 mode, one at a time) 2. Constant Coding and Modulation (CCM).
Inputs bit-rate	upto 30 Mbps
Forward Error Correction and Modulation Scheme	
FEC Coding(LDPC), RB & Convolution	DVB-S: 1/2, 2/3, 3/4, 4/6, 7/8, DVB-S2: 1/3,2/5,1/2,3/5,2/3,3/4,4/5,5/6,8/9,9/10
Spectrum Roll off factor	DVB-S: 25% and 35% selectable DVB-S2: 20%, 25% and 35% selectable
Modulation Format	DVB-S: QPSK DVB-S2: QPSK
Transmission Rates	Variable, 0.05 to 30 M symbols / sec

IF Output Interface Specifications(In case of 70 Mhz Upconverter)

Output Frequency Range	52 to 88 MHz tunable
Synthesizer Step Size	1 kHz, step
Frequency Stability	<± 0.1Khz (all causes over 10 years)
Output Impedance	75 ohms unbalanced
Connector	BNC, female
Output Return Loss	>20 dB (50 – 90 MHz)
Output Level Range	-20 to 0 dBm
Level Step Size	0.1 dB, steps
Spurious Outputs	<-65 dBc/4KHz@-10dBm
Synthesizer Phase Noise	Meets requirements of IESS-308
CW mode	Selectable
Noise floor (C/ No)	< -120 dBc/Hz
Spectrum sense	Normal/Inverted

6. INTER FACILITY LINKS (In Uplink Chain)

The tenderer shall quote for Wave guides, couplers, adaptors, cables and other accessories required for Antenna connection to the output of SSPA. All these accessories shall be of professional standard and compatible with the system. Make, Technical specifications and detailed quantity of each of these shall be mentioned clearly in the offer.

7. WIRED RACKS FOR EQUIPMENT

All equipments like Digital encoder, Digital Modulator, Upconverters, SSPA, Dehydrator, Antenna Controller, UPS, Digital Receiver, PC, etc. shall be installed in the industrial Standard Size (46 U) wired racks (3 Nos.) along with requisite jack –strip, tag block, patch cords & other item. The racks must be properly fitted & earthed.

8. ACCESSORIES FOR SYSTEM INTEGRATION

Interconnecting cables, power supply cables, suitable Audio Distribution Amplifiers, Power Splitter, connectors and other accessories required for the integration of the complete Captive Earth Station system shall be included in the tender.

9. DEHYDRATOR

A dehydrator for pressurizing the wave guide with dehydrated air, connecting HPA output to the antenna shall also be quoted along with all accessories, tubings etc.. It shall be compatible with the feed system and SSPA system etc.

1.	Air Capacity/Flow rate	60 Litres / Hour.
2.	RF-line pressure	Adjustable Upto 0.35 bar
3.	Pressure control	RF line pressure adjustable reduction valve
4.	Over pressure protection	Automatic through safety valve
5.	Pressure indication	Pressure gauge for the complete range of pressure

10. Professional Grade C-BAND LNBC (Make & Model to be specified)

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 ± 2 PPM
f)	Noise temperature	$\leq 35^\circ\text{K}$
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

11. CABLE

i) Impedance : 75 Ohms, (ii) Loss: ≤ 3.5 dB/ 100 Feet at 1500 Mhz.

12. Professional IRD Receiver

The IRD should have a front panel display and one should be able to enter or edit all the parameters for a perfect reception of the signals. There should be provision for observing the BER of the signal and signal level on the front panel. It will be required for receiving **Audio Signal Only**

RF Parameter Specifications:

(a) Input Frequency Range	950 - 1750 MHz
(b) No. of Inputs	1 nos.
(c) Tuning Step Size	1 kHz
(d) Satellite Frequency Band	C- & KU-Band, selectable
(e) Input Impedance	75 Ohms
(f) Input Connector	F-Type female
(g) Input Power Range	-30 to -85 dBm per carrier
(h) Image Rejection	>30 dB
(l) De-Modulation Method	DVB-S QPSK, DVB-S2 QPSK demodulation
(m) Variable Symbol Rates	0.256 to 30 M sym/sec,
(n) Convolutional Inner FEC Rates selectable	R= 1/2, 2/3, 3/4, 5/6, 7/8 (DVB-S, QPSK) R= 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10 (DVB-S- 2, QPSK),
(o) IF Filter Bandwidth	Automatic Selection (dependent on Symbol Rate).

Audio and Video Decompression Parameters

(a) Audio Decompression Type MPEG-1 Layer-II audio (Stereo/ Musicam, i.e. Single Mono, Dual Mono, Stereo,

Transport Stream O/P : DVB-ASI on BNC

Audio Output -

Each analog audio output shall be presented as a stereo pair. In the event of "Mono" transmissions, the same encoder input channel will be output to both left and right connectors. In other modes ("Stereo", and "Dual Mono"), the two encoder input channels will be output as left and right.

Analog Audio Output Specifications

(a) Output Impedance	600 Ω (balanced)
(b) Number of Outputs	2 Stereo, configurable as Stereo, Single mono, Dual mono.
(c) Connector Type	XLR Male Socket or with suitable XLR Adapter

Digital Audio Output Specifications

(a) Output Level	2 to 7 volts
(b) Output Format	AES/EBU
(c) Load Impedance	110 Ohms
(d) Connector Type	XLR male Socket or with suitable XLR adapter (i.e. no terminal block)
(b) Number of Outputs	2, Stereo Channels

Audio Performance Specifications

(a) Peak Output Level	+ 18 dBm into 600Ω balanced
(c) Sampling Rates	48 KHz
(d) Frequency Response	40 Hz to 20 kHz ± 1 dB
(e) THD	<0.3 % at 1 kHz
(f) Dynamic range	> 60 dB
(g) Cross talk at 1 kHz	> 60 dB,
(i) Signal to noise ratio	> 60 dB

13. INTER-CONNECTING CABLES, CONNECTORS AND ACCESSORIES

Interconnecting RF & Audio cables, power supply cables, connectors, L Band Splitter, audio patch cords (20 nos., assorted length) and other accessories required for the monitoring system shall be included in the tender.

14. L- BAND LINE AMPLIFIER

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)	± 2 dB
8.	Operating voltage (Through centre conductor of the RF cable)	+14V to 24 VDC
Features :		
a) Capable of handling voltage required for LNBC.		
b) Provision for wall mount installation		

15. UPS 2 x 5 KVA

2 x 5 KVA online single phase UPS, with 30 minutes full load battery backup, sealed maintenance free batteries shall be supplied in (1+1) parallel configuration. Each such unit (i.e. 5KVA UPS in 1+1 parallel configuration) shall be required to be supplied at each site.

1.	Type	On line, pure sine wave
2.	Power rating	5 KVA, Single phase
3.	Configuration	(1+1)Parallel Redundant load sharing mode
4.	Output Bus bar	The output of both the UPS's will be connected to a single bus bar. Normally when both UPS's are OK they shall share 50:50 loads. In case of failure of any of the UPS, full load will be taken over by other unit.
5.	Battery back up	For 30 minutes operation on full load
6.	Type of Battery	Sealed Maintenance free battery. Separate Battery pack has to be provided for individual UPS. (Batteries need not be Rack Mounted)
7.	Input voltage range	230±20% V A/C (at full load)
8.	Input frequency range	50 ± 5% Hz
9.	Output Voltage	220V, 50 Hz, Single phase
10.	Output Voltage regulation	+/- 2%
11.	Output frequency	50 Hz
12.	Type of approval	ISO certified, standard, reputed make
13.	Metering & indicators	It should be possible to monitor battery low, over Load etc. through Meters/Indicators & Network Management Software (NMS). It should also be possible to monitor all types of alarms.
14	Maintenance Bypass	Suitable circuit breakers be provided to facilitate removal of defective or installation of repaired UPS without affecting normal operation at load side.

16. NETWORK MANAGEMENT SYSTEM (NMS)

The Monitoring & Control Software shall have all the necessary features and parameters. The measurement package shall also include various sensors/interfaces etc., for acquiring data from Digital encoder & modulators, upconverters and SSPA on the uplink side and IRDs on the downlink monitoring side. The system shall also be able to communicate with UPS etc. The data thus acquired from these equipment shall be analysed by the system for storage and continuous display of the following parameters for all the channels uplinked from the Earth Station.

- a) Uplink frequency
- b) Carrier power
- c) Down link frequency
- d) Down link C/N
- e) Eb /No

16. Laptop and Laser jet Printer

Laptop of reputed make with latest operating system (licensed in the name of consignee) shall be provided along with recovery CD for future reloading. Laser jet printer of reputed make of reasonable speed is to be provided.

Laptop shall be mounted in the rack.(slide-in mechanism) It shall be used for control and setting of the operational parameters for Digital encoder, modulators, Upconverters and SSPA on the uplink side and Digital SCPC Receivers on the downlink monitoring side.

18. INSTALLATION & COMMISSIONING

Installation will include 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.

19. DIGITAL TEST SET/ TRANSMISSION ANALYSER

This equipment is essentially required to measure the Bit Error Rate (BER) & other communication parameters of digital channel of the overall Captive Earth Station from the input of the uplink chain to the downlink monitoring SCPC Receiver output. The equipment shall therefore, generate the necessary transmit signals for BER & Modulation measurement, which are compatible with the Digital Encoder/Digital modulator on the uplink side. Similarly, the equipment shall have the capability to receive and analyse the digital signals received from the Digital SCPC Receiver on the downlink

monitoring side. The data rates and data interfaces provided in the equipment shall be compatible with the Digital Encoder/Modulators and Digital SCPC Receiver. Following features are required for measurements:

1.	Multi interface capability	V.35, V.36/ RS-449, V.11/ X 21, RS - 232
2.	Test Patterns	n X 64 kbps channels of framed signal, unframed signal
3.	PRBS	$2^n - 1$ where n= 6,9,11,15 Alternating 1 and 0s, All 1s, All 0s, 8 bit and 16 bit programmable words.
4.	Error injection	Bit, Code, CRC errors, Single, ratio (Single , Continuous or burst) or frequency
5.	Clocking	Internal (2048 kbps), External, From RX
6.	Front panel Display	LCD
7.	Stores/ Memory	8 test result memories and 8 configuration store memory.

20. SPECTRUM ANALYZER

1.	FREQUENCY a) Range b) Tuning Resolution c) Span d) Accuracy	: 100 KHz to ≥ 6.7 GHz : 1 Hz :10 Hz to full range; 0 Hz (for Zero Span) : 1×10^{-6} or better
2.	BAND WIDTH a) Resolution BW b) Video BW	: 10 Hz to 3.0 MHz in 1-3 Steps : 1 Hz to 3.0 MHz in 1-3 Steps
3.	SWEEP TIME a) Zero Span b) Non Zero Span c) Sweep Trigger	: upto 600 s. : 200 ms to 600 s : Free Run, External ,Video

4.	AMPLITUDE a) measurement range b) Input Attenuator c) Max. input d) DANL e) Overall Accuracy f) Disp. per Division g) Measurement Units i) Log ii) Linear	: Displayed Average Noise Level to + 30 dBm. : 0 dB to 60 dB in 5/10 dB Step Size. : +30 dBm : Better than -150dBm : ± 1.5 dB (or better) : 1 dB to 15 dB dBm, dBmV, dB _μ V mV, μV, μW, nW
5.	SPECTRAL PURITY a) 10 KHz offset from carrier b) 100KHz offset from carrier	<i>SSB Phase Noise</i> : -98 dBc/Hz : -100dBc/Hz
6.	DISPLAY	High resolution LCD color display
6.	DEMODULATED O/P	AM and FM on internal speaker/connector
7.	DIRECT MEASUREMENT FUNCTIONS Marker Functions	: Adjacent Channel Power Ratio, Occupied Bandwidth, Channel power : Standard, Delta, Marker to Peak etc for measurement of level etc.
8.	Memory	: Should have provision for storing ≥ 200 Setups/Traces in Internal / External memory (Flash card).
9.	Calibration and Self Test	: In-built diagnostics system for self-tests and calibration routines for the instrument to remain within defined tolerances and maintain its accuracy of measurement
10.	GENERAL a) USB 2.0 or equivalent b) RF Input	: For Data transfer to & from PC. : N female, 50Ω
11.	a) Operating TEMP. RANGE b) Power requirement	: 0° to + 40° C : 230V ± 10%, 50 ± 2 Hz, single phase

21. SPARES (Optional):

OEM recommended essential maintenance spares must be quoted by the tenderer for items offered including SSPA, Upconverter, Encoder, modulator, IRD.

SECTION - 'C'

DRAFT ATP

1 INTRODUCTION

This document describes the Acceptance Test Procedure (ATP) for testing the various units of CES Equipment under procurement. It covers the details of the item to be tested, list of equipment required for testing and the tests required to be carried out.

2 ITEMS TO BE TESTED

- i) Solid State Power Amplifier (SSPA).
- ii) Up-converter.
- iii) Digital Encoder and Modulator.
- iv) Monitoring System comprising of LNBC, L-Band Line Amplifier and IRD, etc.
- v) Spectrum Analyzer.
- vi) Transmission Analyzer
- vii) UPS
- viii) Audio Limiter
- ix) Personal Computer/Workstation.

3 TEST EQUIPMENT

- a) All requisite test equipment conforming to the required standard for testing and commissioning shall be provided by the supplier.
- b) List of the test & measuring equipments :

(This is a **tentative list**. Additional equipment shall be specified by the indenter if needed).

- i) Audio Analyzer and Spectrum Analyzer (>8 GHz range)
- ii) Power Meter with sensor & Attenuator etc. (Capable to measure 125 W)
- iii) Frequency counter (≥ 7 GHz)
- iv) Signal Generator (≥ 7 GHz)
- v) Noise figure meter with noise source.
- vi) Digital Modulation Analyzer
- vii) PC with Printer
- viii) Any other equipment and standard reference source/setup necessary for measurements.
- ix) Calibrated Directional coupler, inter-connecting cables, Attenuators, combiner, Dividers, adapters etc. as may be necessary for the tests.

4. TESTS REQUIRED TO BE CARRIED

(NOTE: This is only a **tentative list**; Additional items of tests may be specified and carried out by the indenter, if needed.

4.1 S.S.P.A.

- i) Functionality test for individual SSPA and in (1+1) configuration.
- ii) Power output check
- iii) Gain check
- iv) Gain flatness check
- v) Frequency response
- vi) IMD Product
- vii) Spurious
- viii) Any other tests to check the conformity to the specs.

4.2 UP-CONVERTER :

- i) Functionality test for individual up-converter and in (1+1) configuration
- ii) Output frequency check
- iii) Output level and stability check
- iv) Frequency stability
- v) IMD Product
- vi) Spurious check
- vii) Phase Noise check
- viii) Any other test to check the conformity to the specs.

4.3 DIGITAL MODULATOR AND DIGITAL ENCODER

- i) Functionality test for individual modulator and in (1+1) configuration
- ii) I.F. Range
- iii) O/P Frequency stability and accuracy
- iv) O/P level stability
- v) Coding standard, data rates check
- vi) Digital modulation selectability check
- vii) All Base-band measurements alongwith receivers
- viii) Spurious Check
- ix) Any other test to check the conformity to the specs.

4.4 MONITORING SYSTEM

- i) Functionality check for individual monitoring setups for Digital demodulator.
- ii) Test for LNBC - output frequency level, L.O. stability, Noise Temp., phase and spurious noise, gain etc.
- iii) Test for IRD Receiver including carrier lock range, Eb/No, Analogue and digital (AES/EBU) outputs, level, THD, Noise level, Freq. Response and Cross Talk for both stereo channels, BER immunity test etc.

4.5 ANTENNA SYSTEM (at Site): The tests for antenna will include:

- i) Antenna functionality test as per details given in the specifications.
- ii) Antenna transmit Gain.
- iii) Antenna Radiation Pattern : **The radiation pattern conforming to ITU standard specified shall be got cleared from NOCC by the Supplier.**
- iv) Receive Gain
- v) Cross Pole Discrimination
- vi) VSWR/ Return loss
- vii) Port to port isolation.
- viii) Any other test to check the conformity to the specs

4.6 INTEGRATED SETUP (AT SITE)

- a) After the individual tests the equipment will be installed and integrated to work as CES as per specs. The integrated setup will then be tested for complete system performance and functions.
- b) The tests for commissioning would include the integration check and conformity to system specs including:
 - i. EIRP Stability
 - ii. Radiation conformity to ITU Standard specified
 - iii. Emissions conforming to International Standard for Satellite transmission.
 - iv. Overall uplink/down-link check and performance measurements to meet the specs.
 - v. Any other tests necessary to check the conformity to specs.

4.7 PERIPHERAL EQUIPMENT

All peripheral equipment like UPS (battery details like nos. & rating), PC (System configuration and installed software etc.), Test & Measuring equipment (functionality operation etc.) etc. shall be tested for the various functionalities specified and conformity with the specification.

4.8 In addition, all the manuals/ drawings will be inspected for completeness.

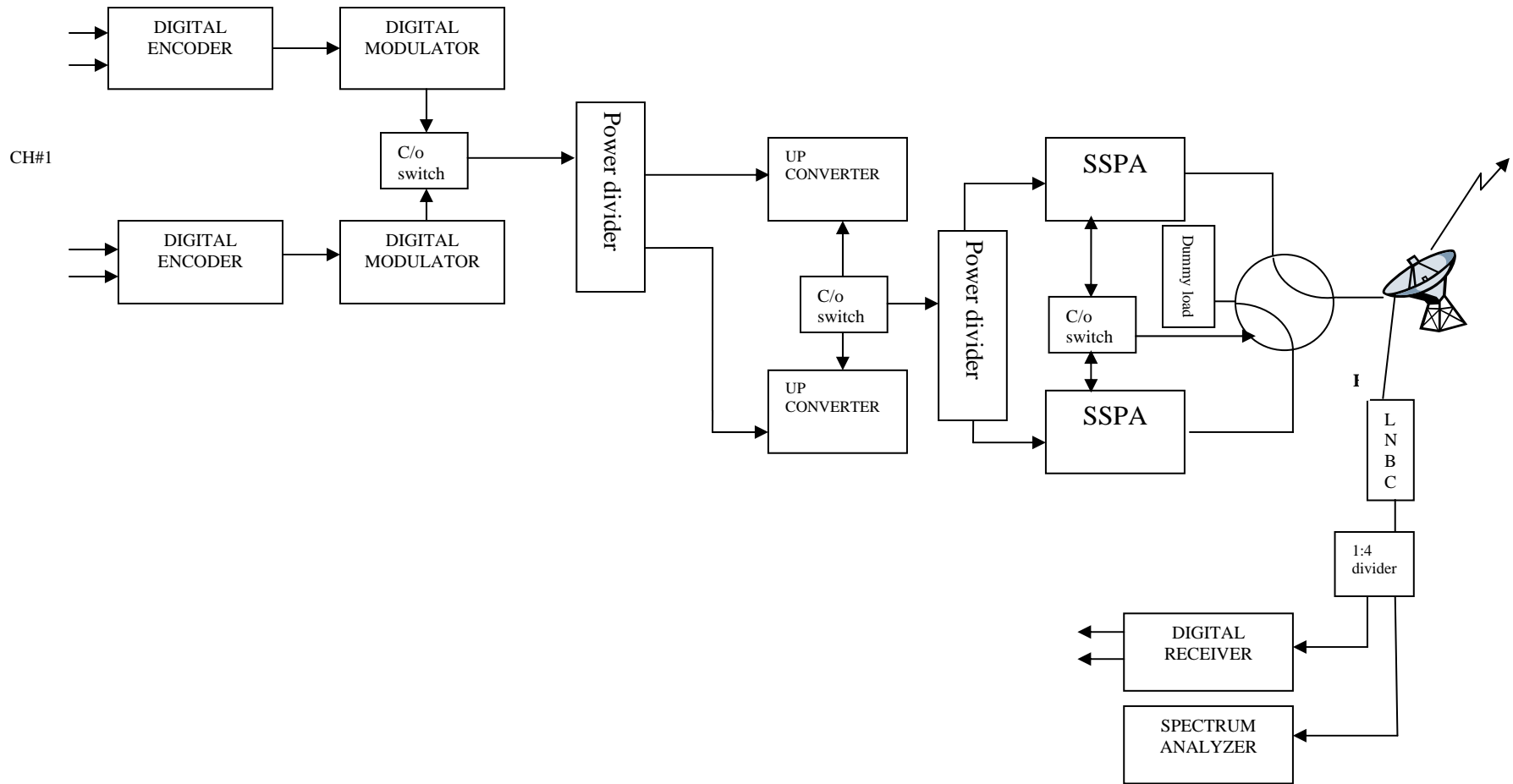
5. GENERAL

- i) Based on above, supplier shall give a detailed ATP document giving procedure for tests of individual item as well integrated setup. This should include test setup, equipment details, inter-connection diagram and the Format for test reports
- ii) The indenter will examine the same and then it will be finalized after mutual discussion.

REPRESENTATIVE BLOCK DIAGRAM OF CAPTIVE EARTH STATION

ANNEXURE I

INSAT 3C



Note: UPS & NMS monitoring etc. not shown