



# All India Radio

Internet  Services

**PRASAR BHARATI  
(BROADCASTING CORPORATION OF INDIA)  
ALL INDIA RADIO  
(TELECOM CELL)**

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## SPECIFICATIONS COVER SHEET

TITLE : Specification for Digital-cum-Analog **C/S**-Band  
RN Terminal

SPECIFICATION NO. : TC/SPEC/08/2003/RNT

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SCHEME : Provision of C Band RN Terminals at 28 AIR  
stations under 10<sup>th</sup> Plan .

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**No.TC/SPEC/08/2003 ( C/S- Band RNT)**

**SPECIFICATION FOR C/S- BAND DIGITAL-CUM-ANALOG 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 net-working through INSAT series of Satellites.

The RN Receive Terminals located at AIR stations, act as Ground Terminals, to receive S-Band/C-Band transmissions through satellite. These programmes thus received through RN Terminal, are fed to the transmitters for broadcast purposes.

AIR has so far been using S-Band RN-Terminal for reception. The presently installed S Band RN Terminals at AIR stations are based on old technology which has become totally obsolete now a days. In the IX plan itself phased change over to C-Band has been started and all the major AIR stations have been provided with C- Band RN Terminals . Now there is a proposal for providing C band RNT at 19 new 1 kW FM AIR stations under NE special package and 09 other new forthcoming AIR stations. Hence it is proposed to provide **C/S-** Band RN Terminal at 28 new AIR stations . This will facilitate to provide both C band and S band downlink at new AIR stations.

Sections below give details of the scope and specification of these Receive terminals. The Networking through satellite is in SCPC mode. Details of the networking & INSAT system parameters are also furnished to enable tenderers to design & offer the appropriate system compatible with the existing setup.

**2. CONFIGURATION OF THE SYSTEM :**

The configuration for each Receive System is shown in the diagram enclosed as **Annexure - 'D'**. It includes :

- |     |  |       |
|-----|--|-------|
| 2.1 | Parabolic Dish Antenna (6.0Meter Nominal )<br>with feed and accessories        | 1 set |
| 2.2 | S band Parabolic Dish Antenna (3.66Meter Nominal)<br>with feed and accessories | 1 set |

2.3	LNBC C-Band 1+1 with low loss cable and 1:4 Power divider	1 set
2.4	LNBC S-Band 1+1 with low loss cable and 1:4 Power divider	1 set
2.5	Digital Receiver	3 Nos.
2.6	Analog Receiver	3 No.
2.7	Full size wired rack with jack strip and tag block (Refer Annexure E & F )	1 No.
2.8	Stereo Monitoring Amplifier(10 W) with a set of matched speakers	1 Set
2.9	RF cable and connectors And Integration material	According to requirement. Rates may be quoted per meter of the cable
2.10	PC	1 No.
2.11	Installation and Commissioning	
2.12	Training as per tender requirement <b>(Optional)</b>	
2.13	ATP	

### 3 SCOPE

- 3.13 The scope of this tender 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 these C/S- Band receive terminals at site will be carried out by the supplier.
- 3.14 After acceptance of the tender, the tenderer should also provide detailed plans of supply of material and testing as per ATP.
- 3.15 The indenter will provide the necessary space for the installation of the equipment, layout of the cable and location of the parabolic dish antenna (wherever applicable) etc.
- 3.16 The complete installation of RN Terminal will be carried out by the tenderer after placement of order. At few locations antenna may be required to be installed at the roof top. Also at some locations , ground leveling or construction of platform may be required for proper insallation of the antenna.
- 3.17 During the installation of these equipment, supplier will 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 and disruption of services is done due to process of installation and commissioning.
- 3.18 The tenderer shall ensure that the equipment offered fully incorporate the standard features for safety and protection including shielding from EMI.
- 3.6 Inspection will be carried out at supplier's works / site in India by engineer(s) of All India Radio. Complete specifications and details will be checked and all parameter values will be measured. Typical details are enclosed in Draft ATP. The inspection will be carried out on these lines.

The supplier shall put up all the equipment for test on the test bench at his premises before the AIR Representative and shall provide, electric energy, consumable materials, tools, testing instruments, labour and assistance of every kind for carrying out acceptance tests.

- 3.7 One week training for 12 engineers (two engineers from each zone , one from STI(T) and one from Directorate) in servicing of the equipment will be required to be arranged at a centralised location in the country. In addition to above, tenderers are also required to arrange two days' training at five locations (one in each zone) on site to AIR personnel on operation and maintenance of the equipment at each of the above locations.

### **3 LOCATION FOR SUPPLY OF RN TERMINAL EQUIPMENT:**

These RN Receive terminals will be supplied at the locations listed in **Annexure-'A'**.

### **4 SYSTEM PARAMETERS & COMPATIBILITY :**

The system parameters of AIR's Radio Net-working system and INSAT system details are enclosed as **Annexure - 'B'**. While quoting for the RN Terminals, the tenderer may refer to these details to ensure conformity to the existing uplink system.

### **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 should be based on industry standard and state of art technology.

### **7. GENERAL CLAUSES :**

- (i) The supplier shall intimate the source of supply and technical parameters for major and critical components/spares so that no difficulty is encountered later on in procuring the spares for maintenance and repair of these equipment.
- (ii) If at any stage during next ten years the manufacturer stops production of these equipment, he shall intimate AIR in advance to enable AIR to stock the critical items of spares for the life of the equipment.
- (iii) Warranty and guarantee clause will be as per the terms and conditions specified in the commercial section of the tender in this respect.
- (iv) The supplier will be required to quote all the optional items.
- (v) The supplier will have to provide list of clients for whom they have offered equipments/subsystems quoted in this tender.
- (vi) The supplier may be asked to demonstrate the working of the complete or in partial quoted system if required.

## 8. TECHNICAL SPECIFICATION FOR DIGITAL CUM ANALOG RECEIVE TERMINAL

The Digital cum Analog Receive terminal should conform to the following technical specifications.

### 8.1 C- BAND ANTENNA

#### 8.1 Specification for 6M Diameter C-Band PDA:

##### 8.1.1(A) Electrical Specification:

i)	Diameter	Nominal Diameter of 6Meter to meet the gain requirements mentioned below.
ii)	Frequency Range	3.7 –4.2 GHz
iii)	Receive gain at 4Ghz	>46 dBi
iv)	Receive G/T	Better than 24.5 dB/°K
v)	Pointing Accuracy	Better than $\pm 0.25^\circ$
vi)	Side Lobe Level/Gain Pattern	As per ITU-R-580 Rec
vii)	Tracking mode	Manual (motorized may be quoted as optional). The Antenna should have calibrated marking for Elevation & Azimuth angle indication.

##### 8.1.2(B) Mechanical Specification:

SI No	Parameter	Specification
1	<b>Reflector Structure:</b>	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 tubs/angles and mounted over trusses emanating from the central hub.
	i) Reflector Material:	Perforated Aluminum sheet with thickness of at least 2.5mm
	ii) Coated with:	Non metallic 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	<b>Antenna Stand:</b>	
	Mount:	Kingpost
	Material:	Heavy duty, Hot dip Galvanized steel make and coated with anti corrosive paint.
4	<b>Steerability:</b>	
	Elevation:	15° to 85° (continuous)
	Azimuthal:	$\geq \pm 55^\circ$ (continuous, without change of mount position)
5	<b>Wind Load:</b>	
	Operational:	80 KM/Hr

	Survival:	150 KM/Hr
6	<b>Environmental:</b>	
	Temperature:	-5° to +50°C
	Relative Humidity:	95%
	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 the antenna. One no of proper earth pit will have to be provided for earthing the lightning arrester of the antenna.

## 8.2 DETAILS OF THE FEED

i)	Type of Mounting	Receive Prime Focus. Provision for adjustment of the feed should be made. It should have calibrated polarization angle indication and adjustable smoothly for optimization.
ii)	Ports	Receive Two (Orthogonal)
iii)	Polarisation	Linear (adjustable, $\pm 90^\circ$ )
iv)	Freq. Range	3.7 - 4.2 GHz
v)	Return loss at Centre freq.	$\geq 17$ dB
vi)	Connector/ Output mating flange	Wave-guide WG229G
vii)	Output Impedence	50 Ohms
Viii)	Cross-Polarization discrimination	$\geq 33$ dB (on axis) 30 dB (1 dB BW)

**Note :** Feed of C-Band antenna would be two port (orthogonal). One LNBC would be mounted over each port. At a time only one LNBC output would be connected to the input of 1:4 power divider. The other LNBC mounted over orthogonal port will serve as cold stand by. Arrangement should be provided so that by rotating the feed by  $90^\circ$ , the standby LNBC could be brought into circuit by connecting corresponding cable of standby LNBC to the 1:4 divider.

## 8.3 Cable

Only good quality professional grade cable may be quoted with following specifications

i)	Cable Loss( RG 35 with F connectors at both ends)	$\leq 3$ dB/100 feet at 1450 MHz
ii)	Impedance	75 $\Omega$

## 8.4 L Band Splitter

Only good quality professional grade splitter may be quoted with following specifications :

(a)	Type of splitter	Preferably passive type
(b)	No.of outputs	Four

(c)	Division loss	6 dB or less
(d)	Input impedance	75 ohm
(e)	Output impedance	75 ohm

### 8.5 C- BAND L.N.B.C.

i)	Input Freq. Range	3.7 - 4.2 GHz
ii)	Output freq.	950 - 1450 MHz
iii)	Input Impedance	50 $\Omega$
iv)	Output impedance	75 $\Omega$
v)	Input connector	WR 229 G Flange
vi)	Noise temperature	$\leq 45^\circ\text{K}$
vii)	Conversion gain	$\geq 55$ dB
viii)	Gain flatness	$\leq \pm 2$ dB, p-p over full band
ix)	Input/Output return loss	$\geq 12$ dB
x)	Input/Output interface	As per antenna/receiver
xi)	Dynamic range (1 dB GCP)	$\geq 80$ dB
xii)	Minimum Image rejection	-60 dB or better.
xiii)	Spurious / Harmonics	$\leq -50$ dBc.
xiv)	Power supply	+15 to +24 V through output connector.
xv)	Phase noise	
	@ 1 KHz	-65 dBc/Hz
	@ 100 KHz	-85 dBc/Hz
xvi)	L.O. Stability	PLL, better than $\pm 2$ PPM over the temp.range from $0^\circ$ to $50^\circ\text{C}$ and over 24 Hrs.
xvii)	G/T of Receive system	$\geq 24.5$ dB/ $^\circ\text{K}$ (at 4 GHz, Elev.= $15^\circ$ )

### 8.6 DIGITAL RECEIVER (DEMODULATOR + DECODER)

The Digital receiver should conform to the standard and specification of the existing digital radio networking system. The existing digital modulators/ encoders are Comstream Radyne make . So receiver should be compatible with the same.

i)	Input	
	a) Freq. Range	950 - 1450 MHz
	b) Freq. Tuning	Resolution $\leq 25$ KHz Local (remote control optional)
	c) Impedance	75 $\Omega$
	d) Level	-25 dBm to $\leq -70$ dBm
ii)	Demodulation	QPSK (Optional BPSK user selectable)
iii)	Carrier lock range	$\geq \pm 500$ KHz

iv)	FEC decoding	Rate $\frac{1}{2}$ Viterbi-decoding, sequential-decoding (optional) (Selectable Rate preferred)
v)	Audio decoding	ISO/MPEG-I/Layer-2
vi)	Data rates (Selectable)	64, 128, 192 & 256,kbps (QPSK) 64, 128, 192 & 256 kbps (BPSK)
vii)	Modes	Mono, Dual mono & Joint stereo
viii)	Audio output	
	a) Impedance	Balanced, 600 $\Omega$
	b) Level (Maximum)	+ 8 dBm (adjustable)
	c) T.H.D.	$\leq 0.2\%$ (at +8 dbm output at 1 kHz)
	d) Audio signal bandwidth	20 Hz to 20 KHz
	e) Frequency response	$\pm 1.0$ dB (20 Hz to 20 KHz)
	f) Signal to Noise ratio	$\geq 70$ dB (referred to +8 dbm)
	g) Dynamic range	$\geq 80$ dB
	h) Cross-talk ratio	$\geq 75$ dB.
	i) Audio output channels	Two mono/one stereo
	j) Digital Audio output	AES / EBU STANDARD (Professional)
ix)	Required Eb/No (B.E.R. $\leq 10E^{-5}$ )	$\geq 5.5$ dB(QPSK) , 5 dB (BPSK)
x)	B.E.R. Immunity At 128 kbps, QPSK, Vit. rate $\frac{1}{2}$ at 5.5dB Eb/No	$1 \times 10E^{-4}$ for no subjective loss in quality
xi)	Audio Sampling Rate	48 KHz
xii)	Stereo Phase deviation	Less than $1^\circ$ for 20 Hz to 10 KHz; Less than $3^\circ$ for 10 KHz to 20 KHz.
xiii)	Auxillary data channel	
	a) Data rate	> 4.8 Kbps
	b) Interface	RS – 232

## 8.7 ANALOG RECEIVER

The existing Analog Transmit system being used in the AIR's Radio Networking is of Sat. System Corp. make . So the receiver should be compatible with the same.

i)	Frequency	950 - 1450 MHz
ii)	I.F. Frequency Tune	52 to 88 MHz in 10 KHz step .
iii)	Transponder Tune	Selectable 1 to 24
iv)	No. of channels	Two independent channels
v)	Audio Frequency Response	$\pm 1$ dB, reference 1kHz at $-20$ dBm
vi)	De-emphasis	75 $\mu$ Sec
vii)	Audio output @ $\pm 75$ kHz deviation	+9 dBm max. front panel adjustable.
viii)	Stability factor (Receiver)	PLL System $\pm 15$ KHz.
ix)	Tuning steps	10 KHz, all frequencies
x)	S/N ratio	$\geq 65$ dB

xi)	Input Impedence	75 $\Omega$
xii)	Audio output Impedence	600 $\Omega$
xiii)	Audio expanding	1 : 2
xiv)	Demodulation	FM
xv)	C/No Threshold	64 dB-Hz.
xvi)	Audio distortion	Less than 1% at +9dBm

## 8.8 S – BAND ANTENNA

1.	Type & size	Parabolic dish antenna 3.66 M. dia (Nominal)
2.	Material of dish	Perforated aluminium alloy
3.	Receive Band	S-Band
4.	Feed	Prime focus
5.	Polarization	LHCP
6.	Frequency band	2.5 to 2.7 GHz
7.	Gain	$\geq 36.9$ dB at 2.6 GHz
8.	Type of mount	Elevation over Azimuth
9.	Pointing Accuracy	Better than $\pm 0.5^\circ$
10.	Steerability	Elevation : $30^\circ$ to $85^\circ$ , Azimuth $\pm 30^\circ$
11.	Feed Return Loss	15 dB
12.	Wind Speed	
	Operational	80 KMPH
	Survival	150 KMPH
13.	Axial Ratio	2.2 dB
14.	Focal Length / Diameter	0.4
15.	Feed Impedance	50 $\Omega$
16.	G/T	$\geq 11$ dB/ $^\circ$ K

## 8.9 S - BAND LNBC

a)	Input frequency	2500 – 2700 MHz
b)	Input impedance	50 $\Omega$
c)	Input connector	N type
d)	Input/output return loss	> 12 dB
e)	Output frequency	950 - 1150 MHz
f)	L.O.Stability	PLL, better than $\pm 5$ KHz over the temp. range $0^\circ$ to $50^\circ$ C and over 24 hrs.
g)	Noise temperature	Less than $45^\circ$ K
h)	Conversion gain	55 dB or more
i)	Gain flatness	$\pm 2$ dB over full band

j)	Min. Image rejection	-50 dB
k)	Spurious/harmonics	50 dB below carrier
l)	Phase Noise	
	1 KHz	-60 dBc/Hz
	100 KHz	-80 dBc/Hz
m)	Output impedance	75 $\Omega$
n)	Power supply	+ 15 V to + 24 V through output connector

### 8.10 PC :

The **applicable** model of PC may be quoted for setting various parameters of the receiver including its tuning. It should be pre-loaded with some standard communication software like VT-100. This PC should be compatible with the Analog / Digital SCPC Receivers and also as per the recommendations of the Analog / Digital SCPC Receiver manufacturer. Other specifications are given below :

Pentium-4 processor or latest version, with minimum speed of 1.5 GHz, 40GB HDD, 256 MB DDR SD RAM, 1.44 MB FDD, Combo Drive, 32 MB Video RAM, 10/100 Base T NIC Card, Keyboard, Mouse with pad, USB, Serial and parallel ports, Windows X-P Professional or later version. Back up copy of licensed operating system software should also be supplied. The monitor should be LCD Flat panel display of 15" or more. PC/ Work Station should be complete with necessary interfaces, connectors etc. PC/ Work Station should be rack mounted.

### 8.11 GENERAL / ENVIRONMENTAL

a)	Outdoor Unit	
	Power supply for LNBC	Digital receiver should be able to supply requisite power supply for LNBC.
	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
b)	Indoor Unit (Analog/Digital Receiver)	
	Ambient Temperature	0 to 40°C
	Relative humidity	95% at 40°C.
	Power Supply	230V $\pm$ 5%, 47-53 Hz.

## 9 GENERAL REQUIREMENTS :

9.1 The RN terminals comprising of C Band Antenna, C band LNBC, Digital Receivers and Analog Receiver 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. Suggestive configuration of the rack and jack strip wiring details are attached as **Annexure E** and **Annexure F** respectively.

- 9.2 The suppliers will have to supply the equipment, arrange for its testing as per mutually agreed Acceptance Test Procedure and provide facilities and equipment to carry out the testing . The installation and commissioning of these C- Band receive terminals at site will be carried out by the supplier. A draft copy of the Acceptance Test Procedure is attached in **Annexure C** .
- 9.3 The Antenna for the RN terminal may need to be mounted either on the ground or on top of the building structure. Hence rates may be quoted separately for roof top mounting. The supplier should give full details of the foundation with drawings and details of the load bearing structure required to be built up to safely mount these antenna.
- 9.4 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 be quoted per meter basis so that additional length as per actual requirement may be ordered later. For ranking purposes, an average of 50m length would be considered.
- 9.5 Tenderer are required to provide proper climbing arrangement for repairing/maintaining LNBC and Feed mounted on the Antenna.
- 9.6 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.
- 9.7 A comprehensive schedule of material offered should be attached with the offer in the same format as price bid minus price.
- 9.8 The tender/offer should include following details :
- (i) Sufficient information should be furnished with the tender to assess full merits/demerits of the offer.
  - (ii) 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.
  - (iii) A complete schedule of equipment, accessories and option etc. should also be appended with the tender.
- 9.9 List of essential spares giving quantities and cost may also be given alongwith the offer.
- 9.10 Maintenance support in terms of spare units/components be ensured for atleast 10 years.
- 9.11 Technical Manuals : The supplier will provide original equipment manuals for installation, operation and maintenance for all the item of the RN Equipments as per details below :-
- ◆ 1 Set for each location
  - ◆ 2 Sets for Zonal office
  - ◆ 2 sets for Directorate General (Telecom Division)
  - ◆ 1 Set for STI(T)
  - ◆ 1 set for R&D

**List of Stations where complete C-Band RNT is to be procured and Installed:****WEST**

1. Junagarh
2. Amaravati
3. Oros
4. Ujjain

**SOUTH**

1. Karimnagar
2. Kakinada
3. Srikakulam

**NORTH**

1. Dungarpur

**NORTH-EAST**

1. Anini (Arunachal Pradesh)
2. Changlong (Arunachal Pradesh)
3. Khonsa (Arunachal Pradesh)
4. Daporjio (Arunachal Pradesh)
5. Bomdila (Arunachal Pradesh)
6. Goalpara (Assam)
7. Karimganj (Assam)
8. Lumding (Assam)
9. Dawki (Meghalaya)
10. Tuipang (Mizoram)
11. Chemphai (Mizoram)
12. Kalasib (Mizoram)
13. Wokha (Nagaland)
14. Zunheboto (Nagaland)
15. Phek (Nagaland)
16. Udaipur (Tripura)
17. Nutan Bazar (Tripura)
18. Ukhrul (Manipur)
19. Tamenglong (manipur)
20. Longtherai

**Configuration of system where complete C/S-Band RNT is to be procured and Installed:**

The configuration for each Receive System is shown in the diagram enclosed as **Annexure - 'D'**. It includes :

- |   |   |       |
|---|---|-------|
| 1 | Parabolic Dish Antenna (6.0 Meter Nominal)<br>with feed and accessories         | 1 set |
| 2 | S band Parabolic Dish Antenna (3.66 Meter Nominal)<br>with feed and accessories | 1 set |
| 3 | LNBC C-Band 1+1 with low loss cable and 1:4 Power divider                       | 1 set |
| 4 | LNBC S-Band 1+1 with low loss cable and 1:4 Power divider                       | 1 set |

5	Digital Receiver	3 Nos.
6	Analog Receiver	3 No.
7	Full size wired rack with jack strip and tag block (Refer Annexure E & F )	1 No.
8	Stereo Monitoring Amplifier(10 W) with a set of matched speakers	1 Set
9	RF cable and connectors and Integration material	According to requirement. Rates may be quoted per meter of the cable
10	PC	1 No.
11	Installation and Commissioning	
12	Training as per tender requirement( <b>Optional</b> )	
13	ATP	

## AIR - RN SYSTEM PARAMETERS

## Type of Receive Terminals

S-Band	Size	3.66 M
	G/T	11 dB/°K
	Polarisation	LHCP

C-Band	Size	6.1 M
	G/T	24.5 dB/°K
	Polarisation	Linear H/V

## System Characteristics :

Mode	SCPC
RN Channel Band-Width	200 KHz(Analog) 350 KHz (Digital 256 kbps)

## Analog System :

Modulation/Demodulation	Companded FM
Base-Band	30Hz-15 KHz
Compression	2 : 1
Pre/De-emphasis	75 $\mu$ Sec.
Peak deviation	$\pm$ 75 KHz at +9 dBm

## Digital System :

Modulation	QPSK
FEC	1/2, Convolutional coding and sequential/Viterbi decoding
Base-Band Compression	ISO MPEG - I layer-II Selectable Rates
Base-Band Modes	20 Hz - 20 KHz Stereo, Joint Stereo, Mono, Voice/Data Channel

## INSAT SYSTEM DETAILS

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

## CXS - Band Transponder

	S1	S2
Uplink freq.	5850-5870	5890 - 5910 MHz
Downlink freq.	2550-2570	2590 - 2610 MHz
Polarization	Uplink : Linear H/V or circular	
Downlink	L.H.C.P. or circular	
Sat. EIRP	42 dBw	
S.f.d.	-90 dBw/ m <sup>2</sup>	

## CXC-Band Transponder

Uplink Freq. Band	5925 – 6425 MHz
Downlink Freq, Band	3700 – 4200 MHz
Sat. EIRP	38 dBw
S.f.d.	-85 dBw/ m <sup>2</sup>
Polarisation	
Uplink	Linear H/V or circular
Downlink	Linear H/V or circular

**DRAFT ACCEPTANCE TEST PROCEDURE**

**INTRODUCTION**

New C-band Digital and Analog RN terminal to be installed at various AIR stations are to be tested to ascertain the performance of these terminals before final acceptance. These C-band terminals have to be tested and supplied by the company.

**SCOPE**

This document describes the test procedure for link level measurement of C Band RN terminals. 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 & Analog C-Band transmit (uplink) is already operational at CES Delhi. The operating parameters of transmit system are enclosed as **Annexure-C1**. 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 Analog and Digital transmit system .

**TEST EQUIPMENTS**

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

- (a) Spectrum Analyzer (atleast 4.5 GHz)
- (b) Audio signal generator
- (c) Audio analyzer
- (d) RF signal Generator (atleast 4 GHz)

**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 stabilise 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 either beacon signal or Delhi carrier. Optimisation for all i.e. Azimuth, elevation and polarisation be done for best results. Readings of beacon signal be noted and if possible beacon reception print out be taken.

**DIGITAL RECEIVERS :**

The measurements detailed below will have to be done in real time coordination with CES, 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:

**1. Received Signal level:**

Check the received signal level of pure carrier on spectrum analyser and note down the reading.

**2. 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 Dumb Terminal. 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:**

**1. Linearity:**

**2.**

Vary the input to the Encoder 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		

2. **Frequency Response:**

3.

Feed a 8 dBm 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

3. **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					

4. **Subjective Listening:**

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

**ANALOG RECEIVERS**

**RF MEASUREMENTS:**

1) **Received Signal level:**

Check the received signal level of pure carrier on spectrum analyzer and note down the reading.

Serial No:

RF Level :

**BASE BAND MEASUREMENTS:**

1. **Linearity:**

Feed a 1KHz signal to the input of Analog Modulator and vary the input in steps from -10 dbm to +10 dbm, and note down the output level. Carry out the measurements for both channels.

S.No	INPUT (dBm)	OUTPUT (dBm)	
		CH1	CH2
	+ 10.0		
	0		
	- 10.0		

## 2. Frequency Response:

Feed -20 dBm reference signal at the input of Analog Modulator. Vary the frequency of the signal from 30 Hz to 15 KHz in steps and note down the response with respect to 1 KHz signal.

S.No	Frequency (Hz)	Response w.r.t. 1 KHz	
		CH1	CH2

## 3. THD, SNR & Cross Talk Measurements:

Feed 0 dBm reference signal at the input of Analog Modulator. Note down the output level of the signal, distortion and SNR at the receive end for both channel 1 and channel 2 .

S.No.	Channel	O/P (dBm)	THD %	SNR (dB)	Cross Talk (dB)	Remarks
	I					
	II					

## 4. Subjective Listening:

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

## 5. 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.

**TRANSMISSION PARAMETERS FOR DIGITAL C-BAND SYSTEM**

**A. INSAT System Details and Uplinking Parameters**

Satellite	:	INSAT-3C
Transponder	:	C-11
Uplink Centre freq.	:	6350 MHz
Downlink Centre freq.	:	4125 MHz
Uplink Polarisation	:	Linear Vertical
Downlink Polarisation	:	Linear Horizontal
Uplink	:	From CES DELHI
Downlink	:	Testing Site

Frequency for link level testing

	Uplink	Downlink
Digital Carrier	*	*
Analog Carrier	*	*

\* Freq. shall be intimated at the time of testing.

**B. ANALOG CHAIN PARAMETERS**

Modulation	:	FM
Mode	:	Mono

**C. DIGITAL CHAIN PARAMETERS**

Modulation	:	QPSK
FEC	:	1/2, Seq./Viterbi decoding
Baseband	:	20 Hz-20KHz
Baseband compression	:	ISO MPEG-I, Layer II MUSICAM
Mode	:	Dual Mono
Bit rate	:	256 kbps

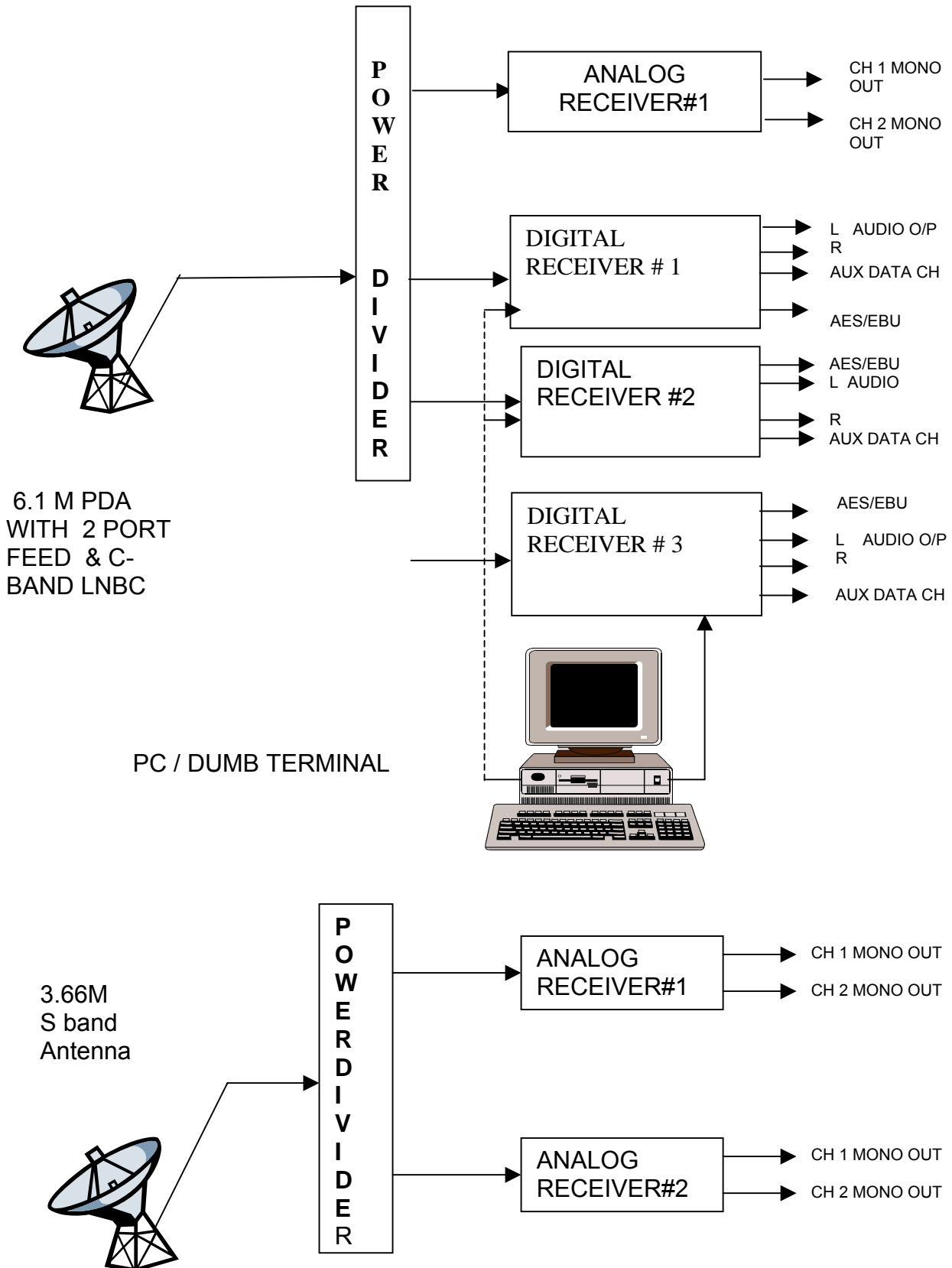
**D. PRESENT CARRIERS OPERATION IN C-BAND**

	<u>Uplink freq</u> (MHz)	<u>Downlink freq.</u> (MHz)	<u>IF</u> (MHz)
Four Delhi Analog Carriers:-			
DLC1 :	6341.000	4116.000	04--74.00
DLC2 :	6341.400	4116.400	04--73.60
DLC3 :	6341.800	4116.800	04--73.20
DLC4 :	6342.200	4117.200	04--72.80
DLC5(digital)	6342.600	4117.600	
DLC6(digital)	6343.000	4118.000	
DLC7(digital)	6343.400	4118.400	
DLC8(digital)	6343.800	4118.800	

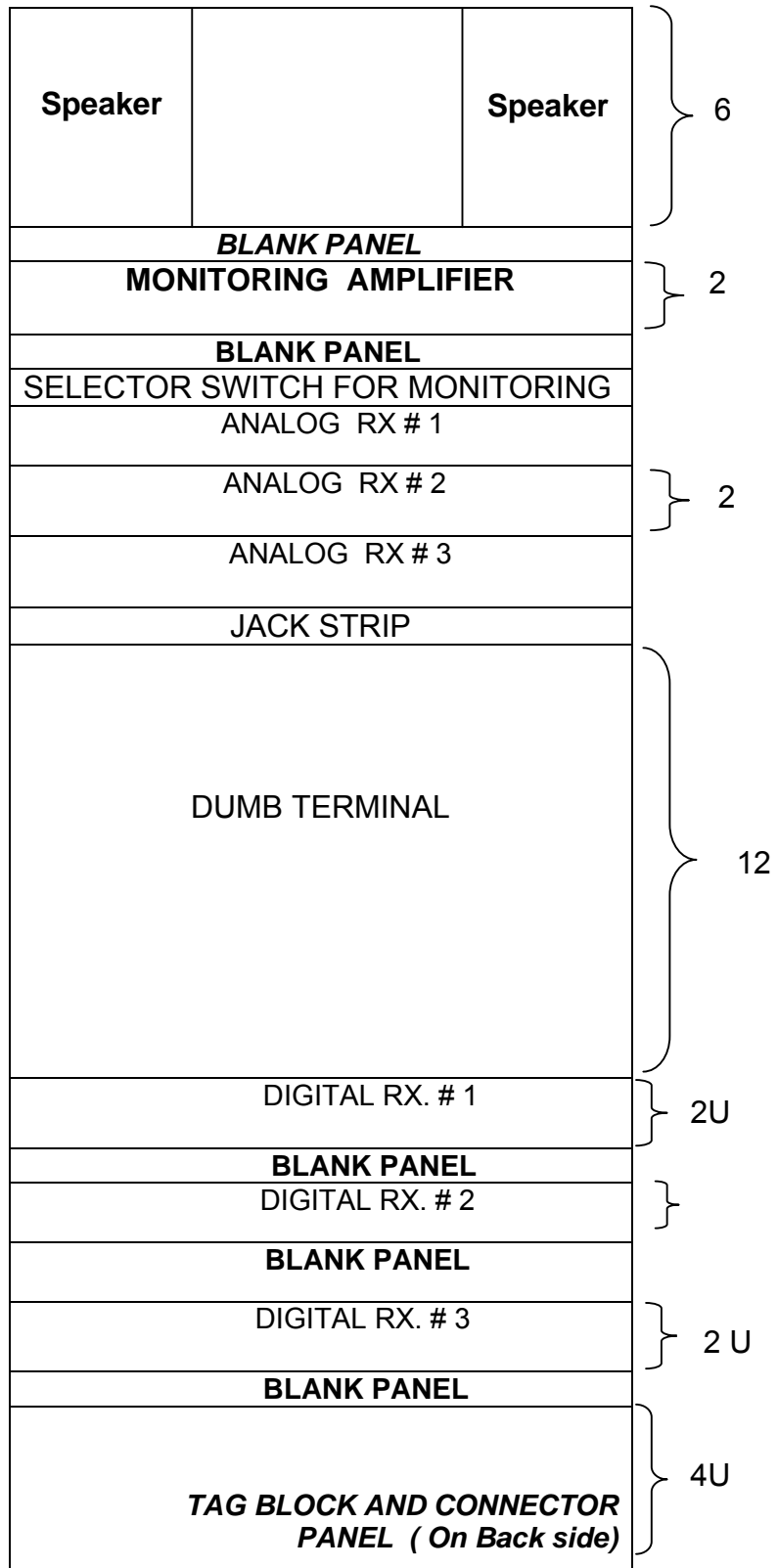
Two VB, Borivalli Carriers:-

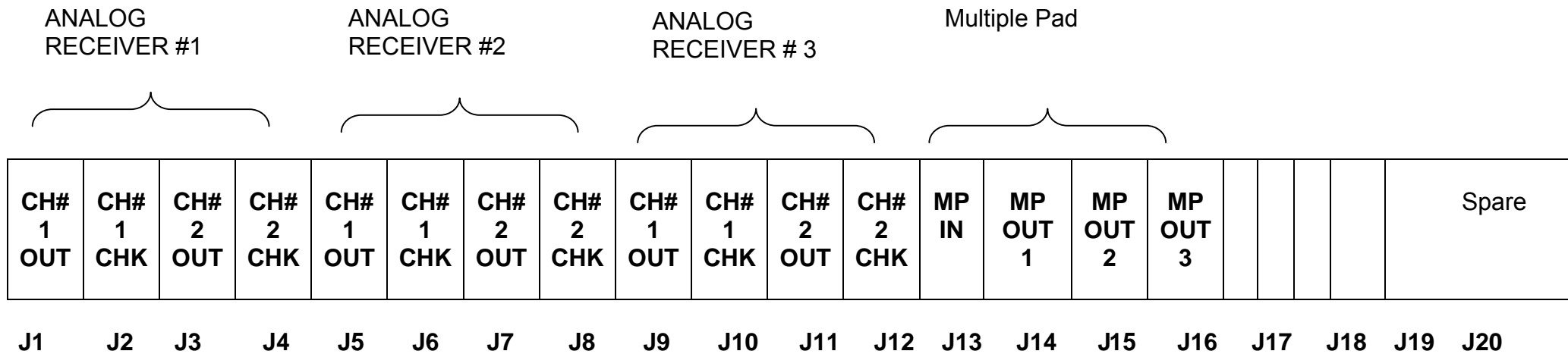
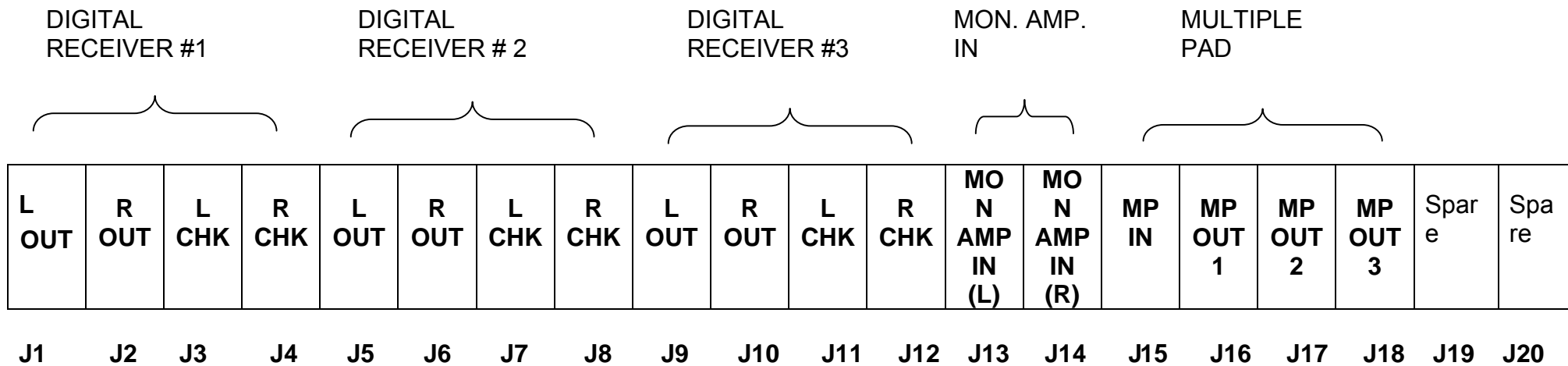
VB Analog :	6354.200	4129.200	04—60.80
VB Digital :	6353.800	4128.800	---

**BLOCK DIAGRAM FOR C BAND DIGITAL & ANALOG RN TERMINAL**



SUGGESTIVE RACK CONFIGURATION FOR RN TERMINAL  
 TOTAL SIZE OF THE RACK = 42 U





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