



**GOVERNMENT OF INDIA**  
**MINISTRY OF RAILWAYS**

**TITLE:**

**DRAFT SPECIFICATION**  
**for**  
**FIXED VSAT TERMINAL**

Specification No.

RDSO/ SPN/ TC/87/2008

*TELECOM DIRECTORATE*  
*RESEARCH DESIGN & STANDARDS ORGANISATION*  
**MANAK NAGAR, LUCKNOW – 226001**

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Abstract  <b>This document specifies technical specification of fixed type VSAT terminal for use in Indian Railways</b>		

**DOCUMENT CONTROL SHEET**

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Page 4 of 11	Effective from : 13.10.2008	RDSO/ SPN/TC/87/2008	Rev. : 0
<b>Fixed VSAT terminal</b>			

**I. SUMMARY :**

This document sets forth general, operational, technical, performance, type test & acceptance test requirements of **fixed type VSAT terminal** for use in Indian Railways.

**II. SOURCE :**

Draft specification no. RDSO/SPN/TC/87/2008 has been prepared by RDSO, Lucknow on advice of Railway Board vide their letter no.2006/Tele/FOIS/Progress dated 11.08.2008 .

**III. FOREWORD :**

Research Designs and Standards Organisation (RDSO) is an attached office of Ministry of Railways, engaged in design and standardization of equipment for use on Indian Railways.

RDSO/ SPN specification is issued as draft specification for discussion. This specification is circulated to customers/ Railways and field inspection units for comments.

RDSO/ SPN along with comments received from various quarters is discussed in Telecom Standards Committee Meeting (TCSC). Recommendation made by TCSC is put up to Railway Board for approval. After approval from Railway Board, the specification is given an IRS number and issued as Indian Railway Standard Specification.

In the absence of IRS specification, procurement may be made as per RDSO/ SPN specification.

**TABLE OF CONTENTS**

<b>Sl. No.</b>	<b>Item</b>	<b>Page No.</b>
1	SCOPE	6
2	REFERENCE	6
3	INTRODUCTION	6
4	FUNCTIONAL AND TECHNICAL REQUIRMENTS	
	4.1 General	6
	4.2 Power supply	7
	4.3 Antenna System fixing & mounting	8
	4.4 Satellite acquisition	8
	4.5 Other parameters	8
5	OPERATIONAL CONDITIONS	9
6	APPROVALS	9
7	MANUALS	10
8	TRAINING	10
9	WARRANTY	10
10	TYPE TEST	10
11	ACCEPTANCE TEST	11

**1 SCOPE:**

This document sets forth general, operational, technical, performance, type test & acceptance test requirements of **fixed type VSAT terminal** for use in Indian Railways.

**2 REFERENCE:**

This specification requires the reference to the following documents:

ITU-R recommendation S.580-6
ITU-R recommendation S 726.1
ITU-R recommendation S.524-7
ETSI, CCIR & FCC requirement for Spurious and Harmonics at rated P1dB of Modem

Wherever, reference to any specifications appears in this document, it shall be taken as a reference to the latest version of that specification unless the year of issue of the specification is specifically stated.

**3 INTRODUCTION:**

This shall be a very small aperture satellite terminal for setting a communication link from any place. This shall provide a communication link from the site to other desired sites. This shall provide voice, video and data communication. This shall communicate through a central earth station called HUB. This shall be stationary, fixed, rugged, all weather and capable of initial manual acquisition of geostationary communication satellites.

**4 FUNCTIONAL AND TECHNICAL REQUIRMENTS:**

**4.1 General**

4.1.1 The VSAT terminal shall be able to work with all geostationary satellites visible from India.

4.1.2 It shall work in Ku Band.

4.1.3 Indian Railway has established its own VSAT network including hub. The system should be compatible with the existing Indian railway's own VSAT network. Presently Indian Railways have hired 4MB inbound and 2MB outbound bandwidth from transponder of INSAT-4CR (Ku Band) satellite. Hub for this VSAT network has been set up at New Delhi by M/s Hughes. The network is in star topology.

4.1.4 The VSAT terminal shall be able to deliver bidirectional composite data traffic (Voice, Video and Data) at nominal speed (bandwidth) of 512 Kbps.

- 4.1.5 The antenna shall be made of lightweight and tough composite material to ensure long life in the rough working environment.
- 4.1.6 It may be required that outdoor unit (Antenna system with RFT & LNBC) is kept some distance away from indoor unit (Modem etc.). To achieve this, all the cables required for interconnection of these two units, shall be of 25 meter nominal length.
- 4.1.7 The VSAT Terminal must be able to both transmit and receive the required quality video/voice/data over existing Indian railway's own VSAT and telecommunication network.
- 4.1.8 All regulatory clearances from various regulatory bodies like DOT/WPC/NOCC etc to operate the VSAT Terminal as applicable shall be available with the vendor and these shall be furnished to Railway.
- 4.1.9 The IP addressing scheme of VSAT has to be integrated with the existing IP addressing scheme of the Indian Railways.
- 4.1.10 Any software required for operation of the terminal shall be embedded (located, stored and operated) in the VSAT terminal itself.

## 4.2 Power supply

- 4.2.1 The VSAT Terminal shall be powered by AC.
- 4.2.2 The AC operating voltage shall be 160 – 250VAC or better.
- 4.2.3 As a backup and for surge protection purpose the VSAT Terminal shall be powered through an offline UPS of 1 KVA rating. It shall have following parameter values-

Sl. No.	Parameter	
1	Input Voltage and Frequency	140 – 290VAC, 45-55 Hz or better
2	Output Voltage and Frequency	220V-230V, 49-51 Hz
3	UPS Type	Offline
4	Battery Type	Sealed Maintenance Free
5	Rating	1 KVA
6	Backup	1 KVAH ie. 1 Hour at 1 KVA load
7	Protection	Overload, Over/Under Voltage and Short-circuit protection
8	Efficiency at full load	> 90%
9	Transfer time	< 10 mili second
10	Output waveform	Sine wave

11	Total Harmonic Distortion	< 3%
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4.2.4 Firm shall submit power consumption of each equipment and the total consumption of VSAT Terminal.

### 4.3 Antenna System fixing & mounting

4.3.1 The Antenna System shall be provided with necessary fixtures and other arrangements to properly fix the Antenna System to the permanent structures.

### 4.4 Satellite acquisition

4.4.1 Suitable means shall be provided for setting and fixing azimuth and elevation for acquisition of the desired satellite

4.5 Other parameters shall be as below-

Parameter	Specifications
<b>Antenna System</b>	
Operating Frequency	13.75-14.5 GHz Tx 10.70-12.75 GHz Rx
VSWR	1.3: 1 max.
Antenna Aperture	1.2 meter (Circular)
Polarization	Linear orthogonal
Azimuth Range	360 ° continuous
Elevation Range	5°-90° continuous
Polarization Range	±95° continuous
TX.X-Pol Isolation	On-axis – better than 30 dB
RX.X-Pol Isolation	On axis – better than 30 dB
Off-axis radiation pattern of antenna	As per ITU-R recommendation S.580-6
Maximum permissible off-axis EIRP	As per ITU-R recommendation S.524-7
<b>LNBC</b>	
Frequency	10.95-11.75 GHz
Noise temperature	90 K or better
Gain	60 dB
Gain Flatness	±1.0 dB full band
Gain Slope	+0.6 dB per 40 MHz max.
VSWR	1.3: 1 max.
<b>Outdoor Radio Frequency Unit</b>	
Frequency	13.75-14.50 GHz



Power Output	2W (33 dBm)
Frequency selection	Synthesized
Input level	-40 to -85 dBm
Spurious Emissions	As per ITU-R S 726.1
<b>Modem</b>	
Output Interface	Ethernet port
Modulation	QPSK, OQPSK and 8PSK (DVB-S2 with ACM)
Outbound transmission format	DVB-S2
Burst Data rate	128, 256, 512 Kbps
Data Transport Protocols	TCP/IP and UDP
Bit Error Rate support	Better than $1 \times 10^{-7}$
FEC rate support	$\frac{1}{2}$ , $\frac{2}{3}$ , or better
Data compression	V.44
Access technology for Inbound	TDMA/FTDMA/MFTDMA
Access Schemes on Inbound	Slotted Aloha, dynamic access.
Management from NCC	Using SNMP
IP Routing Support	ARP, ICMP, IGMP, Routing (RIP v1 & v2), NAT, PAT
Spurious at rated P1dB	ETSI, CCIR & FCC compliant
Harmonics at rated P1dB	ETSI, CCIR & FCC compliant

## 5 OPERATIONAL CONDITIONS

Operational Temperature range:

Antenna & RF Unit (Outdoor Unit) :           0°C to +55°C minimum

Modem (Indoor Unit) :                           0 °C to +50°C minimum

Storage Temperature range: -10°C to +60°C or better

Operational Humidity: up to 95% non-condensing

Wind Speed loading capability-

Operational- min. 70 kmph

Survival- min. 200 kmph

The antenna system with outdoor RF unit shall be rainproof and capable of working in rain of at least 50 mm/hour intensity without any appreciable degradation in performance.

## 6 APPROVALS

Page 10 of 11	Effective from : 13.10.2008	RDSO/ SPN/TC/87/2008	Rev. : 0
<b>Fixed VSAT terminal</b>			

The VSAT terminal should have necessary approvals from appropriate statutory bodies for working with Indian communication satellites and particularly with INSAT 4CR.

## **7 MANUALS**

Installation, operation and maintenance manual in 3 hard copies and 3 soft copies (in CD/DVD) shall be provided for each VSAT Terminal.

## **8 TRAINING**

1 day training at end user premises shall be provided for each VSAT Terminal.

## **9 WARRANTY**

The VSAT terminal shall be warranted for a period of 1 year from date of installation and commissioning or 1&1/2 years from date of supply whichever is earlier. However if installation and commissioning is delayed on contractor account the warranty period shall be 1 year from date of actual installation and commissioning. Railway's decision in this regard shall be final.

## **10 TYPE TEST**

10.1 At least one equipment per lot, randomly selected, shall be type tested. On successful type testing the vendor shall be type approved for supply of such equipments. The initial type approval shall remain valid for a period of two years and subsequent type approvals shall be valid for a period of three years. During validity of type approval the vendor can supply such equipments on the strength of acceptance testing only.

10.2 Supplier shall provide detailed test results for all parameters carried out at OEM premises for the units selected for type testing.

10.3 For type test following Clauses shall be tested-

Sub-clauses 4.1.3, 4.1.4, 4.1.6, 4.1.10, 4.2.2, 4.2.3, 4.3.1, 4.4.1, 4.5- all parameters except spurious and harmonics at rated P1dB for modem parameters.

10.4 Supplier shall arrange all necessary test and measuring instruments and other facilities for conducting type test. The type testing shall be done at place/places nominated by the supplier where all test and measuring instruments and other facilities for conducting type test are available. Supplier shall co-ordinate for the type testing.

10.5 For clause 5 (operational conditions) and clause 6 (Approvals) and other technical and non- technical requirements as stipulated in the specification such as clause 4.1.5, 4.1.8, 4.2.4 and Spurious and harmonics at rated P1dB for modem parameters as per clause 4.5,

Page 11 of 11	Effective from : 13.10.2008	RDSO/ SPN/TC/87/2008	Rev. : 0
<b>Fixed VSAT terminal</b>			

the supplier shall furnish necessary supporting documents, test results and test reports to the satisfaction of purchaser.

10.6 Manuals as per clause 7 for the complete VSAT equipment shall also be furnished by the supplier for approval.

10.7 If the firm do not have their manufacturing base in India and is unable to get the type tests arranged in India, the type approval may be accorded based on the cross approval. The firm has to submit relevant documents required as per guidelines issued by Railway Board for such items. Cross approval shall be issued if the firm meets all the requirement as per Railway Board guidelines.

## **11 ACCEPTANCE TEST**

11.1 All the equipments shall be tested except that equipments which have been type tested.

11.2 Supplier shall provide detailed test results and other supporting documents for all parameters carried out at OEM premises for the units selected for acceptance testing.

11.3 For acceptance test following clauses shall be tested-

Sub-clauses 4.1.3, 4.1.4, 4.1.6, 4.2.3- only battery type and backup capacity, 4.3.1, 4.4.1, 4.5- For Antenna System following parameters shall be tested- Antenna Aperture, Azimuth Range, Elevation Range, Polarization Range,

For RFT & LNBC units following parameters shall be tested - Frequency

For modem unit- all parameters shall be tested except spurious and harmonics at rated P1dB for modem parameters.

11.4 Supplier shall arrange all necessary test and measuring instruments and other facilities for conducting acceptance test and shall co-ordinate for the acceptance testing.

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