



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

**TITLE:**

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

**Specification No.**

**RDSO/SPN/TC/87/2021**

**Rev. 1.0**

*TELECOM DIRECTORATE*

*RESEARCH DESIGN & STANDARDS ORGANISATION*

**MANAK NAGAR, LUCKNOW – 226001**

**Fixed VSAT Terminal**

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

**DOCUMENT CONTROL SHEET**

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<b>Fixed VSAT Terminal</b>
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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 :**

1. 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.
2. Revision 1.0 of the specification RDSO/ SPN/ TC/ 87/2021, Rev 1.0 have been prepared by RDSO, Lucknow as per DG/RDSO letter No. DG/Misc. dated 10.06.2020.

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 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.

**Fixed VSAT Terminal****TABLE OF CONTENTS**

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

## Fixed VSAT Terminal

### 1.0 SCOPE:

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

### 2.0 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.524-9
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.

### 3.0 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.

### 4.0 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. Indian Railways have hired 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. Dynamic bandwidth allocation may be incorporated in the system.
- 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.

**Fixed VSAT Terminal**

- 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.
- 4.1.11 The VSAT Terminal must have Dynamic Control of power to combat the rain attenuation.
- 4.1.12 The VSAT Terminal must have provision for seamless communication with MPLS-VPN networks and other service providers.

**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 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.
- 4.3.2 Earthing point shall be provided on the outdoor unit to enable connection to suitable earth at site.

**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	1.21 meter (Circular)
Polarization	Linear orthogonal
Azimuth Range	360 ° continuous
Elevation Range	5°-90° continuous
Polarization Range	±95° continuous

**Fixed VSAT Terminal**

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.524-9
<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 14.0 – 14.5 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	As per purchaser's Network
Outbound transmission format	As per purchaser's Network
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	½, 2/3, or better
Data compression	As per purchaser's Network
Access technology for Inbound	As per purchaser's Network
Access Schemes on Inbound	As per purchaser's Network
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

**Fixed VSAT Terminal****5.0 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.

**6.0 APPROVALS**

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

**7.0 MANUALS**

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

**8.0 TYPE TEST**

- 8.1 At least one equipment shall be type tested.
- 8.2 Supplier shall provide detailed test results for all parameters carried out at OEM premises for the units selected for type testing.
- 8.3 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, 4.3.1, 4.4.1, 4.5- all parameters except spurious and harmonics at rated P1dB for modem parameters.
- 8.4 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.
- 8.5 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 and Spurious and harmonics at rated P1dB for modem parameters as per clause 4.5, the supplier shall furnish necessary supporting documents, test results and test reports to the satisfaction of purchaser.
- 8.6 Manuals as per clause 7 for the complete VSAT equipment shall also be furnished by the supplier for approval.



## Fixed VSAT Terminal

### 9.0 ACCEPTANCE TEST

- 9.1 All the equipments shall be tested except that equipments which have been type tested.
- 9.2 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.
- 9.3 For acceptance test following clauses shall be tested-  
Sub-clauses 4.1.3, 4.1.4, 4.1.6, 4.3.1, 4.3.2, 4.4.1.  
4.5- For Antenna System following parameters shall be tested:  
For Antenna System: 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.
- 9.4 Supplier shall arrange all necessary test and measuring instruments and other facilities for conducting acceptance test and shall co-ordinate for the acceptance testing.

### 10.0 ROUTINE TEST

- 10.1 The following shall comprise the routine tests and shall be conducted by manufacturer on every Fixed VSAT Terminal and the test results will be submitted to the inspection authority before inspection.
- (i) General Requirement (Clause 4.1.3, 4.1.4 & 4.1.6)
  - (ii) Antenna System fixing & mounting (Clause 4.3.1, 4.3.2 & 4.4.1)
  - (iii) Other parameters (Clause 4.5)
- 10.2 Any other tests shall be carried out as considered necessary by the inspecting authority.

### 11.0 QUALITY ASSURANCE:

- 11.1 All materials & workmanship shall be of good quality.
- 11.2 Since the quality of the equipment bears a direct relationship to the manufacturing process and the environment under which it is manufactured, the manufacturer shall ensure Quality Assurance Program of adequate standard.
- 11.3 The necessary plants, machineries and testing equipments required for production & quality assurance as per schedule of Technical Requirements (STR) shall be available with the manufacturer.

## **Fixed VSAT Terminal**

### **12.0 MARKING & PACKING:**

12.1 The following information shall be clearly marked at a suitable place on each equipment:

- i) Name and Address of the manufacturer.
- ii) Month & Year of the manufacturing.
- iii) Serial number of Equipment.
- iv) Specification number.

12.2 The equipment and its subassemblies shall be packed in Florafoam boxes and the empty spaces shall be filled with suitable filling material. Before keeping in the Florafoam box, the equipment shall be wrapped with bubble sheet. The equipment shall be finally packed in a wooden case of sufficient strength so that it can withstand bumps and jerks encountered in a road/rail journey.

### **13.0 DOCUMENTATION**

13.1 The supplier shall provide the complete operation, maintenance and installation manuals in English for the product under test.

14.0 "All the provisions contained in RDSO's ISO procedures laid down in Document No. QO-D-8.1-11 (titled "Vendor-Changes in approved status") and subsequent versions/amendments thereof, shall be binding and applicable on the successful vendor/vendors in the contracts floated by Railways to maintain quality of products supplied to Railways".