



GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

TITLE:

RDSO SPECIFICATION
for
SUITCASE TYPE PORTABLE AUTO-ACQUIRING VSAT TERMINAL

Specification No.

RDSO/ SPN/ TC/85/2010, Revision 2

TELECOM DIRECTORATE
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Title of Document Suitcase type portable auto-acquiring VSAT terminal		
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Abstract		
<p>This document specifies technical specification of portable suitcase type quick deploying and auto-acquiring VSAT systems for use in Indian Railways.</p>		

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RDSO/SPN/TC/85 /2010	2	This specification has been revised to permit proposed use of second carrier in the Railway hub	25.08.2010

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I. SUMMARY :

This document sets forth general, operational, technical, performance, and test requirements of portable suitcase type quick deploying and auto-acquiring VSAT terminals for use in Indian Railways.

II. FOREWORD

- (i) Specification No. RDSO/SPN/TC/85/2009 Rev.0 was prepared by RDSO, Lucknow on directive of Railway Board vide their letter No.2006/Tele/FOIS/Progress dated 11.08.2008. The specification has been revised and issued bearing No.: RDSO/SPN/TC/85/2010 Rev.1 as per directive of Railway Board vide their letter No.:2004/Tele/TN/2/Pt. dated 10.11.2009 . The specification has been revised again to permit the use of the proposed second carrier in Indian Railway hub, set up by IRPMU
- (ii) Wherever, reference to any specification 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.

1 SCOPE:

This document sets forth general, operational, technical, performance, & test requirements of portable suitcase type quick deploying and auto-acquiring VSAT systems for use in Indian Railways.

2 INTRODUCTION:

Suitcase type portable auto-acquiring VSAT system shall be a very small aperture satellite terminal for quickly setting a communication link from any place (disaster site etc.). This system will provide satellite based communication link from the site to other desired locations such as Railway Board, zonal and divisional headquarters through identified satellite hub. This system will provide voice, video and data communication link to cater for the needs of disaster sites. The system shall be portable, rugged, all weather, quickly deployable and capable of automatic acquisition of relevant geostationary communication satellites.

3. FUNCTIONAL AND TECHNICAL REQUIRMENTS:

3.1 General

- 3.1.1 The VSAT system shall be able to work with any of the identified geostationary satellites visible from India.
- 3.1.2 It shall work in Ku Band.
- 3.1.3 Indian Railway has established its own VSAT network including hub. The suitcase type VSAT system should be compatible with the Indian railway's own VSAT network. Hub for this VSAT network working in Ku band has been set up at New Delhi. The network is in star configuration. Technical details of the existing VSAT network shall be provided by the purchaser.
- 3.1.4 The VSAT terminal shall be able to deliver bidirectional composite data traffic (Voice, Video and Data) at data rate of 2 Mbps (or at the data rate specified by the purchaser). However, the actual working bandwidth may be limited in compliance of VSAT network design of the purchaser and other regulatory requirements.
- 3.1.5 Each portable VSAT system consisting of various components, like Antenna, Antenna Control Unit, Complete RF electronics (SSPA, Block up/ down converters), Power supply, Satellite Modem, etc., shall be integrated into compact enclosure(s) for ease of transportation, deployment and operation at site.

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- 3.1.6 The antenna reflector shall be made of tough composite carbon fiber material. Antenna reflector shall be made of multiple pieces in such a manner as to facilitate portability as well as quick and easy assembly during deployment. The antenna arrangement shall be robust and repeated assembly and disassembly shall not cause degradation in the performance of antenna.
- 3.1.7 The portable VSAT system shall be packed in such a manner so as to facilitate easy and secured transportation to the accident/disaster site without any damage. For smooth transportation, the portable VSAT terminal unit shall be packaged in suitcase type containers not exceeding 2 nos.. Total weight of the complete VSAT system along with suitcase/suitcases and operational accessories shall not exceed 70 kg. The weight of the individual suitcase shall not exceed 50 kgs. The suitcase/suitcases shall be ruggedized, sturdy and all weather type, capable of carrying the weight of the equipments and shall ensure that no damage is done to the equipments due to transportation/ weather etc.. The suitcase/suitcases shall be provided with wheels and sufficient number of handles for easy transportation by two persons. In addition, separate trolley/trolleys shall be supplied with larger and ruggedized wheels capable of being pulled on rough surface at accident site. It should be possible to secure the suitcase/suitcases on the trolley/trolleys and be pulled to the site.
- 3.1.8 It should be possible to setup and have satellite connectivity within 15 minutes by maximum two persons after the system is unpacked.
- 3.1.9 The VSAT Terminal must be able to transmit and receive best quality video/voice/data over existing Indian railway's own VSAT and telecommunication network.
- 3.1.10 All regulatory clearances from various regulatory bodies like DoT/DoS/WPC/NOCC etc to operate the VSAT Terminal as applicable shall be obtained by the vendor/ purchaser
- 3.1.11 The IP addressing scheme of VSAT shall be as decided by the purchaser.
- 3.1.12 Any software required for basic operation of the terminal shall be available (located, stored and operated) in the VSAT system itself to the extent that the basic operation of the terminal "deploy/auto pointing/stow and transmit/ standby" can be done directly through button/ GUI on the VSAT terminal itself or any device attached to it (The attached device shall be part of VSAT system and shall be included in 70 kg weight requirement). Additional user interface, if provided through lap top, the failure of laptop shall not affect basic operation of VSAT terminal."
- 3.1.13 The supplier shall submit link budget calculations for data rate of 2 Mbps (or at the data rate specified by the purchaser). The link budget calculations shall be submitted as per format contained in the TEC document No. IR/SCB-08/02 Sep 2009. The rain attenuation parameters for uplink and down link shall be 5.4 dB and 1.5 dB respectively. Over and above the requirement of link budget, an additional margin of 3dB shall be provided for edge of coverage loss. The link budget calculations shall be done for a BER of 10^{-7} .

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Link budget calculation shall be done taking into account the parameters of the satellite proposed to be used by the purchaser for this application.

3.1.14 Any additional hardware/ software required for intended use of the system shall be provided by the supplier along with the system.

3.2 **Power supply**

3.2.1 The Satellite Terminal shall be capable of working both on AC and DC supply.

3.2.2 The AC operating voltage range shall be from 100 to 275VAC. DC supply voltage shall be 24 V / 12 V DC (Nominal).

3.2.3 UPS of suitable capacity providing a backup of 30 minutes shall be provided by the supplier. The UPS shall have overload, over/under voltage and short circuit protection. The weight of UPS shall not be included for the purpose of deciding the weight of VSAT system.

3.2.4 Firm shall submit power consumption of each sub-system and the total power consumption of VSAT system to the purchaser.

3.3 **Satellite acquisition**

3.3.1 The VSAT system shall acquire its latitude and longitude position via an inbuilt GPS device. The acquired position of latitude and longitude shall be available to the subsystems (In case this position is required by the subsystems for satisfactory working of all the applications on the communication link). Also facility to manually input the latitude and longitude shall be available.

3.3.2 The desired satellite location data shall initially be fed into the VSAT system. The VSAT terminal shall store this data for subsequent use. It shall acquire the satellite on operation of a command. It should be possible for the user to modify/ add satellite location data.

3.3.3 It shall have visual indication to confirm successful acquisition of the desired satellite by the VSAT system.

3.3.4 The terminal shall also have an in-built electronic compass and inclinometer to determine initial direction and level etc. and shall accordingly compute the satellite acquisition process parameters.

3.3.5 The VSAT system shall acquire satellite with no/ minimum initial coarse setting. It shall be possible to acquire the satellite with one command operation once the terminal is placed south facing .

If the system requires initial coarse setting, compass or any other equipment needed for such setting shall be supplied along with the system. The above functionality shall not be affected in 25 kV AC electrified area of Railways.

- 3.3.6 The satellite acquisition process shall be with motorized antenna pointing and optimization.
- 3.3.7 Once the chosen satellite is selected, the antenna unit should be automatically deployed and peaked onto the chosen satellite including polarization matching of both Transmit and receive beams. There after it shall track the selected satellite for peak signal strength.
- 3.3.8 The Satellite Terminal shall also provide automatic satellite identification to ensure that it is pointing towards the correct satellite Also the system shall ensure pointing towards correct satellite throughout the duration of the communication.
- 3.3.9 The system should have capability to display the actual azimuth, elevation and polarization of the satellite link.
- 3.3.10 In case of failure or malfunction of the automatic satellite acquisition system, provision shall be available for manual acquisition of the satellite.
- 3.3.11 The satellite system shall have built in self test (BIST) in order to facilitate quick repair, in case of hardware fault. The status of system's main components (Antenna control unit, BUC, SSPA, modem) shall be graphically presented by the GUI. Indication shall be provided on VSAT system for healthy/ faulty condition of its critical sub systems.
- 3.3.12 Auto acquiring feature shall be possible even on terrain with slope. The supplier shall furnish information to the purchaser regarding the maximum slope of the terrain on which the functionalities regarding auto acquiring of satellite terminal shall not be affected.
- 3.4 The terminal shall comply with the parameters which are mandatory and are defined as interface requirements or otherwise by DoT or any other regulatory body. These and other parameters shall be as below-

Table A: Antenna and terminal parameters

Clause No.	Parameter	Specification
3.4.1	Operating Frequency	Ku band Rx: 10.70 GHz to 12.75 GHz and Tx: 13.75 GHz to 14.5 GHz
3.4.2	PSD limits	Maximum uplink psd limits at the input to the earth station antenna: -39dBW/ Hz

Clause No.	Parameter	Specification
3.4.3	EIRP stability	± 0.5 dB/24 hrs.
3.4.4	Transmit IM product	23 dB below two equal carriers at 6 dB output back off.
3.4.5	Transmit harmonics	Better than -40 dBc up to second harmonic
3.4.6	Frequency stability	Better than 1 ppm over the temperature range of -5°C to +60 °C)
3.4.7	Long term frequency stability	Better than 0.1 ppm over a day
3.4.8	G/T requirements at 20° elevation	For Antenna of dia 1 meter 16.6 dB/°K minimum . For Antenna of dia 1.2 meter 18.2 dB/°K minimum.
3.4.9	Maximum permissible off-axis EIRP density (in dBW/40 KHz)	(39-25 log \emptyset) for (2.5 $\leq\emptyset\leq$ 7) , 18.0 for (7 $\leq\emptyset\leq$ 9.2), (45-25 log \emptyset) for (9.2 $\leq\emptyset\leq$ 48), 0 for 48 $\leq\emptyset\leq$ 180 (\emptyset is off-axis angle in degrees) (ITU-R recommendation S.524)
3.4.10	Transmit spurious limits	Carrier off case : 54 dBpW Carrier on case : 61 dBpW (ITU-R Recommendation S.726-1)
3.4.11	Antenna Aperture (Circular Equivalent Diameter)	≥ 1 meter
3.4.12	Polarization	Linear orthogonal
3.4.13	Transmit Cross Polar Isolation	On-axis – better than 30 dB
3.4.14	Receive cross polar isolation	On-axis – better than 30 dB
3.4.15	Off-axis radiation pattern of antenna	As per ITU-R recommendation S.580-6 and S. 465
3.4.16	Azimuth Range	$\pm 90^\circ$ in 0.1° steps or better
3.4.17	Elevation Range	Minimum 85° travel in the range 5° to 95° in 0.1° steps or better
3.4.18	Polarization Range	180° in 0.1° steps or better

- Note 1.** *Above values are based on parameters applicable to INSAT 4 CR and VSAT systems of antenna diameter of minimum 1 meter.*
- 2.** *In case purchaser decides to use any other ku band satellite and/ or VSAT system with antenna of less than 1 meter, the purchaser shall indicate requisite technical parameters to the suppliers.*

Table B : Broadband satellite modem/ router features/parameters

Clause No.	Parameter	Specification
3.4.19	Output Interface	Two 10/100 Base T Ethernet LAN RJ45 ports , one wi-fi port (IEEE 802.11 b and g)
3.4.20	Out bound Modulation	As per purchaser's network
3.4.21	In bound Modulation	As per purchaser's network
3.4.22	In bound symbol rate	256, 512, 1024, 2048 kbps
3.4.23	Inbound channel	As per purchaser's network
3.4.24	Outbound transmission format	As per purchaser's network
3.4.25	Bit Error Rate support (Transmit)	1×10^{-7} or better
3.4.26	Inbound channel coding rate	1/2, 2/3, or better
3.4.27	Access technology for Inbound	As per purchaser's network
3.4.28	Management from NCC	Using SNMP / WEB interface
3.4.29	IP Routing Support	ARP, ICMP, IGMP, Routing (RIP v1 & v2), NAT/PAT, Unicast and Multicast IP traffic, DHCP server or relay
3.4.30	QoS features	Support for features like packet filtering and prioritization of traffic. There should be at least 4 level of IP prioritization available.
3.4.31	Data security	As per purchaser's network
3.4.32	VLAN tagging	IEEE 802.1Q
3.4.33	Applications	Support VoIP, webcasting, live video streaming, video conferencing. The modem and associated features shall be capable of providing communication facilities as stipulated in RDSO specification No. RDSO/SPN/TC/55/2009, Rev1 or latest at the accident site.
3.4.34	Enhancement features for TCP/IP over satellite link	TCP spoofing, HTTP acceleration, DNS caching
3.4.35	Signaling protocol support	H323, SIP
3.4.36	Additional features	Closed loop control between hub and remote Dynamic remote uplink power control Dynamic inbound coding changes based on received signal

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4 OPERATIONAL CONDITIONS

- 4.1 Operational Temperature range: -15°C to +55°C minimum
- 4.2 **Storage temperature range: -25 °C to 70 °C.**
- 4.3 Operational Humidity: Up to 95% non-condensing
- 4.4 Operational Wind Speed : 45 kmph without anchors, 72 kmph with anchors (weight of anchors shall not be part of system weight)
- 4.5 Sealing Class : IP 65

5 ENVIRONMENTAL, EMI, EMC, SAFETY AND OTHER REQUIREMENTS

5.1 ENVIRONMENTAL STANDARDS & TESTS

The equipment shall be tested as per the following IEC standards or equivalent MIL/ international standards-

Test	Standard
Cold	IEC 60068-2-1
Dry heat	IEC 60068-2-2
Random vibration broadband	IEC 60068-2-64 Fdb
Shock	IEC 60068-2-27 Ea
Bump	IEC 60068-2-29 Eb
Drop and topple	IEC 60068-2-31 Ec
Free fall	IEC 60068-2-32 Ed
Salt mist	IEC 60068-2-52
Sand and dust	IEC 60068-2-68

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5.2 Electromagnetic Compatibility (EMC): The equipment shall be tested as per relevant IEC/ EN or equivalent international standard for EMI and EMC.

5.3 Safety Requirements:

The equipment shall be tested as per relevant IEC/ EN and equivalent international/ national standard for safety of operating personnel and equipment.

5.4 Other Requirements :

5.4.1 The VSAT systems's hardware/software shall not pose any problem due to changes in date and time caused by events such as changeover of millennium/century, leap year etc. in the normal functioning.

5.4.2 A large number of sections where V-SAT terminal is to be deployed are already electrified with 25 KVAC traction. Therefore the terminal shall be capable of working in such environment. All protective measures required for the safety of equipment and the personnel shall be taken.

The following may affect the working of the equipment:

- i) Proximity of live conductor.
- ii) Presence of return current in Rails.
- iii) Induction in all metallic bodies situated closed to over head equipment.

6. GENERAL REQUIREMENTS:

- a. All connectors and the cables used shall be of low-loss type and suitably shielded.
- b. Important Do's and Don'ts about the operation of the equipment shall be clearly indicated at a convenient place on the equipment.
- c. The equipment shall be protected in case of voltage variation beyond the specified ranges
- d. The supplier shall provide one complete set of all the necessary interfaces, connectors, connecting cable and accessories required for satisfactory and convenient operation of the equipment. It shall also provide the software and the arrangement to load the software at site. All the upgrades to the software shall also be provided free of cost through firm's website, or through any other means.
- e. Special tools, extender boards, extender cables and accessories essential for installation, operation and maintenance of the equipment shall be clearly indicated and supplied along with the equipment.

7 APPROVALS

The VSAT system should have necessary approvals from appropriate statutory bodies for working with Indian communication satellites and particularly with INSAT 4CR or the satellite being used by the purchaser for its network. In addition, it should comply at least one international standard such as FCC, Eutelsat, Intelsat, EuropeStar, Hispasat, IPStar, Shin Satellite and Asia Sat.

8 MANUALS

8.1 Installation, operation and maintenance manual:

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

- a. Safety measures to be observed in handling the equipment
- b. Precautions for installation, operation and maintenance
- c. Testing and fixtures required and procedure for routine maintenance, preventive maintenance, troubleshooting and sub assembly replacement
- d. Illustration of internal and external mechanical parts
- e. Detailed description about the operation of the software used including its installation, loading etc.

8.2 Repair manual: repair manual shall include the following

- a. List of replaceable parts used, including their sources
- b. Detailed ordering information for all the replaceable parts shall be listed in the manual to facilitate ordering of spares as and when required.
- c. Procedure with flow chart for trouble shooting and subassembly replacement shall be provided. Test fixtures and accessories required for repair shall also be indicated.

9 TESTS AND PERFORMANCE REQUIREMENT

9.1 The System supplier shall submit detailed test reports for tests done on the proposed system, covering the parameters as given in Functional Requirements and Technical Requirements, operational parameters, environmental, EMI, EMC and safety requirements. of this specification.

9.2 In case Purchaser so desire any other test on the equipment shall be conducted by System supplier in presence of Purchaser's Representative to ascertain conformance.

9.3 At least one equipment of each type should be tested for functional parameter by System supplier in presence of Purchaser's Representative. The tests shall be conducted as per Test Procedure proposed by manufacturer duly reviewed and approved by Purchaser.

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- 9.4 The complete system shall be tested to demonstrate the conformance for the general/ functional/ technical requirement as stipulated in this specification, by the supplier. The tests shall be conducted as per Test Procedure proposed by manufacturer duly reviewed and approved by Purchaser.
- 9.5 Manuals as per clause 8 for the complete VSAT system shall also be furnished by the supplier for approval of the purchaser.

10 Information to be given by the purchaser.

- 10.1 Technical details of VSAT network of the purchaser. (Clause 3.1.3)
- 10.2 Required data rate if other than 2 Mbps stipulated in this document (Clause 3.1.4)
- 10.3. Details of satellite parameters (Clause 3.1.13)
- 10.4 The required technical details if less than 1 meter antenna is also permitted
- 10.5 The parameters details of table B concerning existing network features and parameters (3.4.20, 3.4.21, 3.4.23, 3.4.24, 3.4.27, 3.4.29).

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