सत्यमेव जयते

RESEARCH DESIGNS AND STANDARDS ORGANISATION

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(SIGNAL & TELECOM DIRECTORATE)

RDSO/SPN/TC/107-2018

Specification for
VHF Sets to be used on Indian Railways

I. Amendment History

Sr. No.	Amendment Date	Version	Reason for Amendment
1.	30-08-2018	0	First Issue
2.	21-05-2019	Amend ment.1	Typographical error removal in cl. 5.8.1,5.16.11,5.16.14 XI &XII, 5.18.1
3.	06-07-2022	1.0	Due to Revision in specification. Approved by PED/S&T at Note#166 of file No. RDSO-TELE0LKO(SPEC)/9/2019 -O/o Jt. DIRECTOR/TELE-1/RDSO
4.	24-02-2023	2.0	Due to Revision in specification. Approved by PED/S&T at Note#288 of efile No. RDSO-ELE0LKO(SPEC)/9/2019 -O/o Jt. DIRECTOR/TELE-1/RDSO
5.	21-08-2023	2.1	Due to Revision in specification. Approved by PED/S&T at Note-# 439 of efile No. RDSO-ELE0LKO(SPEC)/9/2019 -O/o Jt. DIRECTOR/TELE-1/RDSO

II. Document Control Sheet

Designation	Organisation	Function	Level
JE/Telecom	RDSO	Member	Assist/ Prepare
ADE/Telecom	RDSO	Member	Assist/ Prepare, Check
Director/ Telecom-I	RDSO	Member Secretary	Prepare, Review, Issue
PED/S&T	RDSO	Approving Authority	Approve

III. TABLE OF CONTENTS

IV. ABBREVIATIONS:

The following abbreviations are used in these specification & standards.

SN	Abbreviation	Full Name
1.	AH	Ampere Hour
2.	dB	Decibel
3.	W	Watt
4.	WPC	Wireless Planning and Coordination
5.	CACT	Component Approval Centre for Telecommunication
6.	DC	Direct Current
7.	DTMF	Dual Tone Multi Frequency
8.	Hz	Hertz
9.	IS	Indian Standards
10.	KHz	Kilo Hertz
11.	Km.	Kilometer
12.	LED	Light Emitting Diode
13.	LCD	Liquid Crystal Display
14.	PCB	Printed Circuit Board
15.	RH	Relative Humidity
16.	Tx.	Trans
17.	Rx.	Receive
18.	S/N Ratio	Signal to Noise Ratio
19.	VF	Voice Frequency
20.	CTCSS	Continuous Tone Coded Squelch System
21.	DCS	Digital coded system

1.0 SCOPE

This document covers the technical requirements, constructional features, electrical characteristics, and provisions of tests & inspection of VHF walkie- Talkie sets, 25 W VHF radio for use over Indian Railways and is issued under the serial No. RDSO/SPN/TC/107 /2018.

1.1 This specification requires reference to the following Indian Railway Standards/ Indian Standards/ Joint Services Standards specifications.

1.1.1 IRS: S-23 — Electrical Signaling and Interlocking equipment (Cl 3 for TERMINOLOGY Cl 14.2.1.1 for VISUAL INSPECTION).

1.1.2 MIL STD 810 — Test Method Standard for Environmental Engineering Considerations and Laboratory Tests.

1.2 Wherever in this specification any of the above mentioned specification is referred, it shall be as reference to the latest issue of the specification, otherwise, the particular year of the issue has to be taken as reference.

1.3 This specification is intended chiefly to cover the technical provision and does not include all the necessary provisions of a contract.

1.4 TERMINOLOGY: For the purpose of this specification terminology as given in IRS: S-23 shall be applicable. The terms referred to in the specification but not covered in IRS: S-23 are defined below:

LOT: A lot is constituted by "VHF radio sets" of the same type manufactured in the same factory during the same period using the same process and materials.

2.0 GENERAL REQUIREMENTS

2.1. VHF communication is used in many applications such as Traffic control, police duties, military operations, mobile communication, point to point communication and disaster management. Presently VHF communication is being used in following applications in Indian Railways:

2.1.1 Communication in Train in between Loco pilot and Guard.
2.1.2 Communication with Loco pilot / Guard of other Trains.
2.1.3 Communication in between moving train and fixed location i.e. Station.
2.1.4 In yard communication.
2.1.5 Security communication.
2.1.6 Communication during maintenance and construction.
2.1.7 ART communication.

2.2. This specification deals with the VHF Based Radio sets to be used on Indian Railways. Radio sets can be broadly categorized in two parts:

I. Hand Held Walkie-Talkie Sets.

II. 25 W Fixed radio sets.

2.3. Further hand held Walkie-Talkie sets are categorized based on the use i.e.

a) Analog Walkie-Talkie Set with basic design.
b) Digital Walkie-Talkie Set with basic design.
c) Digital Walkie-Talkie set with higher features.

2.4. Walkie-Talkie set with basic design: The Walkie-Talkie sets for Guard-Loco pilot communication use should be simple in operation so that Guard-Loco pilot does not face any problem during operation. Walkie-Talkie set for this purpose should be without keypad

& with or without LCD display so that there is no possibility of disturbing the settings of the sets by inadvertently pressing of buttons of keypad by Guard/Loco pilot.

2.5. Walkie-Talkie Set for Other Purpose: Walkie-Talkie set to be used for other purpose like Yard communication, communication for maintenance purpose, communication for RPF staff etc. can be provided with keypad facility and LCD display having special features like selective calling, front panel programming, channel and battery indication etc. Special features with keypad can be used by the group engaged in shunting operation maintenance along the track and during emergency like accident etc. Railways may select the specific features of the sets depending on the requirement of the Railways.

2.6. 25 W radio sets are to be used for communication between adjacent stations and station to Loco pilot /Guard or other maintenance staff.

2.7. The set should be PC programmable for various parameters & features.

3.0 BATTERY FOR WALKIE-TALKIE SET

3.1 Ni-MH/ Li-ion batteries of minimum 2300 mAh to be used for Hand Held Walkie-Talkie sets as per clause No. 2.3 of this specification.

3.2 It is necessary that the battery should work for at least 10 hours in l0:10:80 duty cycle modes (10% in Tx mode, 10% in Rx mode and 80% in idle mode) for Guard--Loco pilot communication purpose.

3.3 The Ni-MH/Li-ion power pack shall be fixed to the Walkie-Talkie sets by means of suitable locking arrangement.

3.4 The set should have 'battery low' alert in the form of audio alert or visual indication or both when battery reaches a certain minimum level (for example 20%) for early warning to the user.

3.5 Battery should be of Radio OEM recommended and BIS approved. The IP rating of battery should be same as of 5W radio set.

3.6 **Battery for 25 W Radio Set**: 12 V minimum 96 AH of Ni Mh/ Li-Ion/ VRLA unless otherwise specified by the purchaser.

4.0 BATTERY CHARGER FOR 5 W SETS

4.1 Quick battery charger may consist of adapter and charging tray as separate units or both may be integrated as a single unit. In case of single unit, it should be radio OEM recommended and BIS approved. In case of separate units, it should be radio OEM recommended and adaptor of the battery charger shall be BIS approved.

4.2 Battery charger should give DC voltage as required for charging the battery of VHF set from input voltage of 230 ± 10%, 50 Hz.

4.3 The charging time should be 2 to 4 hours for charging batteries upto 3000mAh in case battery is fully discharged.

4.4 The charger should have visual indications to indicate the power ON/OFF, battery charging under progress and fully charged condition of the battery.

5.0 TECHNICAL PARAMETERS

A. Analog Walkie-Talkie set with basic feature

5.1 General

5.1.1 Type of working : Simplex/Semi Duplex.

5.1.2 Type of Modulation : Frequency modulation.

5.1.3	Frequency Range	:	146-174MHz.
5.1.4	No. of channels	:	Minimum 16 nos.
5.1.5	Channel separation	:	12.5 KHz.
5.1.6	Spot Frequencies	:	The spot frequencies of each channel to be specified by the purchaser.

5.2 Transmitter

5.2.1	Power output at antenna port	:	5 Watt, tolerance of -2% is acceptable.
5.2.2	Frequency stability	:	±2.5 ppm.
5.2.3	Frequency deviation	:	±2.5KHz for set having channel separation of 12.5 KHz.
5.2.4	Modulation Sensitivity	:	1 to 10 mV at 1 KHz at mic. Input for (+/-) 1.5 KHz (for 12.5 KHz channel spacing) standard deviation.
5.2.5	Modulation Distortion	:	Less than 5% at 1 KHz reference for (+/-) 1.5 KHz (for 12.5 KHz channel spacing) standard deviation.
5.2.6	Modulation Fidelity	:	(+) 1, (-) 3dB of 6dB/Octave Pre-emphasis characteristic from 350 Hz to 2700 Hz with 1 KHz as reference.
5.2.7	Spurious emission	:	Better than 70 dB.
5.2.8	Hum &Noise	:	-34dB @12.5 KHz.
5.2.9	Frequency Generation	:	Frequency synthesized oscillator.
5.2.10	VSWR	:	Better than 1.5.

5.3 Receiver

5.3.1	Sensitivity	:	Better than 0.25 µV for 12dB SINAD.
5.3.2	Adjacent channel selectivity	:	60 dB for 12.5 KHz channel separation.
5.3.3	Spurious and image rejection	:	65 dB or better.
5.3.4	Audio output	:	Minimum 500 milliwatt at 5% distortion with 4/8/16 Ω load as per OEM design.
5.3.5	AF Response	:	Shall be between +l dB & -3 dB over the frequency range 350-2700 Hz with 1 KHz as ref.
5.3.6	Squelch sensitivity	:	0.25 µV.
5.3.7	Inter-modulation rejection	:	Better than 60 dB.

5.4 Antenna

5.4.1 The Walkie-Talkie Sets shall be provided with short helical spring antenna with suitable connector with socket mounted on PCB.

5.5 Signaling

5.5.1 Signaling is not required to be used with such sets.

B. Digital Walkie-Talkie set without Key-pad & with or without Display

5.6 General

5.6.1 Type of working : Simplex/Semi Duplex.

5.6.2 Type of Modulation : Digital DMR TDMA based open standard specifications platform which must have capability of backward compatibility with Analog radios.

5.6.3 Frequency Range : 146-174MHz.

5.6.4 No. of channels : Minimum 16 for without keypad and without display and Minimum 128 for without keypad and with display.

5.6.5 Channel separation : 12.5 KHz.

5.6.6 Spot Frequencies : The spot frequencies of each channel to be specified by the purchaser.

5.6.7 Special features :

i.	CTCSS or DCS	ii.	Channel number announcement
iii.	Capability of being killed /un-killed	iv.	Channel scan
v.	Operate in both analog and digital mode, it should switch over to analog / digital mode automatically as per received signal irrespective of presently selected mode (Analog/Digital).	vi	Provision should be there for battery level audio announcement or LED light indicator in at least three steps.

5.7 Transmitter

5.7.1 Power output at antenna port : 5 Watt, tolerance of -2% is acceptable.

5.7.2 Frequency stability : ±0.5 ppm.

5.7.3 Frequency deviation : ±2.5KHz for set having channel separation of 12.5 KHz.

5.7.4 Digital protocol :

5.7.4.1 Digital protocol shall be ETSI DMR Open standard, and OEM should be Category-1 (Manufacturer Status) member of DMR association.

5.7.4.2 Set shall have IOP certification issued by DMR association.

OR

Walkie-Talkie sets should be interoperable with walkie-talkie sets being used in Indian Railways.

5.7.5 Vocoder type : AMBE+2.

5.7.6 Modulation Sensitivity : 1 to 10 mV at 1 KHz at mic. Input for (+/-) 1.5 KHz (for 12.5 KHz channel spacing) standard deviation.

5.7.7	Modulation Distortion	:	Less than 3% at 1 KHz reference for (+/-) 1.5 KHz (for 12.5 KHz channel spacing) standard deviation.
5.7.8	Modulation Fidelity	:	(+) 1, (-) 3dB of 6dB/Octave Pre-emphasis characteristic from 350 Hz to 2700 Hz with 1 KHz as reference.
5.7.9	Spurious emission		Better than 70dB.
5.7.10	Transmitter Output impedance		50Ω.
5.7.11	Frequency Generation		Frequency synthesized oscillator.
5.7.12	VSWR		Better than 1.5.
5.7.13	Hum &Noise		-34dB @12.5 KHz.

5.8 Receiver

5.8.1	Sensitivity	:	Analog Mode: Better than 0.25 µV for 12dB SINAD, Digital Mode: 0.18 µV or better with BER ≤5%.
5.8.2	Adjacent channel selectivity	:	Better than 60 dB for 12.5 KHz channel separation.
5.8.3	Spurious and image rejection	:	65 dB or better.
5.8.4	Audio output	:	Minimum 500 milliwatt at 4/8/16 Ω load.
5.8.5	Audio distortion	:	Shall not exceed 3% for 4/8/16 Ω load as per OEM design.
5.8.6	AF Response	:	Shall be between +l dB & -3 dB over the frequency range 350-2700 Hz with 1 K Hz as ref.
5.8.7	Squelch sensitivity	:	0.18 µV.
5.8.8	Hum &Noise	:	-34dB @12.5 KHz, -40 dB @ 25 KHz.
5.8.9	Inter-modulation rejection	:	Better than 60 dB.

5.9 Antenna

5.9.1 The Walkie-Talkie Sets shall be provided with short helical spring antenna with suitable connector with socket mounted on PCB.

5.10 Signaling

5.10.1 It is desirable that the Walkie-Talkie sets for General purpose use should have CTCSS/ DCS/ Digital Signaling facility and should be selected as per requirement of the Railways.

C. DMR Walkie-Talkie with Keypad and Display

5.11. General

5.11.1	Type of working	:	Simplex/semi-duplex.
5.11.2	Type of Modulation	:	TDMA (2 Voice Channels in Simplex Mode on 1 Frequency).
5.11.3	Frequency Range	:	146-174MHz.
5.11.4	No. of channels	:	Minimum 255 nos.

5.11.5 Channel separation : 12.5 Khz.

5.11.6 **Special features** :

i. CTCSS or DCS.

ii. Protection against high VSWR.

iii. Capability of being killed /un-killed.

iv. Emergency siren.

v. Radio Check.

vi. Busy Channel lockout.

vii. Channel scan.

viii. Channel number announcement or display in English or hindi as per user requirement.

ix. Private call, group call, all call in digital mode.

x. Operate in both analog and digital mode, it should switch over to mode analog / digital automatically as per received signal irrespective of presently selected mode (Analog/Digital).

xi. Battery status Indicator.

xii. Low battery alert.

xiii. VHF set shall have built in GPS with capability of GIS. However GIS software as per User's Application requirement (For Life Time) is **optional** and this feature is to be shown only in case Railway is purchasing the software.

xiv. Built in AES 256 bit Encryption(Open standard for interoperability)

xv. Built in Open Standard Bluetooth for Audio accessory connectivity

xvi. PTT ID & ANI

xvii. SMS texting & predefined message

xviii. Alpha Numeric Channel & Contacts Alias

5.12. Transmitter

5.12.1 Power output at antenna port : 5 Watt, tolerance of -2% is acceptable.

5.12.2 Frequency stability : ±0.5 ppm

5.12.3 Frequency deviation : ±2.5KHz for set having channel separation of 12.5 KHz

5.12.4 Digital protocol :

5.12.4.1 Digital protocol shall be ETSI DMR Open standard, and OEM should be Category-1 (Manufacturer Status) member of DMR association.

5.12.4.2 Set shall have IOP certification issued by DMR association.

OR

Walkie-Talkie sets should be interoperable with walkie-talkie sets being used in Indian Railways.

5.12.5 Vocoder type : AMBE+2.

5.12.6 Modulation Sensitivity : 1 to 10 mV at 1 KHz at mic. Input for (+/-) 1.5 KHz (for 12.5 KHz channel spacing)

standard deviation.

5.12.7	Modulation Distortion	:	Less than 5% at 1 KHz reference for (+/-) 1.5 KHz (for 12.5 KHz channel spacing) standard deviation.
5.12.8	Modulation Fidelity	:	Within +1, -3 dB of 6 dB / Octave
5.12.9	Spurious emission		Better than 70dB.
5.12.10	Transmitter Output impedance		50Ω.
5.12.11	AF distortion @ l KHz		<3% at 5 Watt
5.12.12	Frequency Generation		Frequency synthesized oscillator.
5.12.13	VSWR		Better than 1.5.
5.12.14	Hum &Noise		-40dB @12.5 KHz

5.13. Receiver

5.13.1	Sensitivity	:	Analog Mode- Better than 0.25 µV for 12dB SINAD. Digital Mode- 0.18 uV or better with BER ≤5%
5.13.2	Adjacent channel selectivity	:	> 60 db
5.13.3	Spurious and image rejection	:	> 65 db
5.13.4	Audio output	:	Minimum 500 milliwatt
5.13.5	Audio distortion	:	< 3%
5.13.6	AF Response	:	Shall be between +1 dB & -3 dB over the frequency range 350 Hz to 2700 Hz with 1KHz as ref.
5.13.7	Squelch sensitivity	:	0.18 µV
5.13.8	Inter-modulation rejection	:	Better than 60 dB

5.14. Antenna

5.14.1. The Walkie-Talkie Sets shall be provided with short helical spring antenna with coaxial connector with socket mounted on PCB.

5.15. **Signaling**

5.15.1. Walkie-Talkie sets for General purpose use should have DMR Digital/ CTCSS/ DCS Signaling facility and should be selected as per requirement of the Railways.

D. 25 W VHF Digital Radio Set

5.16. General

5.16.1	Type of Operation	:	Simplex / Semi - duplex.
5.16.2	Frequency Range	:	146 to 174 MHz.
5.16.3	Channel Spacing	:	12.5 kHz.
5.16.4	Emission	:	11KOF3E (12.5 khz) and 4FSK.
5.16.5	12.5 kHz Data	:	7K60F1D and 7K60FXD.
5.16.6	12.5 kHz Voice	:	7K60F1E and 7K60FXE.
5.16.7	Combination of 12.5 kHz	:	7K60F1W.

Voice and Data

5.16.8	Frequency Spread	:	28 MHz.
5.16.9	Type of Modulation		Digital DMR TDMA based open standard specifications platform which must have capability of backward compatibility with Analog radios.
5.16.10	Frequency Stability	:	±0.5 ppm
5.16.11	Speaker Impedance	:	4/8/16 Ω
5.16.12	No of channels	:	128 Minimum
5.16.13	**Special features**:	:	

i. CTCSS or DCS
ii. Protection against high VSWR
iii. Capability of being killed /un-killed
iv. Emergency siren
v. Radio Check
vi. Busy Channel lockout
vii. Channel scan
viii. Channel number announcement or display in English.
ix. Private call, group call, all call in digital mode
x. Operate in both analog and digital mode
xi. VHF set shall have built in GPS with capability of GIS. However GIS software as per User's Application requirement (GIS software for life time) is **optional** and this feature is to be shown only in case Railway is purchasing software.
xii. Built in AES 256 bit Encryption (Open standard for interoperability)
xiii. PTT ID & ANI
xiv. SMS texting & predefined message
xv. Alpha Numeric Channel & Contacts Alias

5.17. Transmitter

5.17.1	RF Power Output	:	10 to 25 Watt adjustable, Tolerance of -2% is acceptable.
5.17.2	Frequency Deviation	:	+/- 2.5 kHz for Narrow Band Channel Spacing.
5.17.3	Modulation Sensitivity	:	1 to 10 mV at 1 KHz at mic. Input for (+/-) 1.5 KHz (for 12.5 KHz channel spacing) standard deviation.
5.17.4	Modulation distortion	:	Better than 3%
5.17.5	Modulation fidelity	:	Within +1, -3 dB of 6 dB / Octave Pre-emphasis characteristic from 350 Hz to 2700 Hz with 1KHz as reference
5.17.6	Spurious and Harmonics	:	Better than 60db

5.17.7	Output Impedance	:	50 Ω
5.17.8	**Digital protocol**	:	

5.17.8.1 Digital protocol shall be ETSI DMR Open standard, and OEM should be Category-1 (Manufacturer Status) member of DMR association.

5.17.8.2 Set shall have IOP certification issued by DMR association.

OR

Radio sets should be interoperable with Radio sets being used in Indian Railways.

5.18. Receiver

5.18.1	Sensitivity	:	Analog Mode- Better than 0.25 µV for 12dB SINAD. Digital Mode- 0.18 uV or better with BER ≤5%
5.18.2	Selectivity	:	Better than 60 db
5.18.3	Image and Spurious rejection	:	Better than 65 db
5.18.4	Audio output	:	Better than 3W with less than 3% distortion at 1 kHz ref. measured at specified output.
5.18.5	Squelch sensitivity	:	Better than 0.25 µV
5.18.6	AF Response	:	Shall be between +1dB & -3 dB over the frequency range350 Hz to 2700 Hz with 1KHz as reference.

5.19. Antenna

5.19.1. Electrical

5.19.1.1.	Type	:	Omni Directional Ground Plane
5.19.1.2.	Gain	:	6 dB
5.19.1.3.	Frequency Range	:	MHz 146 – 174
5.19.1.4.	Bandwidth	:	MHz 10
5.19.1.5.	Impedance	:	Ohms 50 unbalanced
5.19.1.6.	VSWR	:	Less than 1.5
5.19.1.7.	RF Power handling capacity	:	100W
5.19.1.8.	Termination	:	N female/UHF Female.
5.19.1.9.	Lightening Protection	:	Direct Ground

5.19.2. Mechanical Support Specification

5.19.2.1. Support Pipe Material Aluminum

5.19.2.2. Support Pipe Length – feet 12

5.19.2.3. Support Pipe O D – mm 50

5.19.2.4. Support Pipe Wall Thickness – mm 2.5

5.19.2.5. Radiating Elements Material Aluminum

5.19.2.6. Radiating Elements Material O D –mm 12

5.19.2.7. Radiating Elements Mounting Clamp Cast Iron / Aluminum

5.19.2.8. Mounting Clamp for Antenna Cast Iron / Aluminum

5.19.2.9. Shipping Length - Feet 6.5

5.20. Specification of Antenna Cable: Supplier to submit the test report of all the parameter mentioned in the specification for the cable to inspecting authority.

5.20.1.	Length	:	30 mtr.
5.20.2.	Size	:	RG 217 Low Loss Cable
5.20.3.	Jacket	:	Polyethylene Black
5.20.4.	Outer Diameter	:	14 mm or more
5.20.5.	Characteristic Impedance	:	50 + / - 1 ohm
5.20.6.	Average Power Rating	:	1.00 kW at 100 MHz
5.20.7.	Attenuation	:	0.05 dB / Mt at 100 MHz

6.0 ELECTRICAL CHARACTERISTICS

6.1 Current consumption during transmission of rated full power should not be more than 1600 mA in case of no keypad and LCD display and 1750 mA in case of model with Keypad and display.

6.2 Current consumption during receiving the signal with full volume condition should not be more than 125 mA in case of analog Radio and 450mA in case of Digital radio both Keypad and non-keypad sets.

6.3 Idle current should not be more than 70 mA in case of without display 90mA in case of sets with LCD display.

6.4 When tested in 10:10:80 it should give at least 95% of its rated capacity as specified by manufacturer.

6.5 Charger output current should be such that it can charge a fully discharged battery in 2-4 Hrs. in case battery capacity is upto 3000 mAh.

7.0 PERFORMANCE TEST

7.1 Transmitter should be tested as per clause number 5.2/ 5.7/ 5.12/ 5.17 whichever applicable.

7.2 Receiver portion should be tested as per clause number 5.3/ 5.8/ 5.13/ 5.18 whichever applicable.

7.3 Special feature should be tested for compliance as per clause number 5.6.7/ 5.11.6/ 5.16.13 in case of Digital radio.

8.0 ENVIRONMENTAL AND CLIMATIC REQUIREMENT

8.1 VHF radio set should meet following climatic requirements:

SN	Parameter	Reference	Severity required
1.	Low pressure test	MIL STD 810 G Pro I	15000 ft./57 kPa 1 Hr.
2.	High temperature	MIL STD 810 G Pro I	7*(35°C-71°C-35°C of 24 Hrs)
		MIL STD 810 G Pro II	7 cycles comprising one cycle as (32°C-49°C-32°C of 24 Hrs)
3.	Low temperature	MIL STD 810 G Pro I	-57°C*24Hrs.
		MIL STD 810 G Pro II	-33°C*4Hrs.
4.	Temperature shock	MIL STD 810 G Pro I	(-30°C*2Hrs, 61°C*2Hrs, -30°C* 2Hrs) *4

5.	Rain (blowing rain) test	MIL STD 810 G Pro I	(Drop size 0.5 to 4.5 mm@4"/Hour, Wind Velocity 40 mph)* 6 sides/faces 30 Min. each side/face covering all axes
6.	Humidity test	MIL STD 810 G Pro I	15*(34C, RH 65%, RH 85 %,71 C, RH 20 % total 24 hrs.) Deionised water of 6.5-7.5 PH used
7.	Salt fog test	MIL STD 810 G Pro I	48Hrs (Salt Soln 6.5-7.2 Ph, 5% Conc @1-2 ml/Hour)
8.	Sand dust blowing	MIL STD 810 G Pro I	2*(10gm/m3 air velocity 1.5 m/s*1 Hr)
9.	Vibration test	MIL STD 810 G Pro I	Freq 10-500 Hz, Displ Amplitude 5 mm XYZ Axis, 1 Hr /Axis
10.	Shock test	MIL STD 810 G Pro I	40g 15-23 ms 6 shock /Axis
11.	IP	IEC 60529	IP 65/66/67 for 5W radio (Any one to be selected by purchaser) & IP 54 for 25 W radio

8.2 Above test should be conducted in labs as per criteria defined by RDSO.

9.0 TESTS AND PERFORMANCE REQUIREMENT

9.1 Two sets of walkie-talkie with complete accessories including battery shall be offered for type test.

9.2 Operating Manual and Maintenance Manual of the system shall be submitted along with samples during Type Tests.

9.3 Unless otherwise specified, all the tests shall be carried out under prevalent ambient atmospheric conditions.

9.4 **Type Test**

The following shall constitute Type Test:

9.4.1 Visual Inspection (Clause 3.0 to 4.0,12.1 & Cl 14.2.1.1 of IRS:S:23 as applicable)

9.4.2 Electrical Characteristic Test (Clause 6.0)

9.4.3 Performance Test (Clause 5.0 & Clause 7.0)

9.4.4 Climatic Severity Test (Clause 8.0)

9.4.5 After completion of Climatic and Vibration Tests, the equipment shall be visually inspected to check for any damaged or cracked parts. During Final Testing after climatic and vibration tests, all electrical characteristics should be within the specified limits.

9.5 **Acceptance Test**

9.5.1 The Acceptance Test shall comprise of following tests taken in sequential order as follows:

9.5.1.1 Visual Inspection (Clause 3.0 to 4.0,12.1 & Cl 14.2.1.1 of IRS:S:23 as applicable)

9.5.1.2 Electrical Characteristic Test (Clause 6.0)

9.5.1.3 Performance Test (Clause 5.0 & Clause 7.0 except intermodulation rejection)

9.5.2 Following sampling plan shall be applicable for acceptance test:

Lot consisting Equipment	1st Sample size (N1)	2nd Sample size (N2)	Combined Sample size (N1 + N2)	Acceptance Number (C1)	Rejection Number (C2)
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Under 25	3	6	9	0	2
25 to 50	7	14	21	0	3
51 to 100	10	20	30	0	3
101 to 200	13	26	39	0	5
201 to 300	20	40	60	1	5
301 to 500	25	50	75	1	6

The number of Equipment (N1) as given in Column '2' shall first be selected and subjected to the Acceptance Test. If in the first sample, the number of defective Equipment, that is those failing in one or more acceptance test is less than or equal to the corresponding number (C1) given in Column '5', that lot shall be considered as conforming to the requirement of the acceptance test. If the number of defective equipment in the first sample is greater than or equal to the rejection number in Column '6', the lot shall be considered as not conforming to the requirements of the acceptance test. If number of defective equipment in the first sample lies between C1 and C2, a second sample of size N2 as given in Column '3'shall be selected and subjected to the acceptance test. If in the combined sample, the number of defective equipment is less than C2, the lot shall be considered as conforming to the requirement of acceptance test.

9.6 **Routine test**

The manufacturer shall certify that all the tests given in para 9.5 have been successfully carried out on all the equipments offered for inspection. He shall produce those tests results at the time of inspection. The manufacturer shall under take auditing of the components/ devices for ensuring the reliability. Audit record shall be shown to the inspection authority.

9.7 **POC Trial**

To check the actual field performance of the VHF set, POC trial shall be conducted by the concerned Zonal Railway indenting the VHF sets as per guidelines issued by RDSO.

10.0 ITEMS TO BE SPECIFIED BY PURCHASER

10.1 Purchaser should specify the spot frequency.

10.2 Required technical parameter as per Cl. 5 A/B/C/D (Any one)

10.3 Battery Type Ni Mh / Li-Ion for 5 W set and Ni Mh/ Li-Ion/ VRLA for 25 W set.

10.4 Battery Capacity for 25 W Set: 12 V minimum 96 AH unless specified by purchaser.

10.5 Length of cable to be supplied in case of 25 W radio (otherwise standard length to be supplied is 30 mtrs).

10.6 Requirement of GIS software to be specified by the purchaser in case of 5 W DMR Walkie-Talkie set with keypad and display and 25 W radio set.

10.7 Language required (English or Hindi) for channel no announcement/display (Cl no. 5.11.6 VIII).

10.8 Required IP as per Cl. 8.1, SN 11 for 5W walkie-talkie set.

11.0 MAINTENANCE PRACTICE

11.1 GENERAL HANDLING AND USE

11.1.1 Regularly inspect the radio and its components for damage or wear. Most radio performance issues and premature failure of radio components are due to antenna malfunction. Maintenance of the antenna, therefore, is of critical concern. A severely bent antenna will reduce the effective range of communication, and should be replaced. An annual check-up is recommended to measure radio output and antenna reflected power.

11.1.2 Ensure that the antenna is screwed properly to the base and is sealed from moisture by a rubber O-ring.

11.1.3 Ensure that the antenna connector at the back of the radio is tight, and that the cable is not kinked at this connection.

11.1.4 Do not subject the radio to physical abuse, excessive shock or vibration.

11.1.5 Do not drop, jar or throw the radio.

11.1.6 Do not carry the radio by the antenna.

11.1.7 Avoid exposure to excessive moisture or liquids.

11.1.8 Do not submerse the radio unless it is designed to be submersible.

11.1.9 Do not expose the radio to corrosives, solvents, cleaners or mineral spirits.

11.1.10 Avoid exposure to excessive cold and heat.

11.1.11 Avoid prolonged exposure to direct sunlight.

11.1.12 Do not place or leave radios on surfaces that are unstable.

11.1.13 Always turn the radio off before installing optional accessories.

11.1.14 Only use accessories intended for the specific make and model of your radio, especially batteries, chargers and power adapters.

11.2 DAILY CARE AND CHARGING

11.2.1 Use approved batteries, chargers and adapters designed specifically for your make and model radio.

11.2.2 Do not attempt to charge a wet radio or battery pack.

11.2.3 Do not charge the radio or battery pack near anything flammable.

11.2.4 If the radio becomes wet, immediately dry it with a microfiber or other lint-free cloth

11.2.5 Stabilize the battery pack to room temperature (72 degrees F) before charging.

11.2.6 Do not charge radios and/or battery packs on wet or unstable surfaces.

11.2.7 Do not leave radios and/or batteries in chargers for excessive periods.

11.3 STORAGE

11.3.1 Turn off the radio and remove batteries before storage.

11.3.2 Store radios and battery packs in a cool, dry area at room temperature (72 degrees F).

11.3.3 Do not store radios and/or batteries in active chargers.

11.4 SIGNS THAT INDICATES THAT BATTERIES ARE TO BE REPLACED

11.4.1 Weak battery will hold a charge for shorter periods and require more frequent charging.

11.4.2 Despite constantly needing to be charged, a weak battery will charge rapidly because of its limited battery capacity.

11.4.3 Weak batteries often overheat during charging or usage.

11.4.4 If you remove the battery cover and notice any corrosion on the battery.

11.4.5 If you detach the entire battery and feel any hard spot, bubbling or swelling.

12.0 MARKING & PACKING

12.1 The following information shall be clearly embossed / engraved / screen printed at a conspicuous places.

a) Item Name

b) RDSO Specification Number

c) Name or monogram of the manufacturer.

d) Year of manufacture.

e) Serial Number

12.2 Any other information specially requested and required by purchaser should also be incorporated in the system.

12.3 PACKING: The equipment shall be suitably packed so as to avoid any damage or deterioration during storage and transit.

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Digitally Signed by Vijay Garg
Date: 21-08-2023 10:41:40
Reason: Approved