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GOVERNMENT OF INDIA

MINISTRY OF RAILWAYS

VHF Based Approaching Train Warning System for Track Maintainers



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Target group: Track and S&T Maintenance staff

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VHF Based
Approaching Train Warning System for Track Maintainers

Introduction

VHF Based Approaching Train Warning System has been designed for the safety of Track Maintainers who perform patrolling on Railway Track throughout the year to ensure safe running of trains during all-weather conditions. The system conforms to ***RDSO Specification No. RDSO/SPN/TC/105-2015 ver. 2.0***. This equipment will give an advance warning to maintenance staffs about an approaching train in mid-section through hand held VHF receiver unit so that maintenance staff are alert about approaching train.

This is a portable system which is primarily to give basic information regarding approaching trains. In no case, this system should be considered as the primary safety system for working on the tracks and all necessary instructions/precautions/norms regarding ensuring safety of men working along the track should be followed.

System Working

Radio Frequency (RF) coded signals are transmitted from a VHF Transmitter kept at station through a roof top antenna to indicate information of an approaching train in the block section.

Relay contacts of Advanced Starter Signal aspects status are interfaced with VHF Transmitter to activate transmission of warning signals about an approaching train. When OFF aspect information of a departure signal is made available to the Transmitter Unit, it transmits this signal once every 20 ± 2 seconds through the roof top antenna.

These transmitted RF signals will be received by Hand Held Receiver (HHR) available with the Track Maintainer (when VHF Receiver is "ON") present in the block section ahead under the coverage area of the transmitter.

HHR processes the received signal to decode and generate visual alarm through suitable LED indication and triggers audible pre-recorded alarm with vibrations to alert maintenance staff about the presence of approaching train on UP/DN track.

Manual trigger of warning is also possible by a push button switch provided on the transmitter panel for "UP and/or DN" trains. The procedure for manual operation should be defined in SWR (Station Working Rule).

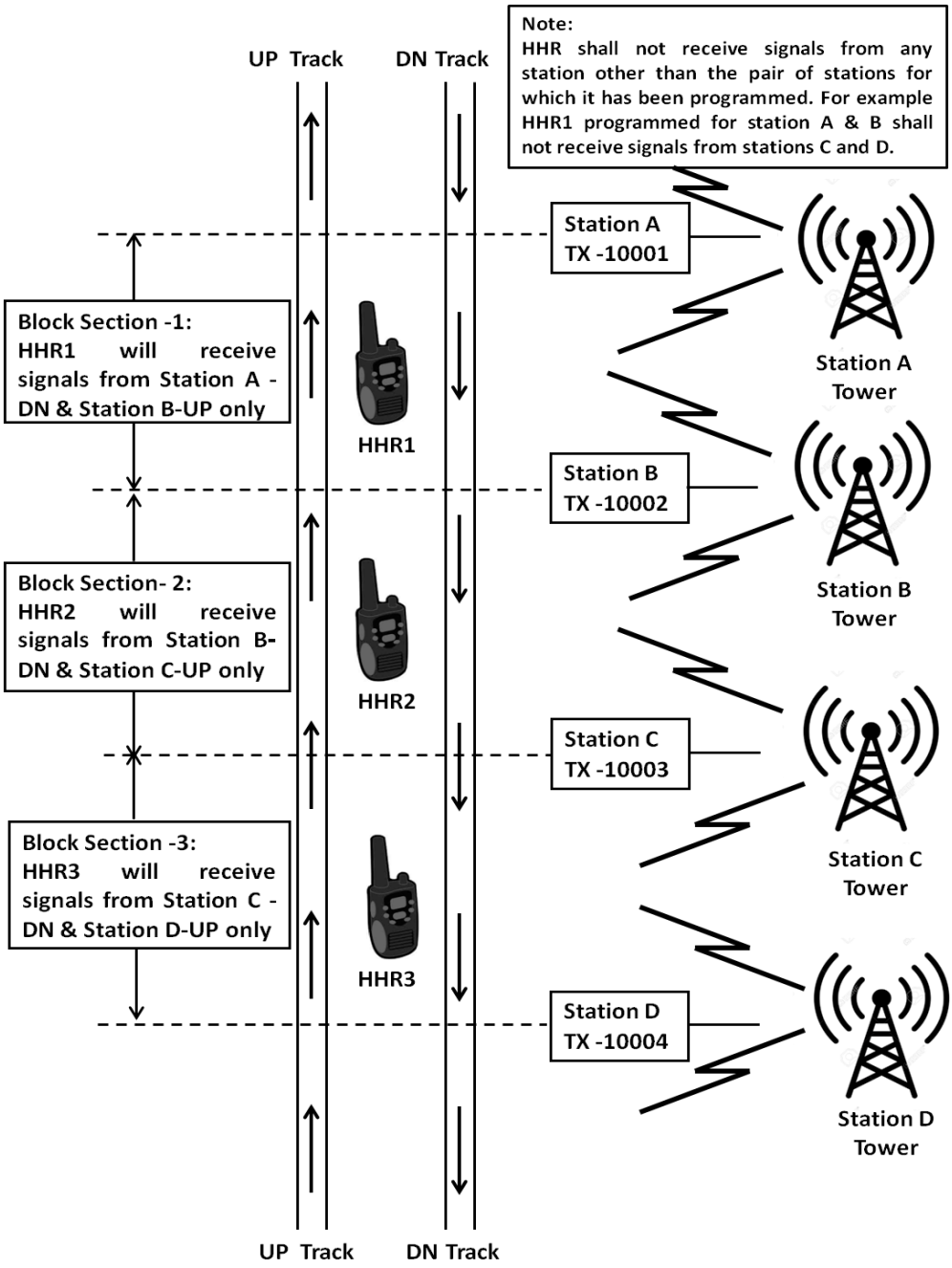
Communication requirements

The system is based on VHF radio communication and works in the frequency range 150 -174 MHz. The propagation of signal significantly depends on availability of Line of Sight.

Sufficient signal strength is not available at some areas in a block section and the system may not function properly, especially on hilly terrains, ghat sections, thick forest/vegetation/buildings/curves etc. Such areas need to be identified during installation and be informed to the users, by way of suitable boards installed along the track.

Proper site survey should be carried out before installation, as the efficacy of the system will depend upon the direction as well as height of the antenna.

Typical RF Signal coverage diagram



Equipment details

The system consists of mainly two parts:

- Fixed VHF Transmitter
- Hand held VHF Receiver-HHR

Fixed VHF Transmitter

VHF Transmitter with a Unique ID Code is normally installed at an appropriate location preferably Station Master's Room.

The output of transmitter is connected to the Antenna mounted on roof top or mast at a suitable height (10 -12 Metres) to get adequate coverage in the block section.

RF output power of transmitter should be min. 15 watts at 160.450 MHz, which will provide coverage of about 10 Km under proper line of sight.

The Transmitter Unit consists of:

- 25W ± 10% Fixed VHF Radio.
- Interfacing and control card.
- Protection arrangements.
- Power supply unit with built- in 12V/7AH Battery & Suitable charger.
- Ground Plane (GP) Antenna with RF cable.
- Power supply cord (Min. 3 meter length) with 230 V AC/5A plug top.
- Connector to connect wires of advance starter signal contacts for UP/ DOWN direction trains.
- ON/OFF switch to switch ON/OFF the transmitter unit .
- Various indications and controls. (Details in Table A)

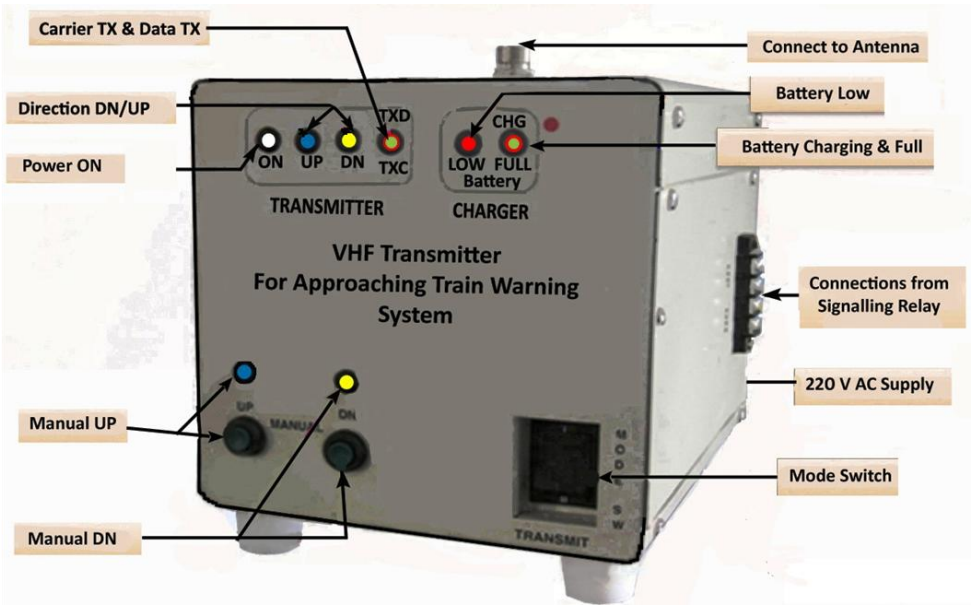


Table A: Indications on front panel of VHF Transmitter

Sr. No.	Indication	Description
1	ON (White LED)	Transmitter ON
2	UP (Blue LED)	UP Signal from Signalling Relay
3	DN (Yellow LED)	DN Signal from Signalling Relay
4	TXC (Dual LED Red) TXD (Dual LED Green)	Transmitted Carrier Transmitted Data
5	Low (Red LED)	Battery Low
6	CHG (Dual LED Red) FULL (Dual LED Green)	Battery Charging Battery Full Charge
7	UP (Green LED)	UP Signal from Manual Trigger
8	DN (Green LED)	DN Signal from Manual Trigger

Mode Switch: Mode Switch to be put in ON position after connecting Antenna to transmitter unit via RF cable for Transmission of warning signals in Auto mode through Relay Contacts.

VHF Based Hand held Receiver (HHR)

This is a small VHF Receiver unit (working frequency 160.450 MHz ± 5Khz), which will be used by the field staff, working along the railway track. HHR responds to the transmitted signal received from the VHF Transmitter for which it has been programmed.

The Receiver unit consists of :

- ON/OFF Switch with Switch ON indication.
- Antenna
- Inbuilt Rechargeable battery (with a backup of 12 hours when fully charged) in ABS housing.
- Suitable fastening arrangement for fixing it on trouser belt/pocket.
- Indications (Details in Table B, C & D)



Table B: Indications on front panel of Hand held Receiver (HHR)

Sr. No.	Indication	Description of Warning Signals
1	UP (Blue LED) blinks.	Train on 'UP' track
2	DN (Yellow LED) blinks	Train on 'DOWN' track
3	Both UP and DN LEDs blink	Train on both UP & DN Tracks

In addition to above, Audio signal "UP TRAIN – UP TRAIN" or "DN TRAIN – DN TRAIN" or alternatively both will activate at every (20 ± 2) seconds as per the situation 1, 2 and 3 above respectively along with vibration of approximate 1 second duration 3 times at an interval of approximate 1 sec.

Table C : Battery status indications on HHR

Sr. No.	Indication	Status
1	Dual LED Red Steady	Battery Low
2	Dual LED Green Blinking	Battery Charging
3	Dual LED Green Steady	Battery Fully Charged

Table D : Indications on HHR for Range of Received Signals

Sr. No.	Condition of RF Signal	Status
1	Healthy Signal from both UP & DN Transmitter	Both UP and DN LED blink after every minute ± 5 seconds without any buzzer or vibration.
2	Healthy Signal from only UP Transmitter	Only UP LED blinks after every minute ± 5 seconds. HHR sounds 2 beeps without vibration.
3	Healthy Signal from only DN Transmitter	Only DN LED blinks after every minute ± 5 seconds. HHR sounds 2 beeps without vibration.
4	Weak Signal from both UP & DN Transmitter	HHR sounds 2 beeps after every minute ± 5 seconds without any buzzer or vibration.

Troubleshooting

VHF Transmitter

Sr. No.	Fault	Remedy
1	Unit is not turning ON	➢ Check whether the voltage supply is NORMAL. ➢ Check whether Mode Switch is broken down.
2	UP or DN Signal is not triggered	➢ Check Unit and Mode Switch is ON. ➢ Check whether the UP or DN switch is broken down.

Hand Held Receiver (HHR)

Sr. No.	Fault	Remedy
1	Unit is not turning ON	➢ Check whether the battery is dead. ➢ Check whether the battery is in well contact with the foil of the ➢ unit. ➢ Check whether battery is low. Then connect 230V AC charger to ➢ the HHR till Green (3rd) LED will glow continuously.
2	Unit cannot be charged	➢ Check whether plug of the charger is firmly connected with the port of the unit.
3	Can't receive "UP", "DN" or "RF Signal"	➢ Check whether the HHR is paired with UP and DN corresponding station - VHF Transmitters

Do's & Don'ts

Do's

- Only authorized person should open the system.
- Switch ON the "Mode Switch" of VHF Transmitter only after installing and connecting G.P. Antenna properly.
- Before operating ensure that, earthing wire is connected properly to the "Earthing" terminal provided on VHF Transmitter.
- Connect the "VHF Transmitter Unit" continuously on 230V AC mains supply for charging the battery.

Don'ts

- Don't switch ON the "MODE SWITCH" of VHF Transmitter till installation is completed.
- Don't disconnect RF cable coming from Antenna to VHF Transmitter, once
- installation is done.
- Don't keep the unit "ON", if the Battery is low, which is indicated by Red LED (5th) – "LOW" in ON condition.
- Don't operate unit on Low Battery to avoid damage to the System.

Disclaimer

The information given in this pamphlet does not supersede any existing provisions laid down in Signal Engineering Manual, Telecom Engineering Manual, P. Way Manual and any other manual associated train operation. This document is not statutory and instructions given in it are for the purpose of guidance only. If at any point contradiction is observed, then Rly. Board/RDSO guidelines or Zonal Rly. instructions may be followed.