1.0 OBJECTIVE:

1.1 To define the standard process for conducting Quality Assurance (QA) and Quality Control (QC) activities for Way-side Kavach installations. The objective is to ensure that all civil, electrical, networking, and equipment-related works are carried out in compliance with approved drawings, specifications, and safety standards.

1.2 This document also aims to provide a uniform approach for inspection, verification, and documentation, ensuring reliability and readiness of the Kavach system before commissioning.

2.0 SCOPE:

2.1 This SOP applies to all QA/QC engineers, site teams, and associated stakeholders involved in the installation, inspection, testing, and commissioning of Way-side Kavach equipment and infrastructure. The scope covers activities including site surveys, civil works, cable laying, equipment installation, wiring, earthing, testing, commissioning, and certification. It also extends to documentation, compliance verification, and closure of non-conformities across all project sites under Kavach deployment.

3.0 REFERENCES:

Ref #	Activity / Reference Document title	Document number
1.0	**Station Kavach Installation**	
1.1	Station Kavach Relay Room Layout Diagram	EG-IC-FT-27
1.2	Station Kavach Installation Checklist	EG-IC-FT-48
1.3	Personnel Safety Instruction Manual	5 16 76 0014
1.4	OFC Splicing Block Diagram	5 16 49 0559
1.5	Deployment Record	EG-IC-FT-52
1.6	Acceptance Test Report	SIF:589 (System Level Functional Test Case)
2.0	**RF Communication Tower**	
2.1	RDSO Approved Drawing for Tower	RDSO/TC/TOWER/L/40/180/T/6.5
2.2	Stationary TCAS Tower (I&C)	5 16 76 0009
2.3	Drawing for RCC Cable Marker	15-D1
3.0	**Radio Tower Unit**	
3.1	Installation arrangement for 10.2Dbi Omni direction antennas and Radio Tower Unit	5 16 67 0983
4.0	**RF Communication Antennae**	
4.1	Procedure for Antenna fixing & Cable Routing	5 16 90 0018
4.2	KAVACH_HIGH PROFILE ANTENNA	5 16 76 0041

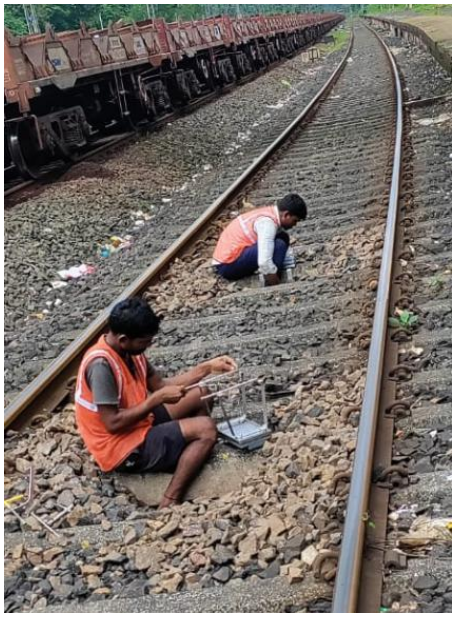
Ref #	Activity / Reference Document title	Document number
	INSTALLATION DRAWING	
5.0	**Station Master Operation-Cum- Indication Panel**	
5.1	KAVACH_SM OCIP INSTALLATION DRAWING	5 16 76 0040
5.2	KAVACH_SM OCIP TERMINATION PANEL INSTALLATION DRAWING	5 16 76 0046
6.0	**Arrangement of Station termination box**	5 16 49 0617
6.1	KAVACH_STATIONARY TERMINATION PANEL INSTALLATION DRAWING	5 16 76 0045
7.0	**GPS & GSM Antennae**	
7.1	KAVACH_GPS GSM INSTALLATION DRAWING	5 16 76 0039
8.0	**OFC Communication Rack**	
8.1	KAVACH OFC COMMUNICATION RACK INSTALLATION DRAWING	5 16 76 0047
9.0	**RIU**	
9.1	RIU Installation Manual	5 16 53 0079
9.2	RIU Pre Installation Checklist	SIF-0551
10.0	**Kavach - Interlocking System Interface**	
10.1	Relay Wiring diagram	Respective station diagram
10.2	STCAS - Siemens EI Interface Drawing	5 16 49 0609
10.3	STCAS - Medha EI Interface Drawing	5 16 49 0610
10.4	STCAS - Kyosan EI Interface Drawing	5 16 49 0611
10.5	STCAS - Hitachi EI Interface Drawing	5 16 49 0612
10.6	Interface Wiring Integrity Test Report	EG-FT-IC-44
11.0	**RFID Tags**	
11.1	RFID Tag Placement Plan	EG-PJ-FT-20
11.2	Installation procedure for RFID Tags	5 16 76 0031
11.3	RFID Tag Verification Report at site	EG-IC-FT-56
11.4	DCN Implementation Report at site	EG-IC-FT-52
11.5	Typical Kavach RFID Sleeper	DWG.No.KAVACH/RFID/SLEEPER/2024
11.6	Typical Kavach RFID Board	DWG.No.KAVACH/RFID/BOARD/2024
12.0	**Inter-connection Drawings**	
12.1	Stationary Kavach Connectivity Diagram	5 16 49 0614
12.2	Cable Route Plan Tower to Station Kavach	EG-IC-FT-63
12.3	OFC Network Connectivity Drawing	Project specific drawings issued by Engineering
12.4	Typical diagram of Signaling and telecon service Building for Kavach Mid-section	Annexure II(A) of WCR Feasibility Report
12.5	Typical diagram of Signaling and telecon	Annexure II(B) of WCR Feasibility

Ref #	Activity / Reference Document title	Document number
	service Building for Kavach at Station	Report
12.6	Feasibility Report	Respective contract document
13.0	**Earthing**	
13.1	Station TCAS Tower Earth Drawing	Approved Letter no.DY.CSTE-C-KOTA-S AND T / EPC-WCR-SnT-02, Dt 21.12.2022
13.2	STCAS unit & TCAS Relay rack earth	5 16 76 0044
14.0	**Pre-Commissioning Check**	
14.1	PCCL for Stationary Kavach, issued by RDSO	SIF-0577 Ver 2.1
14.2	PCCL for RIU	SIF-0577 Ver 1.0; Annexure-A1
15.0	**Site Acceptance Testing (SAT)**	
15.1	SAT procedure, issued by RDSO	SIF:0593 Ver 1.0 (issued by RDSO)
16.0	**PCSTE**	
16.1	Book of Rules for PCSTE Sanction of Kavach Implementation on Indian Railways	SIF:0592 Ver 1.0
16.2	QC Manager Certification Report	

4.0 Personnel safety instructions:

QC shall ensure that all personnel strictly adhere to the safety requirements during the installation of STCAS and its associated sub-systems in the railway environment, as these activities involve potential safety risks.

- Personnel shall follow the guidelines provided in the **Personnel Safety Instruction Manual** [Ref 1.3] at all times.
- Non-compliance with these safety instructions may lead to serious risks to personnel safety and may also render insurance claims invalid.
- All personnel working on tracks must **wear reflective safety jackets, helmet and safety shoes** at all times.
- QC Engineers are responsible for **monitoring and ensuring compliance** with safety requirements at the worksite.
- In case any contractor or worker is found not using reflective jackets or safety shoes, the QC Engineer shall:



- **Immediately stop the work**.
- **Escalate the non-compliance** to the Site In-charge/Project Manager for corrective action.
- Ensure that **work does not resume until full compliance** with safety requirements is achieved.

5.0 PROCEDURE:

5.1 Survey:

The following survey activities shall be conducted by the Installation team. QC shall ensure to initiate and verify the commencement of these surveys. In case any of the activities are not carried out, QC shall inform the Installation team immediately.

5.1.1 RSSI survey
5.1.2 Track survey by using LIDAR
5.1.3 Floor Plan
5.1.4 Cable Route Plan from SKavach to Tower and SKavach to Station Manager Room
5.1.5 OFC Cable route survey
5.1.6 Building Plan for SKAVACH
5.1.7 Proposed Tower Location Survey
5.1.8 Verification of RFID Tag ABS location as per RFID Layout
5.1.9 Kavach Equipment, Telecom Equipment, Building and Tower Earthing Plan

5.2 Site drawings:

The following site drawings/Documents shall be provided by the Installation team. QC shall ensure the availability and correctness of these documents prior to and during in-process inspection:

5.2.1 Floor Plans
5.2.2 Cable route plan from Kavach to Tower location
5.2.3 Power Supply drawings (PSD and Load Calculations)
5.2.4 OFC network drawings
5.2.5 OFC Cable Route Plans (foot by foot survey)
5.2.6 Towers Typical Earthing Plan for Kavach Tower
5.2.7 Proposed Tower Location approved copy
5.2.8 Proposed building approved copy
5.2.9 Tower foundation diagram

5.3 Construction & erection of towers:

5.3.1 QC shall verify the quality of tower construction and erection activities.
5.3.2 The verification shall cover workmanship, material quality, alignment, Tower foundation Orientation, Safety Bari gating and compliance with approved drawings and specifications.

5.3.3 Any deviations or deficiencies shall be recorded and informed to the concerned team for corrective action.

5.4 Construction of buildings: (if applicable based on the contract)

5.4.1 QC shall verify the quality of buildings constructed as per the approved diagram [Ref:12.4] and [Ref:12.5] (or) requirement of respective Tender document [Ref:12.5] Feasibility Report.

- The verification shall include workmanship, material quality, and adherence to approved drawings and specifications like; Flooring – Ceramic Tiles, Wall Tiles (Skirting & Dado), Door Shutters & Frame, Electrical – Wiring (Point), Electrical – Main Circuit,Electrical – Conduits,Electrical Termination,Codal Provisions.

5.4.2 Verification details shall be recorded in the QC check list.

5.4.3 Any deviations or deficiencies shall be recorded and informed to the concerned team for corrective action.

5.5 Laying of sectional OFC Cable:

5.5.1 Pre-laying Check

- Verification of approved cable route plan.
- Confirmation of trench dimensions (depth, width) as per the specification [Ref:12.6]
- Condition of ducts, pipes, or HDPE conduits (if applicable).
- Ensuring proper clearance from power lines, water pipelines, and other utilities.

5.5.2 Cable Handling and Laying

QC has to ensure;

- Cable drums mounted on Jackscrew stand shall be used for cable laying to avoid any kinks or pressure on the cable during cable laying. Sufficient manpower should be arranged by the contractor to lay the cable manually so that it does not rub on the ground.

5.5.3 Protection and Joining

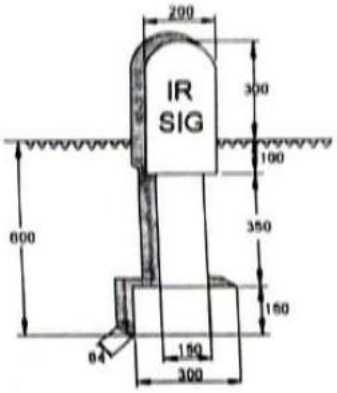
- Use of protective Caps/insulation tape at both ends of the cable.

5.5.4 Post-laying Verification

- Cable route markers shall be provided all along the route at a nominal interval of 50 m. Additional markers shall be provided to indicate important points like cable joints, water

and sewage mains, power cable, crossings, alignment bends/curves,
etc.[Ref:2.3]

- Cable markers to be fixed before backfilling, ensuring top portion remains visible after filling



5.5.5 Testing & Documentation

- OTDR (Optical Time Domain Reflectometer) test for attenuation and fiber loss.
- Verification of cable test results against specifications.
- Insulation resistance test (Megger ≥100 MΩ at 500V) for OFC metallic parts / armoring continuity.

5.6 Installation of Kavach equipment:

QC shall ensure the following inspection steps are carried out as per the approved Installation Procedure and referenced drawings:

5.6.1 SKavach

- Ensure the installation location matches the **approved floor plan** [Ref:1.1]
- Check **grouting quality** of the stand with insulator.
- Verify that the stand is securely fixed using **mounting bolts** tightened to the **required torque** and record torque values in the QC report.
- Ensure earthing is connected to the **ring earth/bus bar earth**.
- Ensure quality of all local materials such as ladders, troughs, lugs,etc.
- Ensure all cable routing shall be done properly, No cable hanging, neat, safe.
- Check that appropriate **cable glands** are used for all cable entries.
- If a cable gland is **not used**, close the opening with a **dummy gland** to prevent dust/rodent entry.
- Ensure there is no gap between the floor and the door of the Kavach room.
- Ensure all the cable entry and exit at relay room shall be completely sealed with cement to avoid rodent entry.
- Ensure cable are properly connected as per OFC block diagram [Ref: 1.4] and [Ref:6.1]

- Check the LED of all modules showing healthy or not, LED indicators of all modules shall be checked when the system is on [Ref: 1.6]

5.6.2 Networking rack

- Verify rack installation shall be done as per the drawing [Ref: 8.1]
- Ensure all modems, switches, routers are fixed firmly with power supply and fiber termination and fiber connectivity as per network diagram
- Inspect labeling and cable dressing.
- Ensure earthing is connected to the **ring earth/bus bar earth**.
- Cable Connections and Cable routing as per diagram

5.6.3 IPS

- Installation shall be done as per the floor plan [Ref:1.1]
- Cable connections and Routing done as per diagram [Ref :1.5]
- Ensure earthing is connected to the **ring earth/bus bar earth**.

5.6.4 DC-DC Converters

- Ensure Installation shall be done as per the floor plan [Ref:1.1]
- Cable connections and Routing done as per PSD and Load calculation diagram [Ref: 9.1]
- Ensure earthing is connected to the **ring earth/bus bar earth**.

5.6.5 PDU

- Ensure Installation shall be done with insulator
- Cable connections and Routing done as per PSD and Load calculation diagram [Ref: 9.1]
- Ensure earthing is connected to the **ring earth/bus bar earth**.

5.6.6 SMOCIP

- Ensure SM-OCIP installed at proper **height & position** for hassle-free operation as location suggested by Station Master [Ref:5.1]
- Ensure 12 Core Signalling cable shall be used for button, counter & power supply. CAT-6 armoured cables shall be used for the communication portion
- OFC Termination shall be done as per diagram [Ref:5.2]
- Ensure earthing is connected to the **ring earth/bus bar earth**.
- Verify functionality of SMOCIP buttons
- Generate SOS and check working mechanical counter
- Press Control button and check checksums are match with FAT certificate

- Ensure with **SM key OFF**, no operations should execute.
- Ensure SM key always available with SMOCIP unit.

5.6.7 GPS/GSM antenna

- Verify the installation of **GPS & GSM antennae** are mounted on rooftop in redundant path as per diagram [Ref: 7.1]
- Ensure mechanical mountings of GSM antennas are properly installed as per the diagram and that no water stagnation occurs.
- Verify that **GPS antenna** has clear view of the sky.
- Check whether **two GPS antenna cables** are firmly connected to GPS IF Modules (as applicable).
- Check whether **two GSM antenna cables** are firmly connected to Stationary KAVACH module.
- Fixing with Anchor bolts
- Ensure cable connections are made as per cable labelling
- Cable Routing with HDPE pipe/ Hard pipe

5.6.8 Relay Rack

- Ensure Relay rack installation shall be done as per floor plan [Ref: 1.1] and fixing done with Insulators.
- Relay wiring shall be done with approved Relay wiring diagram [Ref: 10.1]
- Ensure cable routing and dressing shall be done properly
- Ensure wires are tagged and marked properly for easy identification
- Ensure that wire ends are properly crimped with correct size of lugs and inserted properly in the terminals.

- Verify that the fuses and MCBs of the correct rating are provided in the connectors as specified in the PSD [Ref:9.1]
- Ensure Fuse should be fix in the fuse holders properly and there is no loose connection/contact.
- Ensure Relay Coil Voltage and Relay Output Voltage shall be > 22 V
- Ensure earthing is connected to the **ring earth/bus bar earth**.
- For the EI stations, verify the connections as per the EI Interface diagram [Ref: 10.2, 10.3, 10.4, 10.5]

- After installation and testing by EI team, collect the test reports and upload in to WFMS.
- Ensure Interface Wiring Integrity Test shall be conducted by Installation team and record the results in the template [Ref:10.6]

5.6.9 RIU

- Ensure RIU installation shall be done as per the installation Manual and floor plan [Ref: 9.1] and [Ref:1.1]
- Check that the RIU stand/bracket is **firmly grouted with insulation**
- Verify **connectivity with RIU** through **OFC in redundant path**.
- **Ensure power Voltage 230V AC / 110V DC(+30% or -20%)**
- Ensure dedicated earth connection (<1Ω) with continuity check
- After completion of Installation, installation details shall be recorded in the pre installation template [Ref:9.2]
- Ensure all cable routing shall be done properly, No cable hanging, neat, safe.
- Ensure earthing should connect separately, not to connect looping.

5.6.10 Tower (for new tower installation)

- Verify installation of **tower, ladder, climbing arrangement, plat form, gate and safety features** has been done as per the **approved Tower drawing** [Ref: 2.1] and [Ref: 2.2]
- Check tower foundation and **grouting quality** (no cracks, proper curing, level alignment).
- Ensure **torque of foundation bolts** is as per specification (or) foundation bolts are welded.
- Verify that **all lightning rods are properly earthed** as per the tower earth diagram [Ref: 13.1]
- Verify lightning protection (air terminal and down conductor) is installed as per standard [Ref: 13.1]

5.6.11 RTU

- Verify RTU mounting on tower platform as per diagram [Ref 3.1]
- Inspect power supply connection, fuse and MCB provision.
- Ensure separate earthing connection of RTU (Earth Pit 4) as per diagram [Ref:13.1]
- Verify cable terminations (OFC and Power cable) are made correctly as per diagram.

- Power ON the RTU and verify LED indicators/health status as per RTU User Manual.
- Confirm communication link between RTU and station equipment.
- Ensure power supply for Aviation Lamp.

5.6.12 RF Antennas

- Verify RF antenna type, height, and orientation as per Desktop **survey report**.
- Ensure that **all antennae mounted on the tower are at the same level** [Ref:4.1] and [Ref:4.2]
- Verify that **antennas are properly fixed with clamps at the bottom side of antenna**
- Check that **surge suppressors are connected** to all radio transmit and receive antenna cables.
- Check antenna feeder cable routing — no sharp bends, proper clamping at intervals, and weatherproofing at joints [Ref:4.1]
- Verify **connector termination** (tightness, weatherproof taping, shrink sleeve).[Ref:4.1]
- Measure and confirm **VSWR/return loss** of RF feeder cable within acceptable limits.
- Record antenna alignment and connectivity test results in QC report.
- Ensure all **open connectors are weather-proof sealed**.
- Ensure that an **aviation lamp** is installed at the top of the tower for visibility.
- The Radio tower shall be provided with lightening arrester (Franklin rod) and connected to earth along with aviation lamp.

5.7 Indoor cabling:

5.7.1 Relay rack wiring & interconnection to Railway relay rack

- Verify wiring between KAVACH relay rack & Railway relay rack is as per approved circuit diagram.
- Ensure proper dry solder, lugging of cables, tagging, ferruling & double cutting of relay inputs.
- Check relay contacts are securely tightened, no loose connections.

5.7.2 Datalogger wiring

- Datalogger validation to be verified.

5.7.3 Electronic Interlocking Interface wiring

- Confirm interface wiring between KAVACH and EI is done as per approved design.

- Check isolation between internal & external wiring.
- Ensure correct signalling cables used (button, counter, power supply).

5.7.4 Power supply wiring

- Check that power connections as per the power connectivity diagram.
- Ensure fuses and MCBs are provided with correct rating in connectors as per diagram.
- Verify duplicated 110V DC supply provided with correct gauge (10 sq.mm), voltage drop ≤ 1V.
- DC-DC converters are in N+1 configuration.

5.7.5 Earthing

- Ensure KAVACH equipment earthed to common earth bus bar [Ref:13.2]
- Front & back doors of KAVACH cabinet earthed with copper braid.
- Earth resistance ≤ 1 Ω (KAVACH) ≤ 2 Ω (radio tower and RTU) [Ref:13.1] and Earth resistance value at RIU pit ≤ 2 Ω
- Earth resistances are measured jointly with railways and record the results. Also, ensure the earth resistance meter is calibrated and that a valid calibration certificate is available

5.7.6 GPS/GSM antenna cable

- Verify cables routed in **diverse paths** (GPS/GSM antenna set-1 & set-2) by using HDPE Pipe or Hard pipe .
- Check cables are firmly connected to respective modules.
- Ensure shielding to avoid water ingress at roof entry points.

5.7.7 OFC & Power cable for SMOCIP

- Ensure SM-OCIP communication cable is properly connected to KAVACH unit.
- Verify OFC & power cables routed in redundant path.
- Check proper harnessing & protection (HDPE/DWC pipes, no sharp bends).

5.7.8 Ensure all spare cable entries in panels are sealed with dummy glands/blanking plates to prevent dust and rodent entry.

5.8 Outdoor cabling:

5.8.1 OFC & Power cable to Tower

- Ensure **OFC from tower to KAVACH unit** is routed through a trench at least 1.2 mt **deep** in **HDPE pipe**, with **redundant path** provided [Ref: 12.2]

- Power cable from tower to Kavach/PDU room routed through **redundant path** protected by **DWC duct** or bricks as per Railway practice [Ref:12.3]
- Verify cables are properly tagged, harnessed, and protected against rodent damage.
- Dual OFC and dual power cables provided in **diverse paths** up to tower enclosure box (avoid common mode failures).

5.8.2 Sectional OFC Cable

- Ensure OFC cabling shall be done as per diagram [Ref: 12.3] routing avoids sharp 90° bends.
- Verify routing is done via Truff /flexible hosepipe.
- Protective dust caps provided on spare OFC connectors.

5.9 RFID Tag installation:

The following activities shall be carried out during RFID Tag installation. QC must **verify tag placement against the approved layout** and **validate tag data against the approved RFID Data Sheet**.
All verification reports shall be **prepared, signed, and uploaded in WFMS**.

5.9.1 RFID Tag Marking

- Ensure RFID tags are marked as per the RFID Placement Plan [Ref:11.1].
- Marking must include RFID Number, Main/Duplicate Tag
- In case any deviation, immediately inform the supervisor for corrective action.

5.9.2 RFID Tag assembly with Clamp

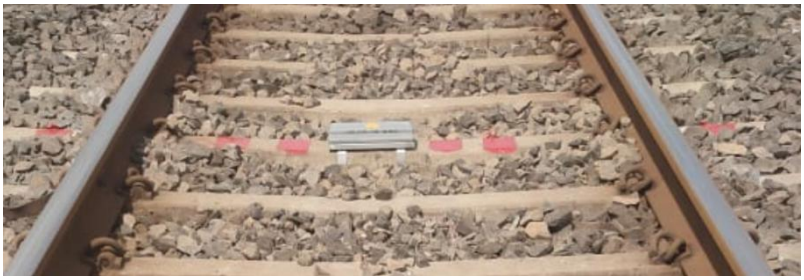
- Verify that RFID tags are assembled with respective clamps as per the type of tag mentioned in the RFID Layout [Ref:11.2]
- Ensure torque marking on 4 bolts with yellow paint.

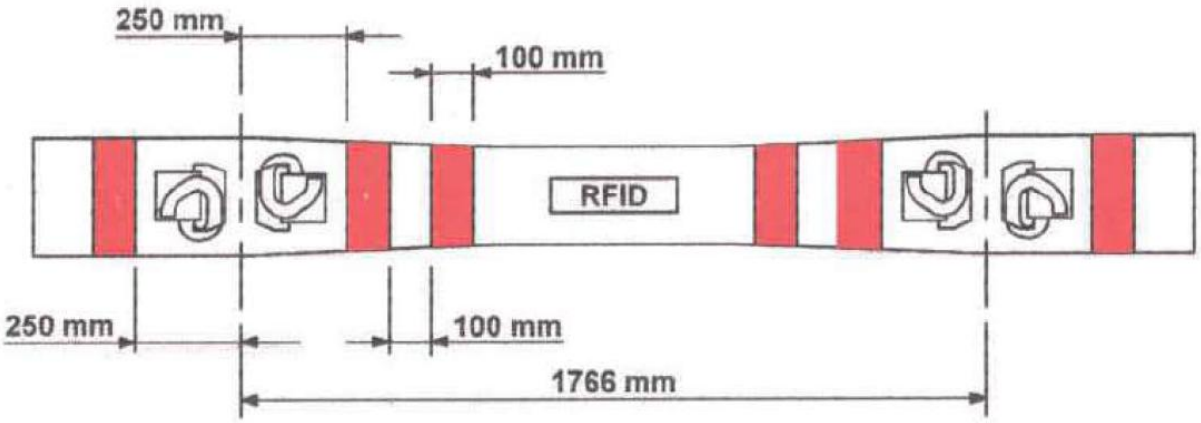
5.9.3 RFID Tag fixing on Sleeper

- Ensure RFID tags are **installed on sleepers strictly as per the approved RFID Layout Drawing**.
- Confirm physical fixing is **firm, properly aligned, and compliant with installation procedure** [Ref:11.2]
- Verify that duplicate tags are installed at a **minimum distance of 3–5 meters** from the main tag.
- For TIN discrimination, turnouts, and junctions, RFID tags shall be placed in the same absolute location
- If any PQRS work is carried out by Railways, ensure tags are re-installed correctly after PQRS work.

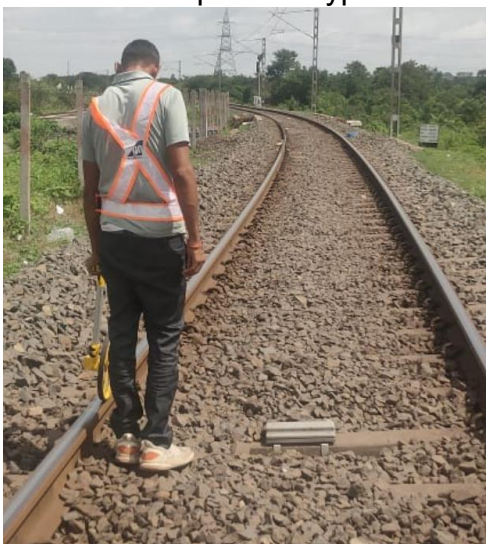
5.9.4 Painting on sleepers and RFID Board (If applicable based on the Contract)

- Ensure painting shall be done on sleeper as per Typical Kavach RFID sleeper diagram [Ref:11.6]
  Red color strips of enamel paint of reputed brand like Asian paint, Berger, Nerolac.





- Ensure RFID Board shall be installed at site as per the Typical Kavach RFID Board [Ref: 11.7]



5.9.5 RFID Tag Placement Verification

- Verify that RFID tags are placed at the respective ABS locations as per the RFID Tag

Layout.

- Measure the tag-to-tag distance using the Rodometer and record the actual values in the RFID Tag Verification Report [Ref: 11.3].
- Ensure the tag-to-tag distance is within ±5 m. If the distance exceeds the tolerance, reposition the tag as per the layout.

5.9.6 RFID Tag Data Validation

- Verify that the programmed RFID tag data matches the approved RFID Tag Data Sheet.
- Validate Tag IDs, ABS, PageX, and PageY using an RFID handheld reader.
- Generate the RFID Tag Data Verification Report from the reader and confirm that all tags show PASS [Ref: 11.4]. If any tag fails, cross-check with the Tag Data / DCN.
- After installation, if any changes are required, ensure tags are replaced/removed/reprogrammed strictly as per the DCN.
- Upon completion of such work, update the results in the DCN Implementation Report [Ref: 11.5] and upload it into the WFMS.

Note: The tolerance for RFID tag placement should be within 1 meter, with a maximum deviation of 5 meters.

RFID tags not installed near rail joints; at least 5 sleepers away from any weld location

5.9.7 Installation checklist

- The installation team shall record all Unit/Module/Card serial numbers and installation details in the Installation Report [Ref: 1.2].
- If any Card/Module/Unit is replaced either during installation or after installation, the updated details shall be recorded in the Deployment Record [Ref: 1.6].

5.9.8 Measuring instruments

- Collect the list of measuring instruments used at the site.
- Ensure only calibrated instruments are used.
- Verify calibration certificates and confirm that all certificates are uploaded and available in the Calibration Portal.
- If uncalibrated instruments are found in use, immediately escalate to the respective in-charge to have them calibrated.

5.10 Testing:

The following tests shall be conducted by the **Commissioning Team**. QC has to verify that all tests are carried out using the **ComWiz application** and that the corresponding reports are uploaded in **WFMS**.

5.10.1 Bell testing
5.10.2 Station Analyser Testing
5.10.3 SAT testing
5.10.4 PCCL [Ref:14.1]

- Ensure PCCL is duly filled with all data, jointly signed by **Railways** and **HBL representatives**.

5.11 Commissioning:

5.11.1 Site Acceptance Testing shall be done as per procedure [Ref: 15.1]
5.11.2 Report shall be uploaded in the WFMS

6.0 CERTIFICATION OF INSTALLATION & COMMISSIONING:

Upon completion of installation, commissioning activities, and preparation of site-specific documents for Stationary KAVACH, the following certification process shall be carried out:

1. **Verification of Work Completion**
   - Installation Report: Signed by Installation Engineer & QC Engineer.
   - QC Inspection Report: Confirm that all installation and commissioning activities (hardware, cabling, RFID, OFC, power supply, SM-OCIP, tower & antennae, and system tests) have been completed as per the approved drawings, specifications, and RDSO guidelines.
   - Work completion reports from contractors via **Avinya Portal**
   - Ensure that all station-specific documents, tower records, OFC and other cable documents are uploaded in WFMS.
2. **Validation of Test Reports**
   - Verify that all test results (hardware checks, wiring validation, OFC test, RFID validation, power & earthing checks, functional checks, FAT/SAT records) meet acceptance criteria.
   - Ensure that deviations, if any, are recorded and closed with corrective action before certification.
3. **Sign-off from Stakeholders**
   - The site-specific documents required for certification are listed in Table–1. Common documents required for PCSTE Sanction [Ref: 16.1] and SASC are also included.
   - The QA Manager shall verify all site-specific documents and record the results in the QC Manager Certification Report [Ref: 16.2], which will be jointly signed by the Project Manager and the QC Manager.

Table1: List of PCSTE Sanction Documents and SASC department-wise

Design Engineering, and Analysis Team	
Site Specific	**Common**
1) Relay Wiring Diagram 2) Bit Chart 3) Drone Survey Data 4) RFID Tag Layout 5) RFID Tag Data 6) Table of Control-Signal 7) Track Profile Tabel 8) Application Data Verification Report 9) Configured parameters Values of Stationary Kavach (Ref: Annexure A3 of Kavach Specs) 10) FAT Report 11) FAT Certificate 12) RSSI Survey Report/ Desktop Survey report	1) TIN and TAG Allocation Report 2) Frequency and Time Slot Allocation Chart 3) Utilization of Input Board 4) National Values 5) NMS Configurable parameters (Ref: Annexure-G of Kavach specification) 6) NMS evidences for all SAT test 7) Performance Report (Daily Incidences summary for 30 days and Operational Availability) 8) Route Map

Product Engineering	
1) Network Connectivity Diagram	1) Design of OFC Network document 2) Network Connectivity Architecture 3) IP Schema 4) Typical Network Connection NMS Ring 5) Typical Network Connection and Power Connection 6) Overview OFC Route Map
Installation and Commissioning	
Site Specific	**Common**
1) Contact Analysis Charts 2) RFID Tag Validation Report 3) RFID Tag Placement Verification Report 4) Station PCCL (Ref: SIF:0577 Version 2.1) 5) RIU PCCL (Ref: SIF:0577 Version 1.0) 6) SAT Report (Ref: SIF:0593 Version 1.0) 7) Stationary Kavach Datalogger Validation Report for Kavach Relays 8) Floor Plan 9) Cable Route Plan 10) PSD and Load Calculation 11) Bell Test Report 12) Installation Report 13) Loco Simulation Test Report 14) Station Analyser Test Report 15) OFC Ring Protecting Testing as per Network diagram 16) Datalogger Validation Report for Kavach Relays 17) OTDR details of Cable from Kavach to OFC hut 18) OTDR details of Cable from Kavach to SM room for SMOCIP 19) OTDR details of Cable from Kavach to RIUs 20) Towers Approved Cable route plan from Kavach to Tower location 21) Meggaring and OTDR details of cables from Kavach to Tower 22) Tower Location Approval Plan 23) Tower Soil investigation reports and recommendation for type of foundation 24) Tower details of the approved tower foundation and structural drawing 25) Towers Approved Quality Assurance Plan (QAP) for tower fabrication for 3rd party Inspection (structural audit). 26) Towers 3rd party Inspection Certificate for Tower fabrication Rites inspection 27) Towers Test reports for Cement, Sand, Aggregate M20, Steel and Cube test pertaining to tower foundations 28) Towers Stage-wise field inspection report for Tower foundation 29) Towers Tower Verticality Test Report 30) Towers Typical Earthing Plan for Kavach Tower 31) Towers Approved Tower fencing diagram 32) Third Party Inspection Cerficate copy 33) Tower Audit Report (Stride) 34) Tower Measurement Report (Stride)	1) Point wise compliance to TAN issued by RDSO 2) SIM Card/KMS Registration details 3) Staff Training 4) SWR Amendments with introduction of Kavach SMOCIP operation 5) Management of spares 6) Maintenance staff nomination and posting.

Quality Assurance
1) OEM Installation certificate 2) Stationary Kavach Installation Manual 3) Stationary Kavach Maintenance Manual 4) Stationary Kavach User Manual 5) SMOCIP Operational Manual 6) RIU Installation Manual 7) RIU Maintenance Manual 8) RIU User Manual 9) Configuration Manual 10) About ISA 11) ISA OEMs Organization Structure 12) Fulfillment of Safety Related Application conditions mentioned in the generic safety case 13) Specific Application Safety Case (SASC) requirements of KAVACH deployed in section. 14) Hazard log and mitigation measures 15) ISA Field audit report. 16) Final ISA assessment Report

#	Name	Function	Level	Signature
1	G.Prabhakar	Sr Manager -Project QA	Prepared	
2	MS Rajesh	Sr Manager -Project QA	Verify	
3	Y. Subrahmanyam	General Manager - Engineering	Verify	
4	K.V. Rajasekhar	GM TCAS projects	Approve	
5	Pradeep Kongalla	GM System	Approve	