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Document:	Pre-commissioning check list for Stationary KAVACH as per RDSO/ SPN/196/2020 Ver 4.0		



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**GOVERNMENT OF INDIA  
MINISTRY OF RAILWAYS**

**Title: Pre-commissioning check list for Stationary KAVACH  
as per RDSO/ SPN/196/2020 Ver 4.0**

**Issued by**

**SIGNAL AND TELECOM DIRECTORATE  
RESEARCH, DESIGNS & STANDARDS ORGANISATION  
MINISTRY OF RAILWAYS  
MANAK NAGAR  
LUCKNOW – 226 011**



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### Revision History

SN.	Issue	Version	Reason of Amendment
1	First	1.0	First Issue
2	2 <sup>nd</sup>	2.0	Revision based on the comments of CoE & Firm comments.
3	3 <sup>rd</sup>	2.1	Clause (f) modified after issue of SAT format SIF-0593.

Prepared by:		Approved by:
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The following specific procedure is recommended for commissioning the stationary KAVACH

**(a) Application data design documents**

- (i) Relay interface circuits.
- (ii) Bit Chart.
- (iii) RFID Layout.
- (iv) RFID Tag Data.
- (v) Table of Control -Signal.
- (vi) Track Profile Table.
- (vii) KMS registration confirmation email from RDSO.
- (viii) RFID-TIN allocation table.
- (ix) Stationary Kavach ID, Frequency and TDMA Slot allocation table.
- (x) OHE pole or milestone marker vis-à-vis distance table.

**(b) Factory Acceptance Testing:** Supervisor level, Junior/Senior Scale Officer and FAT Certification by Junior/Senior Scale Officer.

- (c) Bell test for testing of wiring between interlocking and Kavach.
- (d) Integrity testing of EI if applicable.
- (e) Radio Signal Strength measurement with UHF Radio modem on onboard.

**(f) Site Acceptance Testing:**

- (i) Verification of relay integrity using loco simulator to verify correspondence berthing tracks, TL measuring tracks, Calling ON TPR, signal aspects, points, LC Gates, Block instruments.
- (ii) Physical verification of center location of station, pole distances, tag and its data at site to verify installation as per approved data and layout.
- (iii) Loco trials to satisfaction of OEM to verify the radio coverage, SPAD prevention tests, PSR/TSR Supervision To provide evidences for ISA and PCSTE sanction.
- (iv) Provision of card level test setup at prominent locations such as SSE/JE Offices.
- (v) Format SIF-0593 provides the detailed instructions.

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## 1. STATIONARYARY KAVACH PRE-COMMISSIONING CHECKLIST

### 1.1 General Information

Railway :		Division:	
Stationary KAVACH Id		Station Name	
Stationary KAVACH Serial No		Date of Manufacturing of Stationary KAVACH	
SIM-1 No and Date of recharge: (Applicable for prepaid only) :		SIM-2 No and Date of recharge: (Applicable for prepaid only) :	
Date of Installation:		Date of PCCL	

#### **Details of Card /module of Stationary KAVACH (as Applicable)**

Card Description	Sr No.	Date of Manufacturing
Vital Computer Module		
Communication Module		
Power Supply Module		
Field Input Module		
Filter Module		
Radio Modem		
RM Antennae		
GPS Antennae		
GSM Antennae		
SM-OCIP		

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RFID Tag		
<b>Any Other Module/sub item</b>		

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## 2. HARDWARE CHECKLIST

Before making the interconnections between the Stationary KAVACH, sub-systems, ensure that the KAVACH is switched-off position.

### 2.1 Visual Inspection:

Sl. No	Inspection Required	Observed/ Measured	Remarks (OK/NOT OK)
i.	Check whether the mechanical mountings of Stationary KAVACH and sub systems are mounted properly.		
ii.	Check whether the Stationary KAVACH bin is fixed on insulation bases and is at some height with respect to the room floor.		
iii.	Application Data is loaded into Stationary KAVACH with a Checksum. On loading the checksum is to be verified with the CRC in the FAT Certificate to ensure data integrity.		
iv.	Check whether the RM Antennae are mounted on Tower as per details in installation manual.		
v.	A 30/40 meter tower is installed within the Stationary Vicinity which is protected by the Railway.		
vi.	Radio Communication equipment is installed on the plate form of Tower in an enclosure Box with Lock and Key.		
vii.	OFC from the tower to KAVACH unit is routed through a trench of at least 3 feet deep routed in a HDPE pipe in redundant path.  Power cable from the tower to power supply room is routed through the redundant path and secured through DWC duct or existing practices of Railway.		
viii.	Tower is protected with barbed wire / other means of fencing to ensure no outsider can enter the tower vicinity.		
ix.	Check whether the GPS Antennae are closed in a hood and mounted on Roof top of Station in redundant path. Check that GPS antenna has clear view of sky		

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x.	The mechanical mountings of GSM Antennae should be properly installed.		
xi.	The mechanical mountings of SM-OCIP Panels should be properly installed properly in Station Master Room.		
xii.	Ensure that Cards are Inserted in their respective slots as per nomenclature.		
xiii.	Check whether the two GPS antennae cables are firmly connected to GPS IF Modules (as applicable)		
xiv.	Check whether the two RM antennae cables are firmly & properly connected to RM Units.		
xv.	KAVACH is installed within the Relay room which is locked and protected by Railway.		
xvi.	Check whether the two GSM antennae cables are firmly connected to Stationary KAVACH module.		
xvii.	Check whether locking arrangement is provided for front and rear doors of the Stationary KAVACH equipment.		
xviii.	Check whether dummy fascia's are fixed on the unused slots.		
xix.	All the modules should be free of dirt, dust and be neat, clean and fitted in to the KAVACH rack as per the Installation manual.		
xx.	Check whether free space is available around the rack for maintenance and circulation of air.		
xxi.	Check whether shielded communication cable is used for connection.		
xxii.	Check whether all the EMI filters are fixed properly on DIN rail/ standard frame in the Stationary KAVACH equipment.		
xxiii.	Check whether all the OFC cables are connected properly.		
xxiv.	Check whether the Event /data Logger module is properly connected to the Ethernet cable.		
xxv.	KAVACH Wiring Diagram and configuration detail shall form part the S&T circuit diagrams		

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	issued by Zonal Headquarters and these documents shall be placed in all the relay rooms and shall be treated as part of station S&T documents.		
xxvi.	Confirm that Station ID has been registered in the KMS server and key are being received in S-KAVACH.		

## 2.2 Wiring & Routing

Sl. No.	Inspection Required	Observed/ Measured	Remarks (OK/ NOT OK)
(i)	Ensure insulated Wires are protected from mechanical damage in bend. Use rubber gasket in holes and sharp cut edges.		
(ii)	Ensure that no loose wires are hanging.		
(iii)	Ensure that wires are tagged & marked properly for easy identification.		
(iv)	Ensure that wire ends are properly crimped with correct size of lugs and inserted properly in the terminals.		
(v)	Ensure the Cards are firmly screw fixed.		
(vi)	Check whether all the terminations are provided with proper identification markers.		
(vii)	Ensure that internal and external wires are isolated to each other.		
(viii)	All the I/O Cable connection shall be keyed as per the station specific Interface design Drawing approved by the Railway Authority.		
(ix)	Check whether Signalling cable is being used for button, counter & power supply. CAT-6 armoured cables shall be used communication portion. SM-OCIP are routed and harnessed properly.		
(x)	Check whether cable glands are provided for all the incoming and outgoing wires.		
(xi)	Check whether the Power connections are as per the details given the installation manual.		

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(xii)	Check whether the fuses of correct rating are provided in the connectors for power input.		
(xiii)	All the wires used for interface wiring are to be inspected by RDSO for Relay Interface Wiring based on Railway call letter to ensure proper rating and thickness.		
(xiv)	KAVACH wiring is routed on a cable tray/ladder/Pipe with appropriate tagging as per Railway Specifications.		
(xv)	Wiring done outside relay room is done by digging a pit of at least 3 feet (1 meter) deep and wires are routed through HDPE pipe or similar to avoid any damage due to Rodents.		
(xvi)	The Stationary KAVACH shall be enclosed such that the wiring inside the equipment is protected from Rodent.		
(xvii)	As made Wiring diagrams of each stationary KAVACH to be submitted and approved by Railway Authority.		
(xviii)	Input wiring is done with double cutting.		
(xix)	The cables for one set of GSM/GPS Antenna shall be routed in one path and another set shall route in diverse path to avoid failures due to cable cuts at a single location. The installation shall be carried out with shortest path and drilling in roof may be permitted wherever feasible without damaging the structure with proper shielding to avoid ingress of water etc.		
(xx)	Check that 110 Volt DC supply from IPS/Power room to KAVACH rack shall be provided with duplicated cable with suitable gauge (10 Sq. mm), so as to ensure that voltage drop in cable shall not be more than 1 Volt from integrated power supply source. Each cable shall be protected with an individual isolator and		

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	fuse of suitable capacity.		
(xxi)	The DC-DC converters provided for stationary KAVACH unit shall have segregation of cabling and termination. DC-DC converters shall be in N+1 configuration		
(xxii)	Dual OFC and dual power cable in diverse path shall be provided from Stationary KAVACH unit to the enclosure box on the platform of tower to avoid common mode failures.		

### 2.3 OFC Cabling and Routing

Sl.No	Inspection Required	Observed/ Measured	Remarks (OK/ NOT OK)
(i)	Ensure OFC routing is properly done with avoiding 90 degree bending.		
(ii)	Ensure OFC properly routed via PVC Casing / in flexible hosepipe.		
(iii)	Ensure protective dust caps are provided at spare OFC connectors.		

### 2.4 Type of Relays inserted in relay racks

Sl.No	Inspection Required	Observed/ Measured	Remarks (OK/ NOT OK)
(i)	Check whether the type of the Relays mounted on the relay racks are as per the Relay disposition chart (RDC) given in the interface circuits and have RDSO inspection seal.		
(ii)	Wiring from relay interlocking is taken with Double Cutting of Relay Inputs to avoid Signal input is Wrongly Detected.		

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## 2.5 Fixing of Fuses with Proper Rating in the Fuse Terminals

Sl.No	Inspection Required	Observed/ Measured	Remarks (OK/ NOT OK)
(i)	Fuses to be fixed as per the circuits of specific stationary interface design drawing document.		
(ii)	Ensure fuse should be fit in the fuse holders properly and there is no loose connection / contact.		

## 2.6 Power-On Self Test

Sl.No	Inspection Required	Observed/ Measured	Remarks (OK/ NOT OK)
(i)	Power ON the Stationary KAVACH power supply (110VDC/ 24V DC).		
(ii)	Ensure the System Healthy LED present on the KAVACH display unit glows GREEN.		
(iii)	Check whether the Time in the Display is getting updated 2 minutes after the unit was powered ON.		
(iv)	Ensure the power is received to both the Radio units.		

## 2.7 KAVACH SM-OCIP

Sl.No	Inspection Required	Observed/ Measured	Remarks (OK/ NOT OK)
(i)	Ensure that by pressing the SOS and Common Button on the SM-OCIP SOS LED Should be displayed on the SM-OCIP. Note: Display Messages format (SM-OCIP) “SOS PRESSED” Counter shall be incremented by one .		
(ii)	Ensure that by pressing the CANCEL and Common Button on the SM-OCIP CANCEL Popup message Should be displayed on the SM-OCIP.		

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<b>“CANCEL PRESSED”</b>			
(iii)	Ensure that TSRMS imposes a TSR in the stationary KAVACH. The TSR information shall be displayed. When TSR-ACK button is not pressed, the message shall be displayed accordingly.		
(iv)	Ensure that TSRMS imposes a TSR in the stationary KAVACH. The TSR information shall be displayed. When TSR-ACK button is pressed, the message shall be displayed accordingly.		
(v)	If SM key is switched ON, then all above operations shall be executed.  If SM key is switched OFF, no operation shall get executed.		
(vi)	Check whether the SMOCIP is at a height for hassle- free operation of the SM at position specified by User Railway.		
(vii)	Check whether the communication cable is properly connected from the SMOCIP to the Stationary's KAVACH unit.		
(viii)	After powering up the SMOCIP, check whether the Stationary's name, date and time is displayed on the LCD after a few seconds.		

## 2.8 Radios and Antennae Tower

SNo.	Inspection Required	Observed/ Measured	Remarks (OK/ NOT OK)
(i)	Check whether all the poles of the antenna tower are properly connected to earth.		
(ii)	The mounting of all the antennae on the tower shall be at same level.		
(iii)	RF coaxial cable for the two Tower Radios shall be routed in the different path. The coaxial cable shall be minimum LMR-600 of Amphenol/ Helix. As connectors are open to environment, they shall be provided with weather proof sealing.		

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(iv)	Check that Cable joints are not used from tower location box to antennae. The patch cords used shall be of minimum length.		
(v)	Check whether the antennas are properly fixed with the clamps at the bottom side of antenna.		
(vi)	Ensure that the cable between antennas and the radios are properly fixed.		
(vii)	Check if surge suppressors are connected to all the radio transmit and receive antenna cables.		
(viii)	Using the radio configuration software, ensure that the radios are configured for transmission power of 10W, with a transmit / receive frequency and control frequency allotted by Railway.		
(ix)	Ring earth shall be provided to the tower and connected to a lightning arrester provided on the top most point of the tower to avoid lightening strikes.		
(x)	An aviation lamp is installed on the top of a tower to ensure visibility of light.		

## 2.9 RFID Tags:

SNo	Inspection Required	Observed/ Measured	Remarks (OK/ NOT OK)
(i)	Check whether the RFID tags are placed as per the approved RFID tag layout plan.		
(ii)	Check whether all the tags are housed in a proper enclosure and are duplicated.		
(iii)	RFID Tag Data configuration is verified by Railway Authority in the field after installation.		
(iv)	The duplicate RFID tag shall be installed minimum distance of 3 meter to 5 meter between tags in installations.		
(v)	RFID Tag data stored in the tag is protected with 32 bit CRC and only on CRC OK, the RFID Tag data is processed		

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(vi)	The RFID tag enclosure shall be good quality of FRP material and fitment clamp shall be made of stainless steel of grade 316 to avoid the corrosion and environmental effect.																																												
(vii)	All the RFID tag shall be marked at the side with tag number and tag type. The marking shall be as follows:-  RFID NO:.....Type : ..... Location : .... Main-..... Duplicate-.....																																												
(viii)	Tag data shall be validated as per following format																																												
(ix)	<p style="text-align: center;"><b>RFID Layout Checking with Physical Odometry</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">Station</td> <td style="width: 15%;">Wangapalli</td> <td style="width: 15%;">RFID_LAYOUT_WP_2.0.1</td> <td style="width: 15%;"> </td> </tr> <tr> <td>RFID Layout</td> <td> </td> </tr> <tr> <td>Location Reference</td> <td> </td> </tr> <tr> <td> </td> </tr> <tr> <th>RFID Tag</th> <th>Line</th> <th>Main / Duplicate</th> <th>Distance Measured From</th> <th>Distance Measured</th> <th>Absolute Location from Tag Data</th> <th>Absolute Location from Measurements</th> <th>Checksum from Tag Data</th> <th>Checksum Read</th> <th>Sleeper Painted (Yes / No)</th> </tr> </table>			Station	Wangapalli	RFID_LAYOUT_WP_2.0.1						RFID Layout								Location Reference																RFID Tag	Line	Main / Duplicate	Distance Measured From	Distance Measured	Absolute Location from Tag Data	Absolute Location from Measurements	Checksum from Tag Data	Checksum Read	Sleeper Painted (Yes / No)
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(x)	On successful validation of Tag data, the tags to be locked permanently.																																												

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## 2.10 Earthing:

Sl.No	Inspection Required	Expected	Observed/ Measured	Remarks (OK/ NOT OK)
(i)	It shall be ensured that the KAVACH equipment are earthed with shortest path to common earth bus bar in Relay equipment room.	Length of earthing shall be <1.5 meter maximum if possible.		
(ii)	It shall also be ensured that front and back doors of Kavach cabinet shall be earthed using copper braid.	....		
(iii)	Check the value of earth resistance at earth of the radio tower.	Value of earth resistance should be lesser than or equal to 2 ohm.		
(iv)	Check the value of earth resistance at the Stationary KAVACH equipment earth pit.	Value of earth resistance should be lesser than or equal to 1 ohm.		

## 2.11 STATIONARY Input Tests:

Sl.No	Inspection Required	Observed/ Measured	Remarks (OK/ NOT OK)
(i)	According to station master control panel, check all the signals in Stationary KAVACH.		
(ii)	According to the connections, check the communication between other modules.		
(iii)	Connectivity with adjacent stationary KAVACH through OFC in redundant path		
(iv)	Connectivity with RIU through OFC in redundant path.		
(v)	Connectivity with TSRMS through OFC in redundant path		

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(vi)	Connectivity with NMS through OFC.		
(vii)	Connectivity with NMS for fault message through GSM1 and GSM2.		
(viii)	Connectivity with KMS through GSM1 and GSM2.		
(ix)	Connectivity to EI in redundant path (if applicable)		
(x)	Connectivity to EPC in redundant path (if applicable)		

### 3. COMMISSIONING

#### 3.1 General Commissioning Checklist:

Sl.No	Inspection Required	Observed/ Measured	Remarks (OK/ NOTOK)
(i)	Ensure that the system is installed by trained personnel.		
(ii)	Ensure that proper training is provided about the system and its working to Railway Personnel.		
(iii)	Ensure that the system is put to operation for around 72hours before it is commissioned.		
(iv)	Verify that the software checksum loaded in the system for different cards is same as the checksum approved for loading.		

#### 3.2 Module Part Number and Version are as per Approval letter

Sl.No	Type of Card	Part No	Version	Remarks (OK/NOT OK)
1.				
2.				
3.				
4.				
5.				
6.				

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7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			

### 3.3 Software Version No and Checksum are as per approval letter:

Sl.No	Module Name	Version	Checksum	Remarks (OK/NOT OK)
1.				
2.				
3.				
4.				
5.				
6.				
7.				

### 3.4 Application Data Checksum (Stationary Specific)

Sl.No	Stationary Name	Version	Checksum	Remarks (OK/NOT OK)
(i)				

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### 3.5 FAT and SAT Checklist:

Sl.No	Requirements	Remarks (OK/NOT OK)
(i)	Check whether the FAT and SAT is completed and the relevant certificates are obtained prior to commissioning.	

### 3.6 FAT: (100% at inspector level, 20% test check at officer level)

Sl.No	Date of completion of FAT	Name and Designation of official who performed the FAT	Remarks (OK/NOT OK)
(i)			

### 3.7 SAT: (SAT shall be conducted through station analyser and loco simulator).

Sl.No	Date of completion of SAT	Name and Designation of official who performed the SAT	Remarks (OK/NOT OK)
(i)			

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