सत्यमेव जयते

GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

SITE ACCEPTANCE TEST
Procedure for Stationary KAVACH
(The Indian Railway Automatic Train Protection System)
as per RDSO/ SPN/196/2020 Version 4.0

Issued by

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SN	Issue	Version	Reason of Amendment
1	First	1.0 do	First issue as per RDSO/ SPN/196/2020 (version 4.0)
2	2nd	1.0	• Corrected clause 2(c) to add "copy of approved circuits integrated with station circuits shall be available". • Corrected column descriptions in clause 6.5.2 KAVACH TSR speed control test reports, clause 6.6.1 KAVACH SPAD Prevention test reports and clause 6.6.3 KAVACH Head ON collision test reports • Description added for clause 6.6.2 and clause 6.6.3 • New test cases for "train length measurement tests", "soft handover tests" and "On run override signal tests" are added at clause 6.5.5, clause 6.5.6 and clause 6.6.7 respectively.

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1 Introduction

1.1 This document describes the procedure to be followed to perform Site Acceptance Testing of the Stationary KAVACH using Onboard KAVACH and Onboard KAVACH Simulator. The objective of this test procedure is to verify the following in Sequence:

(a) Verification of all Field inputs (Relay/EI Interface).
(b) Verification of Redundant Communication for GPS, GSM, Radio Modems, RIU, ASVK (Adjacent Stationary Vital KAVACH), TSRMS (Temporary Speed Restriction Management System) and Electronic Interlocking (EI).
(c) Verification of Signal aspect linking and Signal naming correspondence.
(d) Verification through real train testing.
(e) Verification of Maximum number of KAVACH equipped trains to be handled by the test Stationary KAVACH.

1.2 The Site Acceptance Testing need not be performed under the witness of Railway Authorities. Evidences in terms of NMS replays and logs shall be sufficient. Phase2 Testing using real train with functional brake shall be carried out by Railway Authorities.

1.3 The complete responsibility of data integrity is with OEM.

2 Pre-requisites

The following are to be ensured prior to start of SAT for Stationary KAVACH

(a) Approved RFID tag layout, RFID Tag data, KAVACH Table of Control and KAVACH track profile table.

(b) Installation of Stationary KAVACH equipment and all its associated sub-assemblies and interfaces.

(c) Field Input Relay wiring is completed and Bell test copy is available. Copy of approved circuits integrated with station circuits shall be available.

(d) All RFIDs are installed in the section under test before carrying out tests mentioned at clause no. 6.

(e) Installation of Radio Tower, antennae, antenna cables, tower box is complete.

(f) Power wiring for the entire equipment including relays, radios and aviation lamp is completed.

(g) RSSI and OHE mast survey is complete.

(h) Adjacent Stationary KAVACH connectivity is established on redundant vital network.

(i) TSRMS connectivity is established on redundant vital network, if TSR is to be tested.

(j) RIU wiring is complete.

(k) SMOCIP is installed.

(l) NMS details are programmed and connected to the test Stationary KAVACH.

(m) FAT certificate is available.

(n) Virtual loco simulators shall be equipped with proper keys. The Virtual loco simulators shall be registered with KMS and shall be interoperable with any make of Stationary KAVACH.

3 Verification of field inputs

3.1 Electronic Interlocking and KAVACH NMS time difference shall be noted before relay events testing. There shall no difference ideally.

SN	Relay Name	Time of up from relay/EI interface	Time of up from NMS	Time of down from relay/EI interface	Time of down from NMS

4 Verification of redundant communication

SN	Function	Blue ring Only	Prompt in NMS	Red ring Only	Prompt in NMS	Both rings fail	Prompt in NMS	Both rings ok	Prompt in NMS
1.	GPS								
2.	GSM								
3.	Radio Modem								
4.	RIU								
4.1.	North								
4.2.	South								
4.3.	Others								
5.	Adjacent SVK								
5.1.	North								
5.2.	South								
5.3.	Others								
6.	TSRMS								
7.	EI								

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5 Verification of Signal correspondence

5.1 The deregistration time-out shall be made to 5-10 seconds as feasible in Stationary KAVACH to save on time.

5.2 The tests are to be carried out based on the routes of the approved ToC.

5.3 The virtual simulator shall have provision to select the routes or entry-exit signal.

5.4 The loco speed shall be raised and the first two tags in the route before entry signal shall be read automatically and train shall stop in front of the entry signal.

5.5 The displayed signal aspect -correspondence, next signal aspect-correspondence and name of entry signal aspect as per the naming rule, movement authority to be checked.

5.6 Now, the station master shall raise the signal so that all the aspects of the entry signal are assumed for testing.

5.7 Relay room opening shall not be required to carry out these tests.

5.8 The test shall not make more than 5 minutes per route for all the aspects.

5.9 The results shall be tabulated below:

SN	ENTRY SIGNAL	EXIT SIGNAL	ENTRY SIGNAL ASPECT	EXIT SIGNAL ASPECT	ENTRY SIGNAL NAME on DMI	MA IN SECTIONS as per ToC	MA value received on DMI	Result (Ok/Not Ok)

5.10 After the tests, the deregistration time out shall be made normal.

6 Verification through real train testing

6.1 The objective of this tests is to check the following in real train scenario: Radio Signal coverage, Tag Linking, Train Length Measurement, Communication Entry and Exit of the test Stationary KAVACH, Seamless handover of trains at border tags, Turnout speeds, Speed restrictions (Permanent and sample temporary on mainline), Level Crossing gates, SoS generation on stoppage in block sections.

6.2 For this purpose, the brakes of onboard KAVACH shall be bypassed and the trials can be carried out on a running train. Special movement of light engine is normally not required. The Onboard KAVACH shall be functional in all other respects.

6.3 The Phase 1 tests are carried out isolating brakes. The Phase 2 tests are carried out through light engine with brakes connected.

6.4 Communication coverage Report-Phase-1

- Switch off radio transmission of adjacent stations and carry out these tests.
- The graphical coverage report shall be submitted for each frequency.

6.4.1 Transmission side (Control Frequency)

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SN	Stationary KAVACH ID	Tx Communication Mandatory area limit	Tx Frequency	Tx frequency reception distance at mobile unit	Is distance more than Communication mandatory Area?

6.4.2 Transmission side (Operational Frequency)

SN	Stationary KAVACH ID	Tx Communication Mandatory area limit	Tx Frequency	Tx frequency reception distance at mobile unit	Is distance more than Communication mandatory Area?

6.4.3 Reception side (Control Frequency)

SN	Stationary KAVACH ID	Rx Communication Mandatory area limit	Rx Frequency	Rx frequency reception distance from mobile unit	Is distance more than Communication mandatory Area?

6.4.4 Reception side (Operational Frequency)

SN	Stationary KAVACH ID	Rx Communication Mandatory area limit	Rx Frequency	Rx frequency reception distance from mobile unit	Is distance more than Communication mandatory Area?

6.5 Track Profile Test Reports- Phase1

6.5.1 RFID placement and Linking distances:

SN	Stationary KAVACH ID	ENTRY SIGNAL	EXIT SIGNAL	REF RFID (Signal Foot Tag)	RFIDs in the route	Any tags missing	Any Invalid tags found

6.5.2 KAVACH TSR speed control test reports

SN	Stationary KAVACH ID	Route ID as per TSR Table	TSR imposed location as per caution order	TSR Command location by KAVACH	Is any Safety infringement observed?	Is any Capacity Loss observed?

6.5.3 KAVACH PSR speed control test reports

SN	Stationary KAVACH ID	Entry Signal	PSR	Start Distance	Is any Safety infringement observed?	Is any Capacity Loss observed?

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6.5.4 LC Gate information testing

- If any level crossing gate is available in the route, the same shall be tested and tabulated below:

S N	ENTRY SIGNAL	EXIT SIGNAL	REF RFID (Signal Foot Tag)	Track Profile Table			Observations on DMI	Result (Ok/ Not Ok)
				Start Distance	LC gate Name	LC Gate Type		

6.5.5 Train length measurement testing

- These tests are aimed to check whether train length is updated properly after every block section entry.
- When the communication mandatory area is 1.5 Km or more beyond last stop signal, the train length details are to be sent by handing over stationary KAVACH.
- When the communication mandatory area is within 1.5 Km after last stop signal, the train length details are to be sent to accepting stationary KAVACH, which informs Onboard KAVACH.

SN	Stationary KAVACH ID	Signal Name at which Train Length Measurement is carried out based on OEM design	Is Communication mandatory area greater than 1.5km beyond LSS (Yes/No)	Train length measured	Is any Safety infringement observed?	Is any Capacity Loss observed?

6.5.6 Soft handover tests

- These tests are to be carried out to ensure that Onboard KAVACH entry / exit to from/to the adjacent stationary KAVACH shall be seamless and no communication failures shall be observed.
- No brakes shall be applied in case of communication failure with adjacent station.
- Approaching Signal shall not become blank ideally.
- The handing over from one Stationary KAVACH shall be not perceived to the loco pilot.

SN	Handing over Stationary KAVACH ID	Border Signal as per OEM design	Border Tag as per OEM design	Accepting Stationary KAVACH ID	Is any Safety infringement observed?	Is any Capacity Loss observed?

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6.6 Functional Test Reports- Phase2

- These tests are to be carried out on real train with brakes functioning and shall be submitted to ISA and PCSTE for sanction.

6.6.1 KAVACH SPAD Prevention test reports

SN	Stationary KAVACH ID	Entry Signal	Exit Signal	Stopping Distance from Exit Signal	Is Day/night speed restrictions/ wait time followed	Is any Safety infringement observed?	Is any Capacity Loss observed?

6.6.2 KAVACH Rear End collision test reports

- The rear loco will always be in OS Mode.

SN	Stationary KAVACH ID	Entry Signal	Exit Signal	Stopping Distance from Rear Loco	Is any Safety infringement observed?	Is any Capacity Loss observed?

6.6.3 KAVACH Head ON collision test reports

- One of the Onboard KAVACH will be in SR Mode and direction shall be available and shall be moving in opposite to traffic direction in Accepting Stationary Kavach territory.
- The Other loco can be in FS/OS/SR mode with direction available.

SN	Accepting Stationary KAVACH ID	Onboard KAVACH ID in Opposite direction	Handing over Stationary KAVACH ID	Onboard Kavach ID in traffic direction	Is any Safety infringement observed?

6.6.4 KAVACH Unusual Stoppage in Block section test reports

- This SoS will not be generated in Station Section. For this purpose, the Station section shall be matching with the details prescribed in the Station Working Rules. The Tag data is to be checked for this.
- In case of diverging lines, the adjacent tag shall be placed suitably, to avoid stopping of trains where not required.

SN	Stationary KAVACH ID	Entry Signal	Exit Signal	Stopping Distance	Is any Safety infringement observed?	Is any Capacity Loss observed?

6.6.5 Manual SoS Generation from Stationary KAVACH test reports

SN	Stationary KAVACH ID	Entry	Exit	Stopping	Is any Safety	Is any Capacity

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		Signal	Signal	Distance	infringement observed?	Loss observed?

6.6.6 Manual SoS Generation from Onboard KAVACH test reports

SN	Stationary KAVACH ID	Entry Signal	Exit Signal	Stopping Distance	Is any Safety infringement observed?	Is any Capacity Loss observed?

6.6.7 On run override signals testing

- The signals which are permitted for on run override shall be put at ON.
- Advance authority to pass this signals at danger shall be issued, before carrying out this trial.

SN	Stationary KAVACH ID	Onrun overide Signal permitted as per ToC	MPS permitted as per ToC	MPS observed during trial	Is any Safety infringement observed?	Is any Capacity Loss observed?

7 Time Slot assignment tests

7.1 The following details are to be tabulated.

SN	Stationary KAVACH ID	Max No of simultaneous movements and associated Packet Length from station	Max No of Stationary Movements	Total Time Slots Required	Time slots allotted (<28)

7.2 Introduce one by one additional train virtually to see the timeslots are allotted by Stationary KAVACH properly.

SN	Onboard KAVACH unit	Time slot allotted
1	1	
2	1, 2	
3	1,2,3	
4	1,2,3,4	
	…	

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