MANUAL FOR MAINTENANCE & TROUBLESHOOTING

OF

Stationary KAVACH V2.0

Document Number: 5 53 76 0004

Version: 1.0

Date Published: 28-04-2025

Prepared by

HBL Engineering Ltd
Hyderabad

DOCUMENT CONTROL SHEET

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CHANGE HISTORY

#	Name of the Document	Date	Reason for changes	Version No.
1	Stationary Kavach V2.0 Maintenance & Troubleshooting Manual	28-04-2025	Initial Version	1.0

REFERENCES

#	Document Name	Document Number	Version Number/Year	Source
A	Safety and Reliability Requirements of Electronic Signaling Equipment	RDSO/SPN/ 144/2006	Rev 2	RDSO
B	RDSO Specification for Train Collision Avoidance System	RDSO/SPN/ 196/2020	4.0	RDSO
C.	Railway Applications - Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS)	EN50126-1&2	1999 (with corrigendum 1-28 Feb 2007), Feb 2007	CENELEC

Glossary of terms

#	Abbreviation	Meaning
1	CTF	Control Table File
2	DPS	Digital Power Supply
3	EMI	Electromagnetic interference
4	FIU	Field Interface Unit
5	FLF	Field layout file
6	FSC	Field interface Unit - Scanner Card
7	GPS	Global Positioning System
8	GSM	Global System for Mobile Communications
9	MCB	Molded circuit breaker
10	Modem	Modulator- demodulator
11	OFC	Optical Fibre Cable
12	PPC	Peripheral Processing Card
13	PWR	Power
14	RDSO	Research Designs and Standards Organization
15	RF	Radio Frequency
16	RIU	Remote interface unit
17	RS232	Recommended Standard 232
18	RS485	Recommended Standard 485
19	Rx	Receive
20	SIM	Subscriber identification module
21	SLF	Station Layout File
22	SM	Station Manager
23	SM-OCIP	Station Manager Operation Cum Indication Panel
24	SPN	Specification
25	SRPS	Station radio power supply
26	STC	Station TCAS Configuration
27	TCAS	Train Collision Avoidance System
28	Tx	Transmit
29	VC	Vital Computer

Contents

1.0 Purpose:

1.1 This document provides guidelines for correct maintenance and troubleshooting of Stationary Kavach system along with its peripheral components.

2.0 Specification

2.1 The Kavach System has been designed to meet the RDSO Specification No: RDSO/SPN/196/2020 V4.0 Amdt 3.

3.0 Components of Stationary Kavach System:

3.1 Stationary Kavach System consists of the following sub-systems.

- 3.1.1 Stationary Kavach Unit
- 3.1.2 Station manager's Operation-cum-Indication Panel (SM-OCIP)
- 3.1.3 RF Communication and GPS/GSM Antennae
- 3.1.4 Relay panel
- 3.1.5 Inter-connection Cable Assembly

4.0 References:

Ref #	Document title	Document number
1	Personnel Safety Instruction Manual	5 16 76 0014
2	Stationary Kavach Power Supply Connectivity Diagram	5 16 49 0427
3	Block diagram of Stationary KAVACH Vital Computer	5 16 49 0631
4	Block diagram of SM-OCIP	5 16 49 0632
5	Block diagram of RADIO TOWER UNIT (RTU)	5 16 49 0633
6	Procedure for Commissioning of Stationary Kavach	5 53 76 0634
7	Maintenance schedule for Stationary TCAS by RDSO	SIF-0535 Ver 1 dt12-09-18

5.0 Safety instructions

Maintenance of Stationary Kavach and its associated sub-systems in a railway environment is prone to personnel safety risks. Instructions for personnel safety as indicated in document Personnel Safety Instruction Manual 5 16 76 0014 [Ref: 1] shall always be followed. Failure to follow these instructions will cause insurance claims to be invalid.

6.0 Technical description of Stationary KAVACH

6.1 Stationary Kavach Power Supply Connectivity Diagram [Ref: 2]
6.2 Block diagram of Stationary KAVACH Vital Computer [Ref: 3]
6.3 Block diagram of Radio Tower Unit [Ref: 5]
6.4 Block diagram of SM-OCIP [Ref: 4]

7.0 List of special tools:

7.1 Power Analyser app
7.2 Spare GSM cable, 20Mtr – 1No
7.3 Spare GPS cable, 20Mtr – 1No.
7.4 Allen key set - 1No
7.5 Screwdriver set- 1No
7.6 Digital multi meter-1No
7.7 Torque wrenches up to 60N-M – 1No

8.0 List of field replaceable spare parts:

#	Module Name	SAP Part number	Spare part description
1	Peripheral Processing Card (PPC)	6000041106	PPC MODULE ASSEMBLY STATIONARY
2	Vital Computer Card (VCC)	6000030472	VCC MODULE ASSEMBLY_51690003
3	Voter Card (VTR)	6000044351	VOTER_MODULE_ASSEMBLY_STATIONARY
4	Vital Gate Way card (VGW)	6000054725	VITAL_GATEWAY_MODULE_ASSEMBLY_STATIONARY
5	Scanner Card (FSC)	6000030478	FIU SCANNER MODULE ASSY
6	Station Radio Power Supply (SRPS)	6000033491	SRPS_UNIT_ASSY
7	RADIO	1000024985	GUARDIAN RADIO MODEM_10W RF POWER_CALAMP
8	Digital Power Supply-1 (DPS-1)	6000033735	MODULE DIGITAL POWER SUPPLY DPS1-ELECT
9	Digital Power Supply-2 (DPS-2)	6000033736	MODULE DIGITAL POWER SUPPLY DPS2-ELECT
10	RIU - Host	6000044136	RIU_COMMUNICATION_HOST_MODULE_ASSY
11	Media Converter	6000050754 6000051791	PPCB_RS485-OFC_CONVERTER_516150070 PPCB_RS232-OFC_CONVERTER
12	EI Gateway	6000054134	EI-GATEWAY_KAVACH_MODULE_ASSY
13	Field Termination Card	6000041817	PPCB_FIU_TERMINATION
14	Electro Magnet Interference (EMI) FILTER card	6000032852	PPCB_EMI_LINE_FILTER_ELECT
15	SM-OCIP	6000032844	PPCB_SM-OCIP_CARD
16	GPS+GSM ANTENNA	6000050102	GPS_GSM_UNIT_ASSEMBLY
17	STATIONARY ANTENNA	6000048812	STATIONARY KAVACH ANTENNA UHF-OMNISTAN06
18	GSM Antenna Cable (LMR200)	6000058270 6000057988	CABLE_ASY_LMR200_GSM A_15M_516490596 CABLE ASY_LMR200_GSM B_28M_516490585
19	GPS Antenna Cable (LMR200)	6000058268 6000057987	CABLE_ASY_LMR200_GPS A_15M_516490594 CABLE ASY_LMR200_GPS B_28M_516490584
20	RF Antenna Cable (LMR600)	1000103718	LMR-600DB_CABLE_ASSY_33M_95-82-342-011
21	SM-OCIP Interface Cable	6000032153	CABLE ASY_SMI SIGNAL_516490204

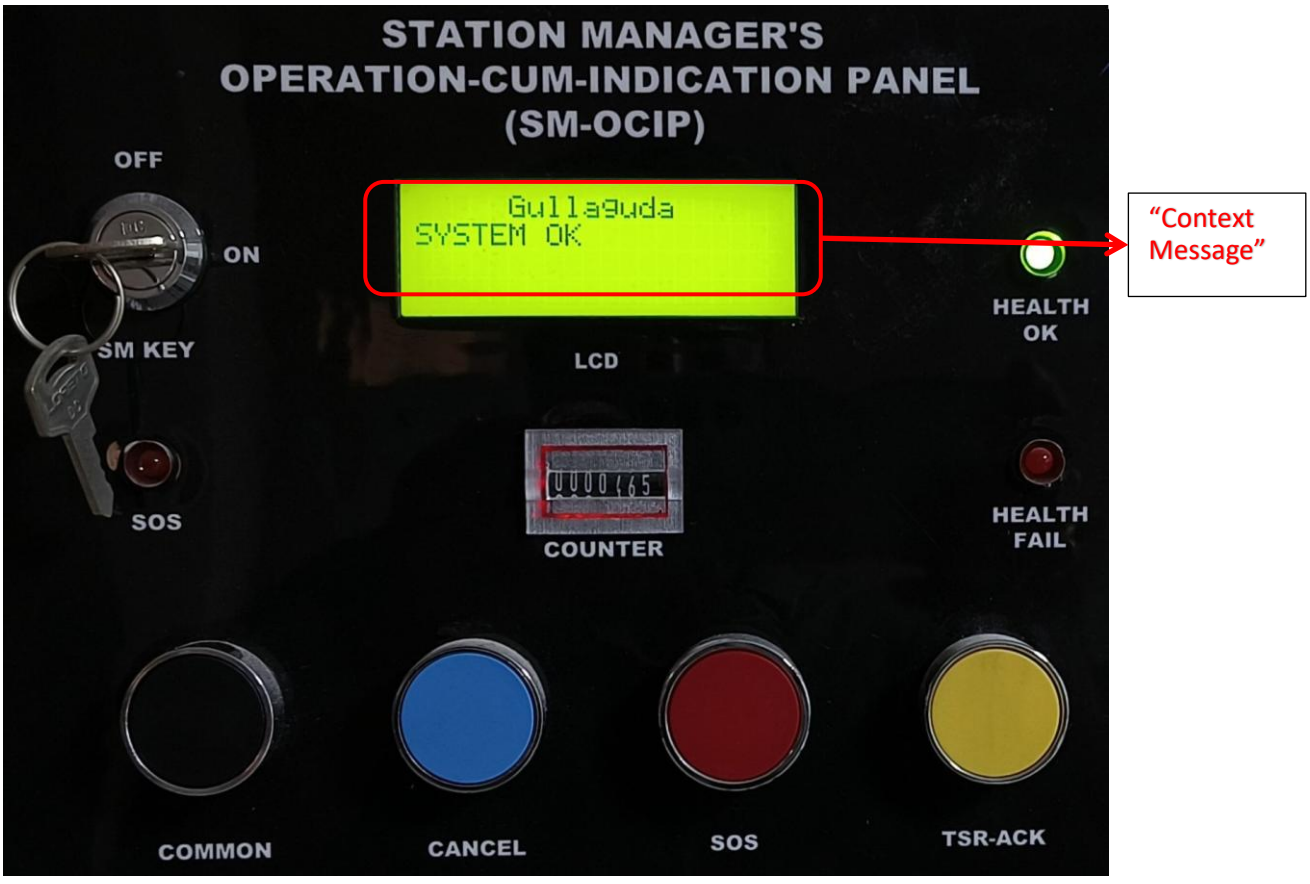
8.1.1 ISA's Safety related application condition (SRAC) for stationary Kavach

Following ISA's SRAC shall be complied for stationary Kavach

SRAC_STN7: *On failure of VC module, the faulty VC module shall be replaced during the first instance of scheduled maintenance within fortnight after failure is recorded*

9.0 Corrective Maintenance:

10.1 Failure of any sub-system in Stationary KAVACH is displayed in the Context Messages section of SM-OCIP, as shown in the following picture.



10.2 The following table lists all possible sub-system failures that appear on SM-OCIP. Troubleshooting chart in Annexure shall be referred for each failure condition and its associated troubleshooting guidelines and corrective actions.

#	SM-OCIP message	Section in Troubleshooting chart – Annexure-I
1	System Fail <GPS>	#1
2	System Fail <RADIO>	#2

#	SM-OCIP message	Section in Troubleshooting chart – Annexure-I
3	System Fail <SLF>	#3
4	System Fail <FLF>	#4
5	System Fail <CTF>	#5
6	System Fail <STC>	#6
7	Link Checking	#7
8	System Fail <EI>	#8

10.3 While attending to sub-system failures or functional problems, it is mandatory to check the health of all modules in the Stationary KAVACH.

10.3.1 If any module is found to be not working, appropriate section in the Troubleshooting Chart shall be referred for identifying the problem and fixing it.

#	Health of the module	Section in Troubleshooting chart – Annexure-II
1	PPC	# 1
2	VCC	# 2
3	VTR	# 3
4	VGW	# 4
5	GSM	# 5
6	DPS	# 6
7	SM-OCIP	# 7
8	FSC	# 8
9	GPS	# 9
10	Media Converter	#10
11	RADIO	#11
12	RIU-Host	#12
13	EI - Gateway	#13

10.4 Instructions for replacement of spare parts

10.4.1 PPCB module

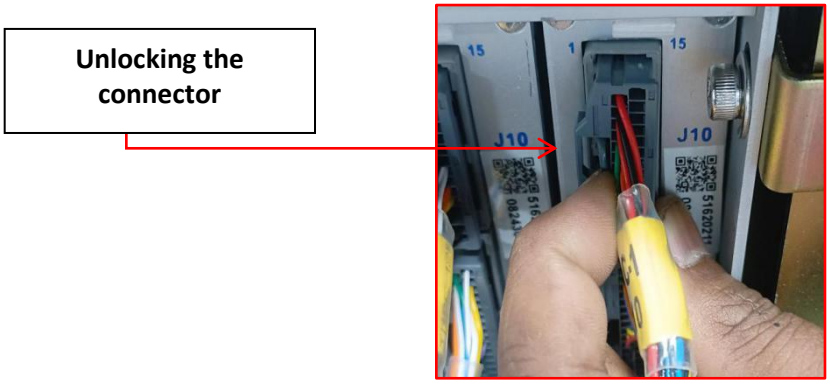
PCB modules like PPC, VC, VOTER, V-GW, FSC, RIU-Host, EI Gateway can be replaced by using the given below procedure

10.4.1.1 Unlock and remove the Front door & Back door of the Stationary Kavach Unit.

Front & Back view of Stationary Kavach

10.4.1.2 For faulty module, unlock the power connector and address connectors of the card.

#	Power Designator	Address Designator
PPC	J10	J11 & J12
VCC	J7	J8 & J9
Voter	J2	J3 & J4
V-GW	J11	J1
Cab input	J1	J2 & J3

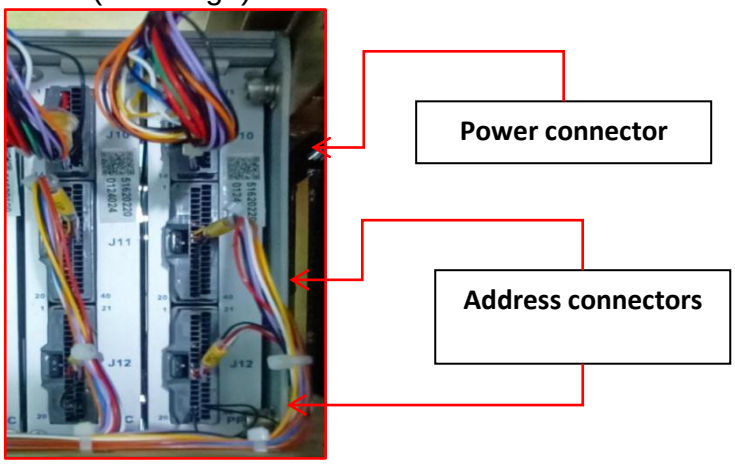


Note : 1. For PPCB, remove GPS cable carefully.

2. For V-GW, remove GSM cable and Ethernet cable carefully.

10.4.1.3 Fasten PCB module to the rack using **M3X10mm** captive screws with torque wrench.

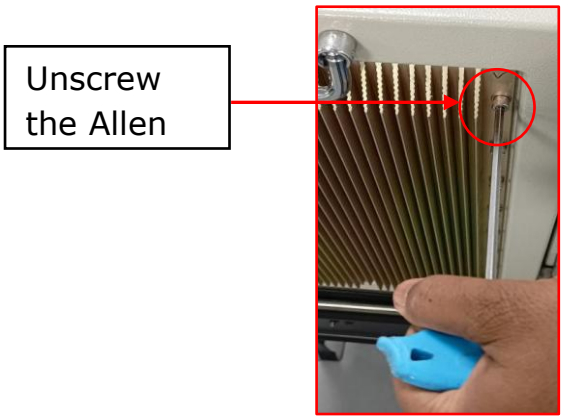
10.4.1.4 First insert the address connectors. Later insert the power connector.(Refer fig5)



10.4.1.5 Now, connect the cables if necessary. (GPS,GSM & Ethernet)

10.4.2 DPS

10.4.2.1 Unscrew the faulty DPS Module fixed to On Board Kavach Unit using torque wrench/Allen key set with a torque of 6N-m

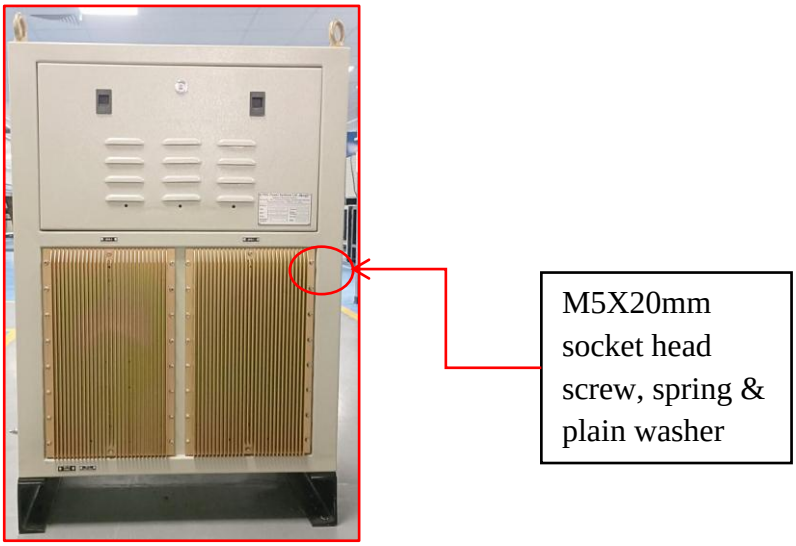


10.4.2.2 Remove the DPS module from the unit carefully.

10.4.2.3 Now unlock all the connectors in DPS card carefully.

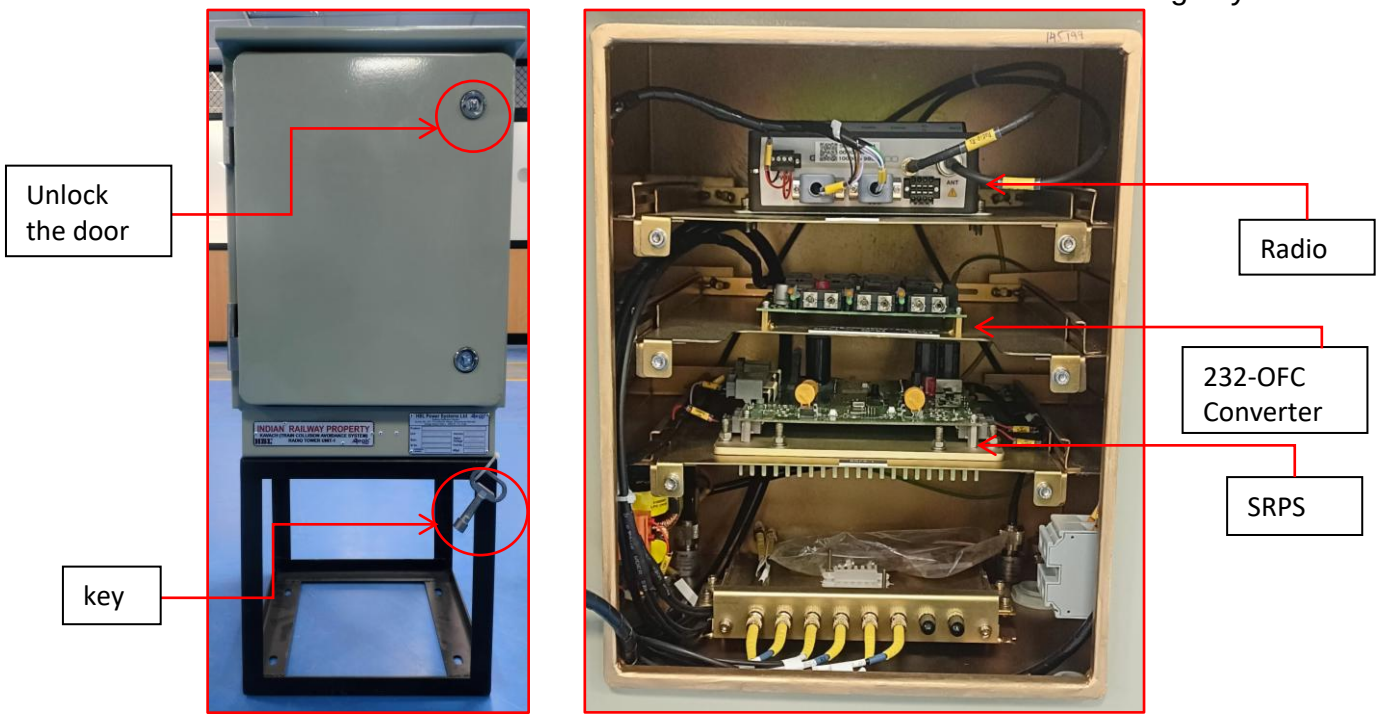
10.4.2.4 Take the new module and insert all the connectors in DPS card as per labeling on harness.

10.4.2.5 Fasten DPS Module to the enclosure using M5X20mm socket head screw, spring & plain washer by applying torque 6N-m with torque wrench/Allen key set.



10.4.3 Radio

10.4.3.1 Unlock the front door fixed to Radio tower unit using key

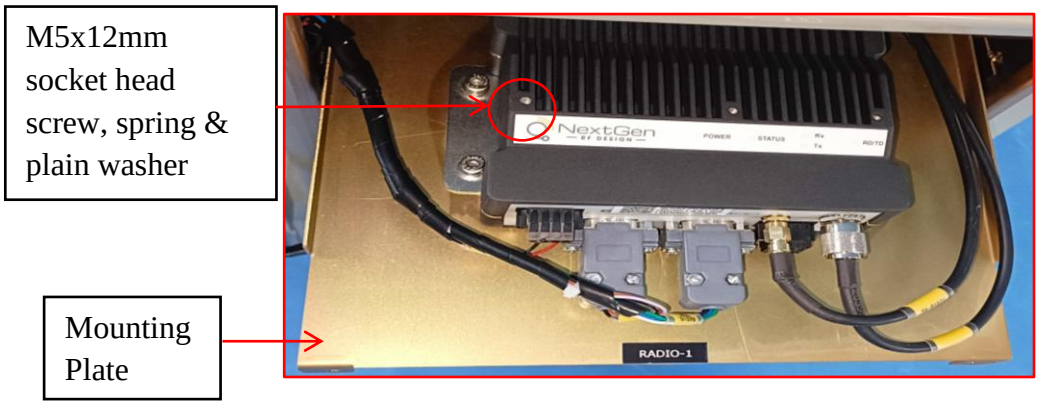


Inner view of Radio Tower unit

10.4.3.2 Now unscrew the radio mounting plate fixed to enclosure using torque wrench /Allen key set with torque of 6N-m.

10.4.3.3 Pull the mounting plate, later unlock all the connectors (RF,Power,DB9) in faulty Radio carefully.

10.4.3.4 Unscrew the Radio fixed to mounting plate using torque wrench /Allen key set with a torque of 6N-m



10.4.3.5 Take the new Radio, fasten Radio to the mounting plate using M5X12mm socket head screw, spring & plain washer by applying torque 6N-m with torque wrench/Allen key set.

10.4.3.6 Insert all the connectors (RF, Power, DB9) to the Radio as per labeling on harness.

10.4.3.7 Fasten mounting plate to the radio tower unit using M5X12mm socket head cap screws by applying torque 6N-m with torque wrench/Allen key set.

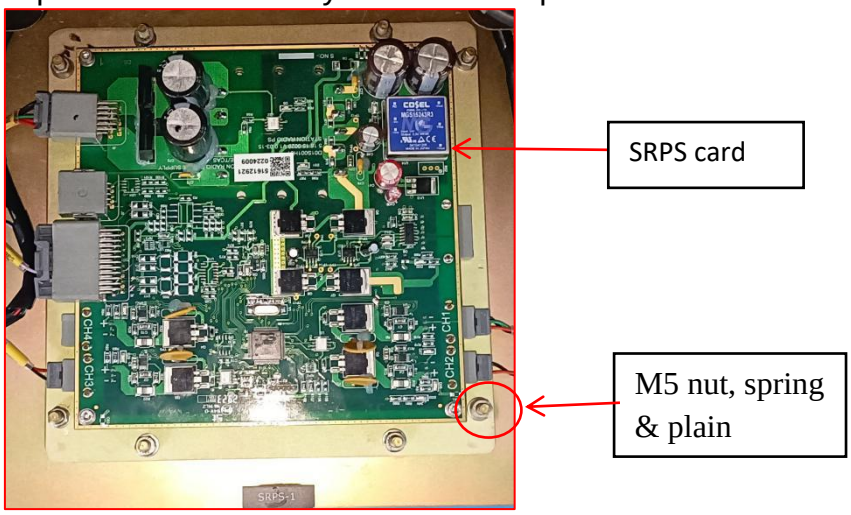
10.4.4 SRPS

10.4.4.1 Unlock the front door fixed to Radio tower unit using key.

10.4.4.2 Now unscrew the SRPS mounting plate fixed to enclosure using torque wrench /Allen key set with torque of 6N-m.

10.4.4.3 Pull the mounting plate, unlock all the connectors in faulty SRPS card.

10.4.4.4 Unscrew the SRPS module fixed to mounting plate using torque wrench /Allen key set with a torque of 6N-m.



10.4.4.5 Take the new SRPS module, fasten SRPS Module to the mounting plate using M5nut, spring & plain washer by applying torque 6N-m with torque wrench/Allen key set.

10.4.4.6 Insert all the connectors in SRPS card as per labeling on harness.

10.4.4.7 Fasten mounting plate to the radio tower unit using M5X12mm socket head cap screws by applying torque 6N-m with torque wrench/Allen key set.

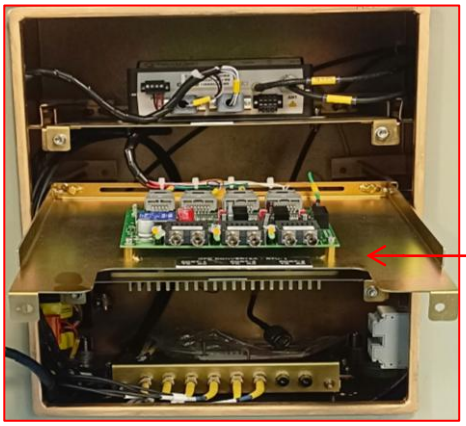
10.4.5 232-OFC Converter

10.4.5.1 Unlock the front door fixed to Radio tower unit using key.

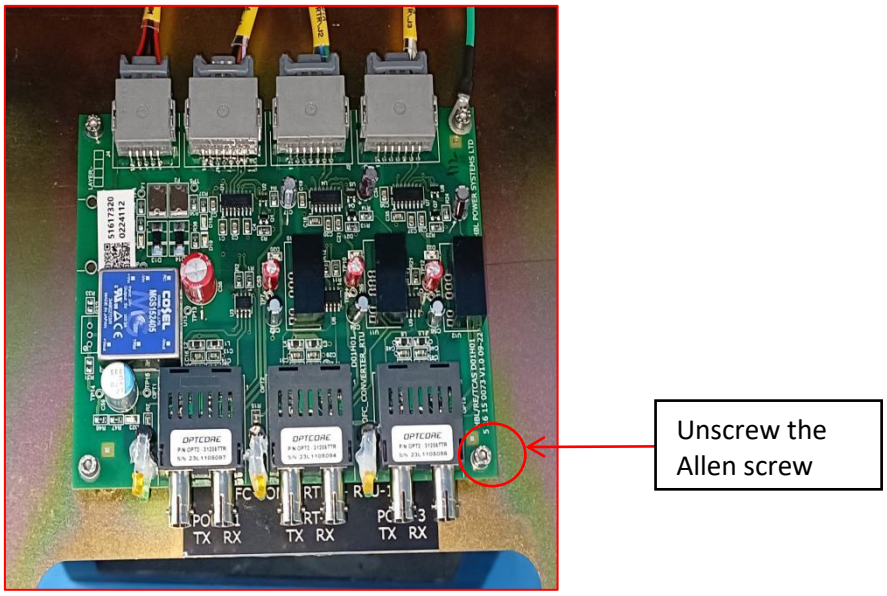
10.4.5.2 Unlock the ST-ST OFC cables connected to the OFC converter PCB carefully.

10.4.5.3 Now unscrew the 232-OFC converter mounting plate fixed to enclosure using torque wrench /Allen key set with torque of 1.3N-m.

10.4.5.4 Pull the mounting plate, unlock all the connectors in OFC converter card.



10.4.5.5 Unscrew the 232-OFC converter PCB fixed to mounting plate using torque wrench /Allen key set with a torque of 1.3N-m.



10.4.5.6 Take the new OFC converter, fasten OFC converter to the mounting plate using M3x8 Allen screw, spring & plain washer by applying torque 1.3N-m with torque wrench/Allen key set.

10.4.5.7 Insert all the connectors in OFC converter card as per labeling on harness.

10.4.5.8 Insert the OFC cables on the PCBA as per OFC drawing no 5 16 49 0559.

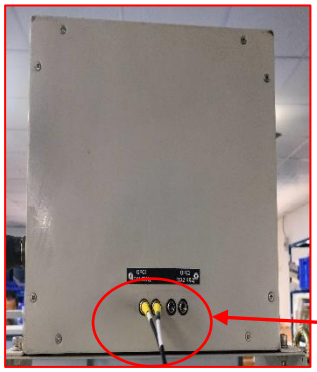
10.4.5.9 Fasten mounting plate to the radio tower unit using M5X12mm socket head cap screws by applying torque 6N-m with torque wrench/Allen key set.

10.4.6 SM-OCIP

10.4.6.1 Unlock the ST-ST OFC cables connected to SM-OCIP unit.

10.4.6.2 Unlock the Mil-connector fixed to the SM-OCIP unit.

10.4.6.3 Take new SM-OCIP unit, insert the OFC cables & mil connector to SMOCIP unit as per labeling on harness.



10.4.7 GPS/GSM antenna

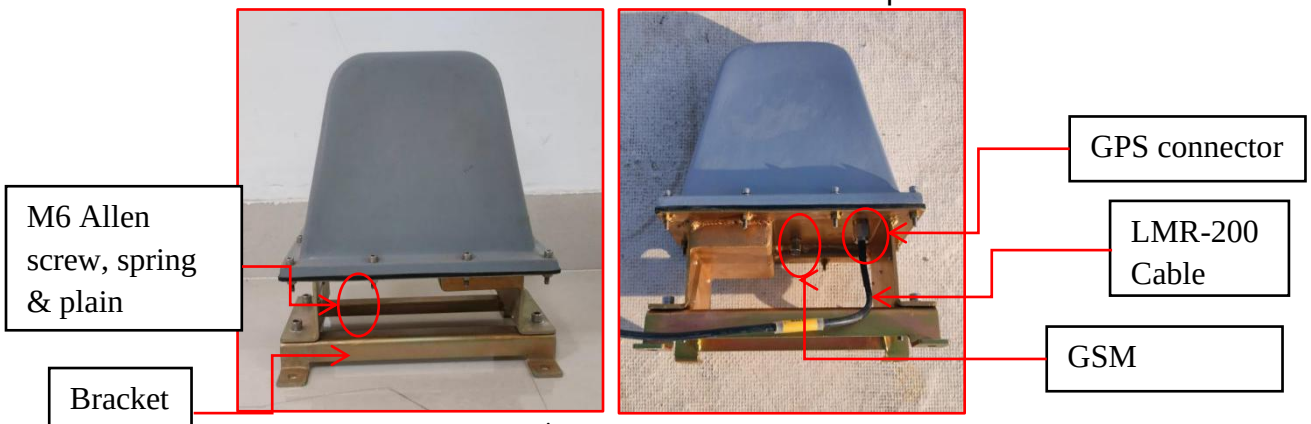
10.4.7.1 Unlock the GPS & GSM connector (SMA) of the GPS/GSM Antenna.

10.4.7.2 Unscrew GPS/GSM antenna fixed to bracket using torque wrench/Allen key set with a torque of 10N-m.

10.4.7.3 Take new working GPS/GSM Antenna, fasten GPS/GSM Antenna to the stand using M6 Allen screw, spring & plain washer by applying torque 10N-m using torque wrench/Allen key set.

10.4.7.4 Insert the GPS/GSM Antenna connector (SMA) to the antenna, as per labeling on harness

10.4.7.5 Ensure LMR-200 cable should not sharp blend.



GPS/GSM Antenna

10.4.8 External Cables

10.4.8.1 First identify faulty or damage cable in Stationary unit.

10.4.8.2 Unlock the matting connectors of faulty cable on both sides connected to unit.

10.4.8.3 Remove the cable ties from the cable bunch using wire stripper carefully.

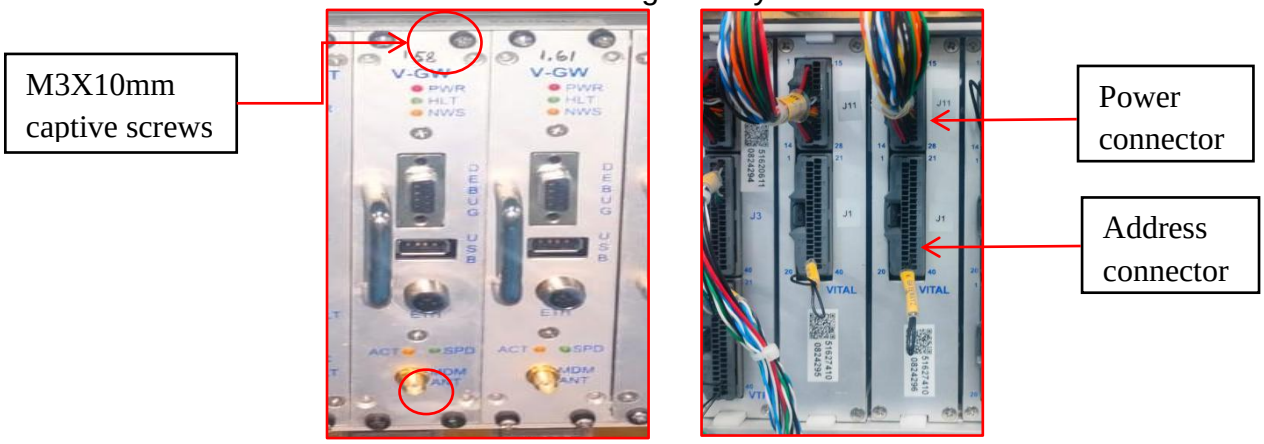
10.4.8.4 Take new respective cable. Route the cable as per drawing, using cable ties.

10.4.8.5 Fix the mating connectors of the new cable on both the sides connected to unit.

10.4.9 SIM card

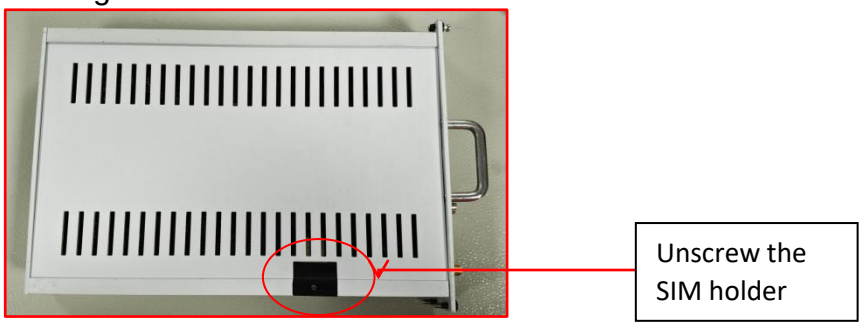
10.4.9.1 Unlock the Vital gate way PPCB Module address connector & power connectors.

10.4.9.2 Unscrew the Vital gate way PPCB module from the rack.



Vital gate way PPCB Module

10.4.9.3 Unscrew the SIM holder screw fixed to V-GW cassette using screwdriver.



10.4.9.4 Remove the inactive SIM card.

10.4.9.5 Take a new active SIM card and insert in the SIM holder as per image below.

Insertion SIM card into the VGW PPCB

10.4.9.6 Fasten SIM holder to V-GW cassette using screwdriver.

10.4.9.7 Insert Vital gate way PPCB module in rack at its respective place, fasten Vital gate way PPCB module to the rack using M3X10mm captive screws.

10.4.9.8 First insert the Address connector later insert the power connector in Vital gate way PPCB module.

10.0 Preventive Maintenance:

10.5 Checklist for preventive maintenance

10.5.1 Ref [14] indicates the checklist issued by CoE for carrying our preventive maintenance checks on Stationary KAVACH unit.

10.5.2 Periodicity of various checks to be performed is indicated in the checklist and shall be followed.

10.6 Instructions for special checks

10.6.1 Weld integrity of RFID Reader bracket shall be performed by dye penetrant test, as mentioned in Stationary KAVACH Installation Manual [Ref: 12]

10.6.2 Each pulse generator shall be removed from the axle box and driving fork and drive pin shall be examined for any wear and tear evidence. If excessive wear and tear are noticed, the pulse generator shall be replaced with a new one of same type.

10.6.3 RF antenna performance shall be checked by connecting them to a VSWR meter and recording return loss. If a return loss is more than 1.4 dBm, the antenna and/or cable shall be replaced.

11.0 Implementation of Field Change Notes:

10.7 Status of implementation of all applicable FCNs shall be verified from Configuration Management System, through WFMS.

10.8 If any FCN is not implemented, the same shall be implemented.

12.0 Functional testing after maintenance:

10.9 Procedure for Functional Testing, explained in Stationary KAVACH Commissioning Procedure shall be executed, through Stationary KAVACH Commissioning Wizard.

10.10 Functional Test report will be automatically uploaded to the respective Stationary folders in WFMS.

13.0 Report preparation and database updating:

13.1 After all maintenance work is completed, relevant records shall be updated in FRACAS system.

14.0 Annexure - I: Troubleshooting Chart

#	Possible problem	Why	Why	Diagnostic procedure	Corrective action
1	GPS Fault	RGS Led found not glowing	Cable cut / Antenna fault	1) Check GPS cable connectivity at PPC 2) Check for GPS cable continuity. If there is no continuity, replace the cable. If the cable has continuity, change the antenna	Replace the cable / Antenna
3	Radio Fault	System Fail <Radio> on SM-OCIP	Power Supply failure	Check continuity in external cable between STATIONARY KAVACH to Radio unit.	
			TX/RX not blinking	Check the cable connectivity at COM port on Radio If connectivity at both COM port and Media converter found Ok, SRPS card may be faulty	Fix the connectivity at COM port & OFC cables to media converters at both sides properly Replace SRPS card
			Status remains RED	Radio Unit problem	Replace Radio
			RD/RT not blinking	Radio Unit problem	Replace Radio
4	SLF fault	System Fail <SLF> on SM-OCIP	Configuration files not properly loaded / corrupted	Check the checksum of SLF file by using “STN config checksum verifier” application OR on SM-OCIP	Reload the config file
4	FLF fault	System Fail <FLF> on SM-OCIP	Configuration files not properly loaded / corrupted	Check the checksum of FLF file by using “STN config checksum verifier” application OR on SM-OCIP	Reload the config file
4	CTF fault	System Fail <CTF> on SM-OCIP	Configuration files not properly loaded / corrupted	Check the checksum of CTF file by using “STN config checksum verifier” application OR on SM-OCIP	Reload the config file
4	STC fault	System Fail <STC> on SM-OCIP	Configuration files not properly loaded / corrupted	Check the checksum of STC file by using “STN config checksum verifier” application OR on SM-OCIP	Reload the config file
17	Link Checking	Link Checking on SM-OCIP	Configuration / BIN files are not properly loaded / corrupted Faulty PCBAs SMI / Media Converter / Voter / VCC and OFC cables	Check the checksum of Config / BIN files by using “STN config checksum verifier” application. Check continuity / damage of the OFC cables.	Reload the config file change the cables if faulty

15.0 Annexure – II Troubleshooting chart

#	Module Name	Why	Diagnostic procedure	Corrective action
1	Peripheral Processing Card (PPC)	1. Improper communication between Master and watchdog controllers. 2. Non-availability of 24V power supply	1. Check status of PWR LED, shall be glow 2. Check status of health LEDs, shall be blinking 3. Check the connector fitment of the JAE connectors	1. If PWR LED is not glowing, restart the module 2. If Health LEDs are not blinking, restart the module 3. Replace the module if module is not functioning after restart
2	Vital Computer (VCC)	1. Non-availability of 24V power supply 2. Improper locking of JAE connectors	1. Check status of PWR LED, shall be glow 2. Check status of health LEDs, shall be blinking 3. Check the connector fitment of the JAE connectors	1. If PWR LED is not glowing, restart the module 2. If Health LEDs are not blinking, restart the module 3. Replace the module if module is not functioning after restart
3	Voter Card	1. Non-availability of 24V power supply 2. Improper locking of JAE connectors	1. Check status of PWR LED, shall be glow 2. Check status of health LEDs, shall be blinking 3. Check the connector fitment of the JAE connectors	1. If PWR LED is not glowing, restart the module 2. If Health LEDs are not blinking, restart the module 3. Replace the module if module is not functioning after restart
4	Vital Gateway (V-GW)	1. Non-availability of 24V power supply 2. Improper locking of JAE connectors	1. Check status of PWR LED, shall be glow 2. Check status of health LED, shall be blinking 3. Check the connector fitment of the JAE connectors	1. If PWR LED is not glowing, restart the module 2. If Health LED is not blinking, restart the module 3. Replace the module if module is not functioning after restart
5	GSM			
6	DPS	1. Non-availability of input voltage 110V 2. Non-functionality of EMI-Filter card 3. Improper locking of MC10 & JAE connectors	1. Check status of input MCB 2. Check the output voltages of EMI Filter cards 3. Check status of Health LED on DPS card, shall be blinking 4. Check the voltages at connector MC10 5. Check the fitment of J2 on DPS1 and DPS2 are connected and locked properly	1. If MCB trip, turn MCB ON 2. If output voltage is not available on EMI filter card, replace EMI filter card 3. If Health LED is not blinking, replace the DPS module
7	SM-OCIP	1. Non-availability of 24V power supply 2. Improper cable connectivity	1. Check status of System Heath LED, shall be blinking 2. Remove the external MC3 cable once and reconnect to SM-OCIP and check for the SM-OCIP communication is OK / not OK.	1. If System Health LED is steady state with RED color, replace the module 2. Check the external cable connectivity at MC3 replace the cable if voltages are not available. 3. Replace the faulty cables, if faulty
8	FSC	1. Non-availability of 24V power supply 2. Improper locking of JAE connectors	1. Check status of PWR LED, shall be glow 2. Check status of health LEDs, shall be blinking 3. Check the connector fitment of the JAE connectors	1. If PWR LED is not glowing, restart the module 2. If Health LEDs are not blinking, restart the module 3. Replace the module if module is not functioning after restart
9	GPS	1. Fault in antenna cable 2. Fault in GPS antenna 3. Fault in GPS module	1. Check the continuity of antenna cable 2. Check using another working antenna	1. Replace the cable, if no continuity 2. Replace antenna, if found faulty. 3. Replace the PPC card, if both cable & antenna are found OK.
10	Media Converter	1. Non-availability of 24V power supply 2. Improper locking of JAE connectors	1. Check status of PWR LED, shall be glow 2. Check status of Data LEDs, shall be blinking 3. Check the connector fitment of the JAE connectors	1. If PWR LED is not glowing, restart the module 2. If Data LEDs are not blinking, restart the module 3. Replace the module if module is not functioning after restart
11	Radio	1. Non-availability of input voltage 24V 2. Non-functionality of SRPS card 3. Improper locking of connectors	1. Check status of PWR LED on Radio, shall be glow 2. Check status of STATUS LED on Radio, shall be blinking 3. Check the connector fitment of the MIL / JAE / D-sub connectors	1. If 24V voltage is available and PWR LED is OFF/RED, replace the Radio 2. If PWR LED is ON and no communication, replace SRPS card 3. If the status LED remains in RED, replace Radio.
12	RIU-Host	1. Non-availability of 24V power supply Improper locking of JAE connectors	1. Check status of PWR LED, shall be glow 2. Check status of health LEDs, shall be blinking 3. Check the status of Data & Link LEDs, shall be blinking 4. Check the connector fitment of the JAE connectors	1. If PWR LED is not glowing, restart the module 2. If Health LEDs are not blinking, restart the module 3. If status of Data & Link LEDs are not blinking, replace the patch cables 4. Replace the module if module is not functioning after restart
13	EI Gateway	2. Non-availability of 24V power supply 3. Improper locking of JAE connectors	1. Check status of PWR LED, shall be glow 2. Check status of health LEDs, shall be blinking 3. Check the connector fitment of the JAE connectors	1. If PWR LED is not glowing, restart the module 2. If Health LEDs are not blinking, restart the module 3. Replace the module if module is not functioning after restart