GOVERNMENT OF INDIA

(भारत सरकार)

MINISTRY OF RAILWAYS

(रेल मंत्रालय)

Annexure – G

KAVACH
Network Monitoring System Protocol

Amdt-4

Issued by

SIGNAL & TELECOM DIRECTORATE
RESEARCH, DESIGNS & STANDARDS ORGANISATION
MINISTRY OF RAILWAYS
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ISO 9001: 2015	Effective from 16.07.2024	RDSO/SPN/196/2020	Version 4.0

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Revision History

Amdt	Date of issue	Amendment
1	13.06.2023	• Figure-1 -KAVACH Network arrangement diagram is modified • Clause 4.1- Station Active Radio - modified and • ~~Loco Regular / Access Request Packet (As per KAVACH Radio Communication Protocol~~ Shifted in clause G.4.2. • Cl. G-4.2 - Loco KAVACH Position Information Message- New clause added • Cl. G 4.3 Adjacent Kavach Information –New clause added. • Cl. G..4.4 Field Input Status Message- New clause • Cl.G.4.5 Field Inputs Event Message- New clause • Cl. G.4.7 Onboard KAVACH Health Packet to NMS- Modified • Cl. G.4.8 KAVACH Fault message to NMS Server-modified • Cl. G.4.9 NMS Acknowledge message to KAVACH Subsystem-Modified. • Cl. G.6.1.24- modified for additional fault message.
2	06.11.2023	• CL.G.2.2-Modified with addition of "The same network may be used for connection TSRMS network". CL.G.2.3- deleted "~~The IB huts shall be connected to the nearest Station in T network.~~ Figure-1 for connectivity with NMS modified. • Cl. G.3- The NMS message structure from Stationary KAVACH corrected. • CL.G.4.1-Modified in field Station Active Radio with addition of "0xE1: if Ethernet 1 is active, 0xE2: if Ethernet 2 is active, Any other data: Active radio un-known". • CL.G.4.2-Modified in field onboard Active Radio with addition of "0xE1: if Ethernet 1 is active, 0xE2: if Ethernet 2 is active, Any other data: Active radio un-known". • CL.4.3- TSR Information Message from stationary KAVACH to NMS- New Packet added. • CL4.4 - **~~Adjacent Kavach Information- Field 10 & 11 is deleted.~~**

3	16.12.2023	• CL.G.4.2- Modified in Loco Regular/ Access Request Packet.
		  a) ~~Current Route ID~~ No of MA section count "~~Current route is the Route ID in which train occupied.~~ Defines the train route in which MA is extended".
		  b) ~~Next~~ Route ID - ~~Next route is the approaching signal Route ID in which train will enter.~~ List of MA sections starting from train front end occupied section to EOA

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		section. • CL.G.4.3- Deleted ~~TSR Data Integrity test message. Acknowledge Medssage~~ in Field No. 10. Modified CRC Field Width ~~32~~4 in Field No. 11. • CL.G.4.4- Deleted ~~Heart Beat message~~ in Field No. 10. • CL.G.4.6 –Field Input event message-Field-17- Registered Loco_Count, 18- Loco _ID, 19- Abs_Loc_1 & 21- Abs_Loc_2. • CL.G.4.8- Onboard KAVACH Health Packet to NMS- Field-16-Stationary_KAVACH_ID, 17-Abs_Loc_1 & 19- Abs_Loc_2.
4	03.06.2024	• CL G.3- New packet of "Loco KAVACH RSSI Message & Stationary KAVACH RSSI Message added. • CL4.3- G.4.3- in field -10 "TSR Data Integrity test message " added TSR Information Message from stationary KAVACH to NMS. • CL 4.4 – In field -10 "Heart Beat message" added in Adjacent Kavach Information • CL.4.7- Stationary KAVACH Health Message to NMS Server ➢ field Registered Loco_Count, Loco _ID, Abs_Loc_1, Frequency Channel_Number, Radio-1 RSSI, Abs_Loc_2, Frequency Channel_Number, Radio-2 RSSI deleted ➢ field 30,31,32,33,34,35 modified with for every one hour in packet. ➢ Field -42- Override Missing TIN modified. ➢ Field-44-6. Exit due to Train Handover. 7. Exit due to Handover cancellation • CL.4.8- Onboard KAVACH Health Packet to NMS ➢ field Stationary_KAVACH_ID, Abs_Loc_1, Frequency Channel_Number, Radio-1 RSSI, Abs_Loc_2, Frequency Channel_Number, Radio-2 RSSI deleted. ➢ Field -16- Stationary Regular packet received time offset- added with (While establishing communication with Stationary KAVACH). ➢ field 20,21,22,23,24,25,26,27, 28, 29 modified with for every one hour in packet. ➢ Field 39-Computed TLM status- 0-TLM failed added. • CL.4.10- Loco KAVACH RSSI Message- new Packet added. • CL.4.11- Stationary KAVACH RSSI Message- new Packet added.

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G.1 **Introduction**

This document describes the protocol for Centralized Intelligent KAVACH Network Monitoring System (CIKMS) for the purpose of KAVACH System.

G.2 **Interface details for Stationary KAVACH to NMS & Stationary KAVACH to Stationary KAVACH Communication on E1 Interface**

G.2.1 KAVACH NMS Network shall be built on E1 interface also which is provided by the Indian Railways. This network shall be used for centralized monitoring of KAVACH equipped Trains and Stations within the network. Centralized monitoring of a group of stations is achieved by collecting signal aspects, track occupancy, loco absolute position etc., from each of the Stationary KAVACH unit within the network. Stationary KAVACH units shall communicate with NMS unit using the predefined packets, as explained in Packet Structure in the subsequent clauses.

G.2.2 Using E1 interface, each Stationary KAVACH (SVK) unit is connected to adjacent stationary KAVACH unit/Network Management System to form a network, as shown in Figure 1. Using Ethernet protocol over this network, Stationary KAVACH units will exchange Stationary-Stationary communication packets with adjacent Stationary KAVACH units and NMS. The same network may be used for connection TSRMS network.

G.2.3 Event logger module of Onboard KAVACH and Stationary KAVACH shall store all the Vital events, messages exchanged between Radio or other unit and diagnostic related messages of all the other module. The modification in NMS protocol may be possible without change in executive logic of vital card.

G.2.4 Number of Stationary KAVACH units in one E1/Ethernet rings shall be limited to 10.

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Figure 1 Connectivity with NMS

G.3 **The NMS message structure from Stationary KAVACH:**

The different types of messages are as defined belowfor logging in NMS

Message Type	Value	Purpose
Stationary KAVACH information Message to NMS server	0x11	Stationary KAVACH will send all packet of Station Regular / Access Authority & Additional Emergency Packet.
Loco KAVACH Position Information Message	0x12	Stationary KAVACH will send all packet of Loco Regular / Access Request Packet.
TSR Information Message from stationary KAVACH to NMS	0x13	The information received from TSRMS to Stationary KAVACH packet.
Adjacent Kavach Information	0x14	The information log in NMS are Command PDI version check Message PDI version check, Heart Beat message, Train Handover Request Message, Train RRI Message, Train Taken Over Message, Train Handover Cancellation message, Train Length Information message, Train Length Acknowledgement, TSL Route Re-quest message, TSL Information message, Field Elements Status Request message & Field element Status

		message.
Field Input Status Message	0x15	The information received from Stationary KAVACH field input status.
Field Inputs Event Message	0x16	The information received from Stationary KAVACH field input event change message.
Stationary KAVACH Health Message to NMS Server	0x17	The health message received from Stationary KAVACH.
Onboard KAVACH Health Packet to NMS	0x18	The health message received from onboard KAVACH packet.
KAVACH Fault message to NMS Server	0x19	The fault code message received from stationary KAVACH.
Loco KAVACH RSSI Message	0x20	RSSI samples captured for last one minute on detection of stationary Ragular packet in Loco KAVACH.
Stationary KAVACH RSSI Message	0x21	RSSI samples captured for last one minute on detection of stationary Ragular packet in stationary KAVACH.
NMS Acknowledge message to KAVACH Subsystem	0x1F	NMS acknowledgement.

Stationary KAVACH NMS Packet Structure

G.3.1   Fields highlighted (marked with Gray color) are of dynamic in size.

G.3.2   Loco to Station packet and Station to Loco packets are the RAW packets which are received/transmitted from/to the radio unit except SOF fields (0xA5, 0xC3). SOF fields shall not be included in Loco to Station Packet and Station to Loco packet.

G.3.3   Loco to Station Packet SOF and Station to Loco packet SOF fields should be repeated for all the packets.

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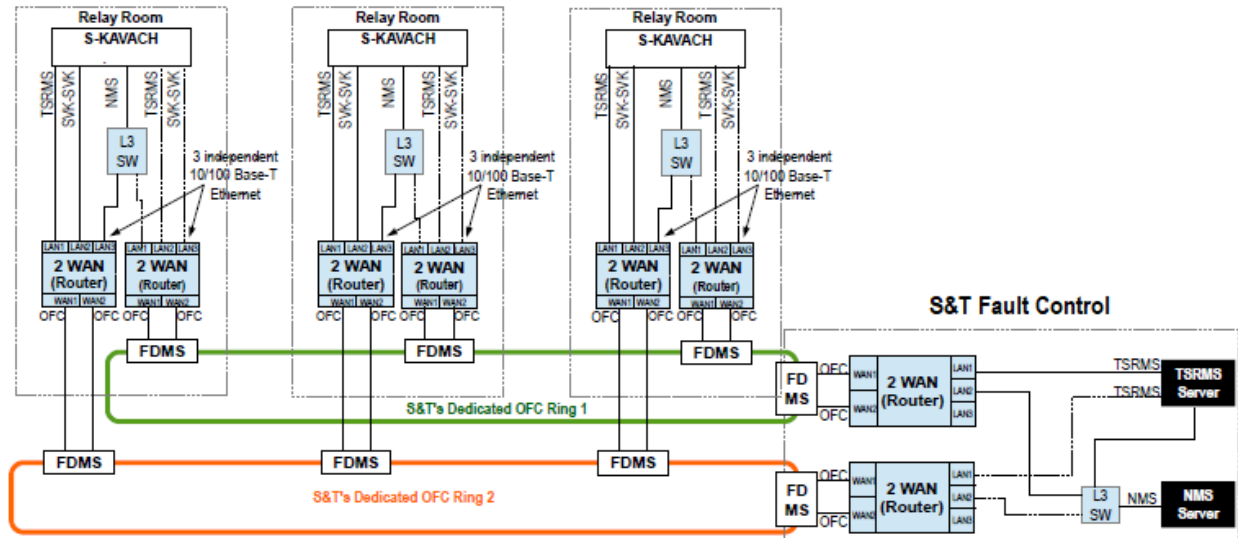| ISO 9001: 2015	Effective from 16.07.2024	RDSO/SPN/196/2020	Version 4.0

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G.4 **NMS Packet Structure for version 4.0**

G.4.1 **Stationary KAVACH information Message to NMS server**

Field No	Field Description	Field Width (Byte)	Comment
1	Start of Frame (SOF)	2	0xAAAA
2	Message Type	1	0x11
3	Message Length	2	In Bytes from field "Message Type" to "CRC" (inclusive of both)
4	Message Sequence	2	0-65535
5	Stationary KAVACH ID	2	Unique Code, Valid values from 1 to 65535 (Purchaser Railway to Decide)
6	NMS system ID	2	It is one of the stationary KA-VACH ID
7	System Version	1	0x00-Version 3.2 0x01- Version 4.0
8	Date	3	DD/MM/YY 00-99: official year; 100-254: not used; 255: year unknown 01-12: official month; 0,13 to 254: not used; 255: month unknown 01-31: official day; 0, 32-254: not used; 255: day unknown Eg: 27/04/18 → 0x1B-0x04-0x12
9	Time	3	HH:MM:SS (IST time- Configurable) 00-23: official hour; 24-254: not used; 255: hour unknown 00-59: official minutes, 60-254: not used, 255: minutes unknown 00-59: official seconds, 60-254: not used, 255: seconds unknown Eg: 06:36:10 → 0x06-0x24-0x0A
10	Station Active Radio	1	0xF1: if Radio 1 is active. 0xF2: if Radio 2 is active. 0xE1: if Ethernet 1 is active. 0xE2: if Ethernet 2 is active. Any other data: Active radio un-

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Field No	Field Description	Field Width (Byte)	Comment
			known
11	SOF Tx byte 1	1	0xA5
12	SOF Tx byte 2	1	0xC3
Station Regular / Access Authority / Additional Emergency Packet / etc. (As per KAVACH Radio Communication Protocol)			
13	CRC	4	CCITT- 32 Bit CRC (0x04C11DB7) excluding SOF field.

G.4.2   **Loco KAVACH Position Information Message:** For Every cycle (1 cycle = 2s) when locos registered with SKAVACH.

Field No	Field Description	Field Width (Bytes)	Comment
1	Start of Frame (SOF)	2	0xAAAA
2	Message Type	1	0x12
3	Message Length	2	In Bytes from field "Message Type" to "CRC" (inclusive of both)
4	Message Sequence	2	0-65535
5	Stationary KAVACH ID	2	Unique Code, Valid values from 1 to 65535 (Purchaser Railway to Decide)
6	NMS system ID	2	It is one of the stationary KAVACH ID
7	System Version	1	1
8	Date	3	DD/MM/YY 00-99: official year; 100-254: not used; 255: year unknown 01-12: official month; 0,13 to 254: not used; 255: month unknown 01-31: official day; 0, 32-254: not used; 255: day unknown Eg: 27/04/18 → 0x1B-0x04-0x12
9	Time	3	HH:MM:SS (IST time) 00-23: official hour; 24-254: not used; 255: hour unknown 00-59: official minutes, 60-254: not used, 255: minutes unknown 00-59: official seconds, 60-254: not used, 255: seconds unknown Eg: 06:36:10 → 0x06-0x24-0x0A

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Field No	Field Description	Field Width (Bytes)	Comment
10	Onboard Active Radio	1	0xF1: if Radio 1 is active. 0xF2: if Radio 2 is active. 0xE1: if Ethernet 1 is active. 0xE2: if Ethernet 2 is active. Any other data: Active radio unknown
11	SOF Tx byte 1	1	0xA5
12	SOF Tx byte 2	1	0xC3
Loco Regular / Access Request Packet (As per KAVACH Radio Communication Protocol)			
13	No of MA section count	1	Defines the train route in which MA is extended.
14	Route ID	2	List of MA sections starting from train front end occupied section to EOA section.
15	CRC	4	CCITT- 32 Bit CRC (0x04C11DB7) excluding SOF (0xAAAA) field.

G.4.3   **TSR Information Message from stationary KAVACH to NMS**

Field No	Field Description	Field Width (Bytes)	Comment
1	Start of Frame (SOF)	2	0xAAAA
2	Message Type	1	0x13
3	Message Length	2	In Bytes from field "Message Type" to "CRC" (inclusive of both)
4	Message Sequence	2	0-65535
5	Stationary KAVACH ID	2	
6	NMS system ID	2	
7	System Version	1	1

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Field No	Field Description	Field Width (Bytes)	Comment
8	Date	3	DD/MM/YY 00-99: official year; 100-254: not used; 255: year unknown 01-12: official month; 0,13 to 254: not used; 255: month unknown 01-31: official day; 0, 32-254: not used; 255: day unknown Eg: 27/04/18 → 0x1B-0x04-0x12
9	Time	3	HH:MM:SS (IST time) 00-23: official hour; 24-254: not used; 255: hour unknown 00-59: official minutes, 60-254: not used, 255: minutes unknown 00-59: official seconds, 60-254: not used, 255: seconds unknown Eg: 06:36:10 → 0x06-0x24-0x0A
10	**All TSR Information message** (As per TSRMS-SKAVACH Communication Protocol) (Command PDI version check, Message PDI version check, All TSR Information message, Get TSR Information message, SKAVACH TSR data message, TSR Data Integrity test message)		
11	CRC	4	CCITT- 32 Bit CRC (0x04C11DB7) excluding SOF field.

G.4.4 **Adjacent Kavach Information:** When handover of Train is in progress.

Field No	Field Description	Field Width (Bytes)	Comment
1	Start of Frame (SOF)	2	0xAAAA
2	Message Type	1	0x14
3	Message Length	2	In Bytes from field "Message Type" to "CRC" (inclusive of both)
4	Message Sequence	2	0-65535
5	Stationary KAVACH ID	2	Unique Code, Valid values from 1 to 65535 (Purchaser Railway to Decide)
6	NMS system ID	2	It is one of the stationary KAVACH ID
7	System Version	1	1

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Field No	Field Description	Field Width (Bytes)	Comment
8	Date	3	DD/MM/YY 00-99: official year; 100-254: not used; 255: year unknown 01-12: official month; 0,13 to 254: not used; 255: month unknown 01-31: official day; 0, 32-254: not used; 255: day unknown Eg: 27/04/18 → 0x1B-0x04-0x12
9	Time	3	HH:MM:SS (IST time) 00-23: official hour; 24-254: not used; 255: hour unknown 00-59: official minutes, 60-254: not used, 255: minutes unknown 00-59: official seconds, 60-254: not used, 255: seconds unknown Eg: 06:36:10 → 0x06-0x24-0x0A
10			As per SKAVACH-SKAVACH Communication Protocol) Command PDI version check Message PDI version check, Heart Beat message, Train Handover Request Message,Train RRI Message, Train Taken Over Message, Train Handover Cancellation message Train Length Information message, Train Length Acknowledgement, TSL Route Request message, TSL Information message, Field Elements Status Request message & Field element Status message.
11	CRC	4	CCITT- 32 Bit CRC (0x04C11DB7) excluding SOF field.

G.4.5   **Field Input Status Message:** On power on of SKAVACH, On Link fail recovery & periodically defined by Railways (for play back reason)

Field No	Field Description	Field Width (Bytes)	Comment
1	Start of Frame (SOF)	2	0xAAAA
2	Message Type	1	0x15
3	Message Length	2	In Bytes from field "Message Type" to "CRC" (inclusive of both)
4	Message Sequence	2	0-65535
5	Stationary KAVACH ID	2	Unique Code, Valid values from 1 to 65535 (Purchaser Railway to Decide)

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Field No	Field Description	Field Width (Bytes)	Comment
6	NMS system ID	2	It is one of the stationary KAVACH ID
7	System Version	1	1
8	Date	3	DD/MM/YY 00-99: official year; 100-254: not used; 255: year unknown 01-12: official month; 0,13 to 254: not used; 255: month unknown 01-31: official day; 0, 32-254: not used; 255: day unknown Eg: 27/04/18 → 0x1B-0x04-0x12
9	Time	3	HH:MM: SS (IST time) 00-23: official hour; 24-254: not used; 255: hour unknown 00-59: official minutes, 60-254: not used, 255: minutes unknown 00-59: official seconds, 60-254: not used, 255: seconds unknown Eg: 06:36:10 → 0x06-0x24-0x0A
10	Total Event Relays (E)	2	The total number of relays (in bytes) for which information is transmitted in this packet shall be specified.
11	Relay Status Image	Round off (E/8) Bytes	Each bit indicates status of each input. ('0' – Drop, '1' – Pickup) LSB of first byte indicates status of first input. This data contains status of all Track Identification Numbers (TIN) and Station Inputs. Status of all TINs (0 to 255) shall be framed first while preparing the packet. All TINs status shall be sent irrespective of TIN allocation in the Station. First input of Stationary KAVACH shall start from 256th bit. Relay status image shall be multiple of 8. Unconnected/Unallocated inputs shall be filled with Zero.

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Field No	Field Description	Field Width (Bytes)	Comment
			Ex: If No. of Stationary KAVACH inputs is 66, Relay Status image shall be 25 Bytes (32 bytes TIN + 9 bytes Stationary KAVACH inputs).
12	CRC	4	CCITT- 32 Bit CRC (0x04C11DB7) excluding SOF field.

G.4.6 **Field Inputs Event Message:** On change of any relay status.

Field No	Field Description	Field Width (Bytes)	Comment
1	Start of Frame (SOF)	2	0xAAAA
2	Message Type	1	0x16
3	Message Length	2	In Bytes from field "Message Type" to "CRC" (inclusive of both)
4	Message Sequence	2	0-65535
5	Stationary KAVACH ID	2	Unique Code, Valid values from 1 to 65535 (Purchaser Railway to Decide)
6	NMS system ID	2	It is one of the stationary KAVACH ID
7	System Version	1	1
8	Date	3	DD/MM/YY 00-99: official year; 100-254: not used; 255: year unknown 01-12: official month; 0,13 to 254: not used; 255: month unknown 01-31: official day; 0, 32-254: not used; 255: day unknown Eg: 27/04/18 → 0x1B-0x04-0x12
9	Time	3	HH:MM:SS (IST time) 00-23: official hour; 24-254: not used; 255: hour unknown 00-59: official minutes, 60-254: not used, 255: minutes unknown 00-59: official seconds, 60-254: not used, 255: seconds unknown Eg: 06:36:10 → 0x06-0x24-0x0A
10	Relay Event Count	1	Total events detected in same time

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Field No	Field Description	Field Width (Bytes)	Comment
11	Relay Address	2	
12	Relay Status	1	0x00 – Drop Down 0x01 – Picked Up
13	CRC	4	CCITT- 32 Bit CRC (0x04C11DB7) excluding SOF field.

G.4.7 **Stationary KAVACH Health Message to NMS Server**

Field No	Field Description	Field Width (Bytes)	Comment
1	Start of Frame (SOF)	2	0xAAAA
2	Message Type	1	0x17
3	Message Length	2	In Bytes from field "Message Type" to "CRC" (inclusive of both)
4	Message Sequence	2	0-65535
5	Stationary KAVACH ID	2	Unique Code, Valid values from 1 to 65535 (Purchaser Railway to Decide)
6	NMS system ID	2	It is one of the stationary KAVACH ID
7	System Version	1	1
8	Date	3	DD/MM/YY 00-99: official year; 100-254: not used; 255: year unknown 01-12: official month; 0,13 to 254: not used; 255: month unknown 01-31: official day; 0, 32-254: not used; 255: day unknown Eg: 27/04/18 → 0x1B-0x04-0x12
9	Time	3	HH:MM:SS (IST time) 00-23: official hour; 24-254: not used; 255: hour unknown 00-59: official minutes, 60-254: not used, 255: minutes unknown 00-59: official seconds, 60-254: not used, 255: seconds unknown Eg: 06:36:10 → 0x06-0x24-0x0A
10	Event Count	1	
11	Event Id	2	Stationary KAVACH Health
12	Event Data	m	
13	CRC	4	CCITT- 32 Bit CRC (0x04C11DB7) excluding SOF field.

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Field No	Field Description	Field Width (Bytes)	Comment
Event Field			
1.	System Temperature	1	System Temperature value (1 byte Signed) *- On change of temperature by 3°C*
2.	Active Radio Number	1	0: not used 1: Radio 1 2: Radio 2 3: Both Radio active
3.	Radio-1 Health	1	1: OK 2: Diagnostic Link Fail 3: Radio Fail
4.	Radio-2 Health	1	1: OK 2: Diagnostic Link Fail 3: Radio Fail
5.	Radio-1 Input supply	1	Value: 10V-30V *- On change of voltage by 1V*
6.	Radio-2 Input supply	1	Value: 10V-30V *- On change of voltage by 1V*
7.	Radio-1 Temperature	1	Value: -30°C to 70°C (1 byte Signed) *- On change of temperature by 3°C*
8.	Radio-2 Temperature	1	Value: -30°C to 70°C (1 byte Signed) *- On change of temperature by 3°C*
9.	Radio-1 PA Temperature	1	Value:20°C to 100°C *- On change of temperature by 3°C*
10.	Radio-2 PA Temperature	1	Value:20°C to 100°C *- On change of temperature by 3°C*
11.	Radio-1 PA Supply Voltage	1	Value: 11V-13V *- On change of voltage by 1V*
12.	Radio-2 PA Supply Voltage	1	Value: 11V-13V *- On change of voltage by 1V*
13.	Radio-1 Tx PA Current	1	Value: 1.5A to 3.2A *- On change of current*
14.	Radio-2 Tx PA Current	1	Value: 1.5A to 3.2A *- On change of current*
15.	Radio-1 Reverse Power	1	Value received from Radio Eg: Value received from Radio is 0x01 = 0.1W (Value: 0x01) - on Change of Reverse power by 0.1W
16.	Radio-2 Reverse Power	1	Value received from Radio Eg: Value received from Radio is 0x0F = 1.5W (Value: 0x0F) - on Change of Reverse power by 0.1W
17.	Radio-1 Forward	1	Value received from Radio

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Field No	Field Description	Field Width (Bytes)	Comment
	Power		Eg: Value received from Radio is 0x36 = 5.4W (Value: 0x36) - on Change of Forward power by 0.1W
18.	Radio-2 Forward Power	1	Value received from Radio Eg: Value received from Radio is 0x78 = 12W (Value: 0x78) - on Change of Forward power by 0.1W
19.	Current Running Key	1	0: Default key set, 1-30: KMS key set - on change of Key Set
20.	Remaining Number of Keys	1	0: No keys, 1-30: Remaining KMS key sets - on change of value
21.	Session Key Checksum	2	Checksum of 16 bytes session key - for every 2s at the time of Authentication only
22.	Allocated time slot for new loco	1	1-50 - for every 2s at the time of Authentication only
23.	New Loco Regular packet received time offset	2	0-2000ms - At the time of successful registration only
24.	Loco Count	1	Value: 0-50 Noof Locos supervised by Stationary KAVACH - *On change of value*
25.	Radio-1 Rx Packet Count	1	Value: 0-50 Total Loco regular packets received from Radio-1 in 2s time frame - *for every 2s time frame when locos are present*
26.	Radio-2 Rx Packet Count	1	Total Loco regular packets received from Radio-2 in 2s time frame - *for every 2s time frame when locos are present*
27.	Active GPS Number	1	Gps used for frame number calculation 0 – No Active GPS 1 – GPS 1 2 – GPS 2 3 – Both GPS - on change of GPS
28.	GPS-1 View	1	0 – No Data 1 – V

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Field No	Field Description	Field Width (Bytes)	Comment
			2 – A - on detection of change *of event*
29.	GPS-2 View	1	0 – No Data 1 – V 2 – A - on detection of change *of event*
30.	GPS-1 Seconds	1	0 to 59 seconds - on change of value for every one hour.
31.	GPS-2 Seconds	1	0 to 59 seconds - on change of value for every one hour.
32.	GPS-1 Satellites in View	1	Value received from GPS receiver - *On change of value* for every one hour.
33.	GPS-1 CNO (Max)	1	Maximum CNO Value received from GPS receiver - *On change of value* for every one hour.
34.	GPS-2 Satellites in View	1	Value received from GPS receiver - *On change of value* for every one hour.
35.	GPS-2 CNO (Max)	1	Maximum CNO Value received from GPS receiver - *On change of value* for every one hour.
36.	GSM-1 RSSI	1	Value received from GSM module - *for every 30 minutes*
37.	GSM-2 RSSI	1	Value received from GSM module - *for every 30 minutes*
38.	Missing RFID	2	- on detection of Missing RFID
39.	Invalid RFID	2	- on detection of Invalid RFID
40.	Conflict Route RFID	2	- on detection of conflicting route RFID
41.	Conflicting TIN	2	Conflicting TIN in the route occupied by another train - *On detection of event*
42.	Missing TIN	2	TIN which is cleared due to RFID reader failure - *On detection of event or missing of con-secutive*
43.	Loco Specific SoS	4	B3 to B1: Loco ID B0: SoS Code given below 1: SoS generated due to wrong route Tag 2: SoS due to collision detection 3: SoS due to shunt limits violation 4: SoS due to Invalid position report 5: SoS due to signal set to conflicting route

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Field No	Field Description	Field Width (Bytes)	Comment
			- *On detection of event*
44.	Train exit mode	4	B3 to B1: Loco ID B0: Exit Code given below 1: Loco exit due to unknown direction in SR or SB mode 2: Loco exit due to out of station boundary 3: Loco exit due to specific mode (IS or NL mode) 4: Loco exit due to authentication failure 5: Loco exit due to communication timeout 6. Exit due to Train Handover. 7. Exit due to Handover cancellation - *On detection of event*
45.	Station Modules Health	2	b15-b4: Module ID b3-b0: Module Health - *On detection of event*
46-199	Reserved		
200-254	Firm specific events	2	This field Information is specific to KAVACH firm
255	Specific value		Not to be used

G.4.8   Onboard KAVACH Health Packet to NMS

Event ID	Onboard KAVACH Health	Field Width (Bytes)	Description
1.	Start of Frame (SOF)	2	0xBBBB
2.	Message Type	1	0x18
3.	Message Length	2	In Bytes from field "Message Type" to "CRC" (inclusive of both)
4.	Message Sequence	2	0-65535
5.	Onboard KAVACH ID	3	
6.	NMS System ID	2	Onboard KAVACH shall identify the NMS system ID from domain name server / Stationary KAVACH shall send the NMS ID during session establishment
7.	System Version	1	1

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8.	Date	3	DD/MM/YY (IST Time- Configurable) 00-99: official year; 100-254: not used; 255: year unknown 01-12: official month; 0,13 to 254: not used; 255: month unknown 01-31: official day; 0, 32-254: not used; 255: day unknown Eg: 27/04/18 → 0x1B-0x04-0x12
9.	Time	3	HH:MM:SS (IST time-Configurable) 00-23: official hour; 24-254: not used; 255: hour unknown 00-59: official minutes, 60-254: not used, 255: minutes unknown 00-59: official seconds, 60-254: not used, 255: seconds unknown Eg: 06:36:10 → 0x06-0x24-0x0A
10.	Event Count	1	
11.	Event Id	2	Onboard KAVACH Health
12.	Event Data	m	
13.	CRC	4	CCITT- 32 Bit CRC (0x04C11DB7) excluding SOF field.

Event ID	Loco KAVACH Health	Field Width (Bytes) – m	Description
1.	Radio-1 Health	1	1: OK 2: Diagnostic Link Fail 3: Radio Fail
2.	Radio-2 Health	1	1: OK 2: Diagnostic Link Fail 3: Radio Fail
3.	Radio-1 Input supply	1	Value: 10V-30V - *On change of voltage by 1V*
4.	Radio-2 Input supply	1	Value: 10V-30V - *On change of voltage by 1V*
5.	Radio-1 Temperature	1	Value: -30°C to 70°C (1 byte Signed) - *On change of temperature by 3°C*
6.	Radio-2 Temperature	1	Value: -30°C to 70°C (1 byte Signed) - *On change of temperature by 3°C*
7.	Radio-1 PA Temperature	1	Value:20°C to 100°C - *On change of temperature by 3°C*
8.	Radio-2 PA Temperature	1	Value:20°C to 100°C - *On change of temperature by 3°C*
9.	Radio-1 PA Supply Voltage	1	Value: 11V-13V - *On change of voltage by 1V*

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10.	Radio-2 PA Supply Voltage	1	Value: 11V-13V - *On change of voltage by 1V*
11.	Radio-1 Tx PA Current	1	Value: 1.5A to 3.2A - *On change of current*
12.	Radio-2 Tx PA Current	1	Value: 1.5A to 3.2A - *On change of current*
13.	Radio-1 Reverse Power	1	Value received from Radio Eg: Value received from Radio is 0x01 = 0.1W (Value: 0x01)
14.	Radio-2 Reverse Power	1	Value received from Radio Eg: Value received from Radio is 0x0F = 1.5W (Value: 0x0F)
15.	Radio-1 Forward Power	1	Value received from Radio Eg: Value received from Radio is 0x36 = 5.4W (Value: 0x36)
16.	Radio-2 Forward Power	1	Value received from Radio Eg: Value received from Radio is 0x78 = 12W (Value: 0x78)
17.	Stationary Regular packet received time offset	2	0-2000 ms (While establishing communication with Stationary KAVACH)
18.	Active GPS Number	1	Gps used for frame number calculation 0 – No Active GPS 1 – GPS 1 2 – GPS 2 3 – Both GPS - on change of GPS
19.	GPS-1 View Status	1	0 – No Data 1 – V 2 – A - on detection of change *of event*
20.	GPS-2 View Status	1	0 – No Data 1 – V 2 – A - on detection of change *of event*
21.	GPS-1 Seconds	1	0 to 59 seconds - on change of value for every one hour
22.	GPS-2 Seconds	1	0 to 59 seconds - on change of value for every one hour
23.	GPS-1 Satellites in View	1	Value received from GPS receiver - *On change of value* for every one hour
24.	GPS-1 CNO (Max)	1	Maximum CNO Value received from

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			GPS receiver - *On change of value* for every one hour
25.	GPS-2 Satellites in View	1	Value received from GPS receiver - *On change of value* for every one hour
26.	GPS-2 CNO (Max)	1	Maximum CNO Value received from GPS receiver - *On change of value* for every one hour
27.	GPS-1 link status	2	0-Both GPS link and PPS fail 1- GPS link fail and PPS ok 2- GPS link ok and PPS fail 3- GPS link ok and PPS ok - *On change of event* for every one hour
28.	GPS-2 link status	2	0-Both GPS link and PPS fail 1- GPS link fail and PPS ok 2- GPS link ok and PPS fail 3- GPS link ok and PPS ok - *On change of event* for every one hour
29.	GSM-1 RSSI	1	Value received from GSM module - *On change of value* for every one hour
30.	GSM-2 RSSI	1	Value received from GSM module - *On change of value* for every one hour
31.	Current Running Key	1	0: Default key set, 1-30: KMS key set - on change of Key Set
32.	Remaining Number of Keys	1	0: No keys, 1-30: Remaining KMS key sets - on change of value
33.	Session Key Checksum	2	Checksum of 16 bytes session key - for every 2s at the time of Authentication only
34.	DMI-1 link status	2	0-NOT OK 1-OK - *On change of event*
35.	DMI-2 link status	2	0-NOT OK 1-OK - *On change of event*
36.	RFID Reader-1 link status	2	0-NOT OK 1-OK - *On change of event*
37.	RFID Reader-2 link	2	0-NOT OK

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	status		1-OK - *On change of event*
38.	Duplicate Missing RFID Tag	2	RFID Tag Number
39.	Missing linked RFID Tag	4	B3-B1: Linked RFID Tag B0: Linking direction
40.	Computed TLM Status	4	B3-B2: Station Id B1-B0: TLM Status b11-b0: Computed TLM Value b15-b12: TLM Status TLM Status: 0- TLM Failed 1 – TLM Updated 2 – TLM Timeout
41.	Train Configuration change	1	0 – No 1 – Yes
42.	Bootup Sequence Error	1	0 – Brake Test failed 1 – MR not available - *On detection of event*
43.	Selected Train formation	1	1 - Light Engine (120kmph) 2 - Light Engine Multi (120kmph) 3 - Passenger Train 3 to 7 Coach (120kmph) 4 - Passenger Train 8 to 13 Coach (120kmph) 5 - Passenger Train 14 to 20 Coach (120kmph) 6 - Passenger Train 21 to 27 Coach(120kmph) 7 - Goods 59 BOXN Empty (1000 - 1999 Ton, 75kmph) 8 - Goods 59 BOXN Half Load(2000 -3499 Ton, 75kmph) 9 - Goods 59 BOXN Full Load(3500 -5500 Ton, 60kmph) 10 - Goods 42 BCN Empty (1000 - 1999 Ton, 75kmph) 11 - Goods 42 BCN Half Load(2000 - 3499 Ton, 75kmph) 12 - Goods 42 BCN Full Load(3500 - 5500 Ton, 60kmph) 13 - Light Engine WAP5 (170kmph) 14 - WAP5-8LHB Coaches (170kmph) 15 - Light Engine WAP7 (140kmph) - *On detection of event*

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44.	Selected Cab	1	0 – No Cab Selected 1 – Cab1 Selected 2 – Cab2 Selected 3 – Both Cabs Selected *- On detection of event*
45.	Brake application reason	1	0-Not used 1-Reverse movement detected 2-Unusual stoppage detected 3-Overspeed 4-Rollback detected 5-MBT selected 6- No LP Acknowledge 7- MA Shortened 8-Headon collision detected 9-Rearend collision detected 10-Loco Specific SoS received 11-Station General SoS received *- On detection of event*
46.	Station General SoS	3	B2-B1: Station Id B0: General SoS status (1 – Received, 2 – Cancelled) *- On detection of event*
47.	Station Loco Specific SoS	3	B2-B1: Station Id B0: Specific SoS status (1 – Received, 2 – Cancelled) *- On detection of event*
48.	Collision Detection	4	B3-B1: Loco Id B0: SoS code Values: 1 – Manual SoS received 2 – Manual SoS cancelled 3 – Unusual stopage detected 4 – Unusual stopage end 5 – Head-on collision detected 6 – Head-on collision end 7 – Rear-end collision detected 8 – Rear-end collision end 9 – Train parting detected 10 – Train parting end *- On detection of event*
49.	Loco Self SoS	1	1 – Manual SoS 2 – Manual SoS end 3 – Unusual stopage start 4 – Unusual stopage end *- On detection of event*
50.	KAVACH Connection	1	1 – KAVACH Isolated 2 – KAVACH Connected

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			- *On detection of event*
51.	BIU Isolated	1	1 – BIU Isolated 2 – BIU Connected
52.	EB Bypassed	1	1 – EB Connected 2 – EB Bypassed - *On detection of event*
53.	KAVACH Territory	1	1 – KAVACH Entry 2 – KAVACH Exit 3 – ETCS Entry 4 – ETCS Exit - *On detection of event*
54.	Brake Interface Error	1	IRAB CCB E70
55.	Onboard KAVACH Modules Health	2	b15-b4: Module ID b3-b0: Module Health Module Health: 0-NOT OK 1-OK - *On detection of event*
56.	Conflict Route RFID	2	-On detection of conflicting route RFID
57.	Train configuration data checksum	4	This is Train Configuration Checksum selected by LP
58-199	Reserved		
200-254	Firm specific events	2	This field Information is specific to KAVACH firm
255	Specific value		Not to be used

G.4.9 KAVACH Fault message to NMS Server

Field No	Field Description	Field Width (Bytes)	Comment
1	Start of Frame (SOF)	2	0xAAAA (E1 Channel/Network Channel) 0xBBBB (GPRS Channel)
2	Message Type	1	0x19
3	Message Length	2	In Bytes from field "Message Type" to "CRC" (inclusive of both)
4	Message Sequence	2	0-65535 Last received KAVACH subsystem message sequence number
5	KAVACH Subsystem ID	3	

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Field No	Field Description	Field Width (Bytes)	Comment
6	NMS System ID	2	Loco KAVACH shall identify the NMS system ID from domain name server / Stationary KAVACH shall send the NMS ID during session establishment
7	System Version	1	
8	Date	3	DD/MM/YY 00-99: official year; 100-254: not used; 255: year unknown 01-12: official month; 0,13 to 254: not used; 255: month unknown 01-31: official day; 0, 32-254: not used; 255: day unknown Eg: 27/04/18 → 0x1B-0x04-0x12
9	Time	3	HH:MM:SS (IST time) 00-23: official hour; 24-254: not used; 255: hour unknown 00-59: official minutes, 60-254: not used, 255: minutes unknown 00-59: official seconds, 60-254: not used, 255: seconds unknown Eg: 06:36:10 → 0x06-0x24-0x0A
10	KAVACH subsystem type	1	0x11 – Stationary KAVACH 0x22 – Onboard KAVACH 0x33 – TSRMS
11	Total Fault Codes (F)	1	Max number of faults shall be 10
12	Module ID	1	Firm Specific
13	Fault Code Type	1	1: Fault Code 2: Recovery Code
14	Fault Code	2	Firm Specific
15	CRC	4	CCITT- 32 Bit CRC (0x04C11DB7) excluding SOF field.

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G.4.10   **Loco KAVACH RSSI Message:** RSSI Samples captured for last one minute on detection of Stationary Regular packet in Loco KAVACH.

Field N o	Field Description	Field Width (Bytes)	Comment
1.	Start of Frame (SOF)	2	0xAAAA
2.	Message Type	1	0x20
3.	Message Length	2	In Bytes from field "Message Type " to "CRC" (inclusive of both)
4.	Message Sequence	2	0-65535 (Last received KAVACH sub-system message sequence number)
	Loco KAVACH ID	3	
5.	NMS system ID	2	
6.	System Version	1	1
7.	Date	3	DD/MM/YY 00-99: official year; 100-254: not used; 255: year unknown 01-12: official month; 0,13 to 254: not used; 255: month unknown 01-31: official day; 0, 32-254: not used; 255: day unknown Eg: 27/04/18 → 0x1B-0x04-0x12
8.	Time	3	HH:MM:SS (IST time) 00-23: official hour; 24-254: not used; 255: hour unknown 00-59: official minutes, 60-254: not used, 255: minutes unknown 00-59: official seconds, 60-254: not used, 255: seconds unknown Eg: 06:36:10 → 0x06-0x24-0x0A
9.	Stationary KAVACH ID	2	Station for which RSSI sampling is under progress
10.	Station Radio-1 RSSI Sample Count	1	Total samples detected in last one minute
11.	Ref_RFID tag	2	Reference RFID
12.	Abs_Ref_RFID Tag	3	This is the absolute location of ReF _RFID Tag.
13.	RSSI Value	2	Value received from Radio (16bit Signed) Eg: Value received from Radio is 0xBDBF = -132.5dBm (Value: 0xBDBF)
14.	Station Radio-2 RSSI	1	Total samples detected in last one mi-

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Field N o	Field Description	Field Width (Bytes)	Comment
	Sample Count		nute
15.	Ref_RFID tag	2	
16.	Abs_Ref_RFID Tag	3	This is the absolute location of ReF _RFID Tag.
17.	RSSI Value	2	Value received from Radio (16bit Signed) Eg: Value received from Radio is 0xBDBF = - 132.5dBm (Value: 0xBDBF)
18.	CRC	4	CCITT- 32 Bit CRC (0x04C11DB7) ex-cluding SOF (0xAAAA) field.

G.4.11   **Stationary KAVACH RSSI Message:** RSSI sample captured for last one minute of detection of onboard regular packet in Stationary KAVACH.

Field No	Field Description	Field Width (Bytes)	Comment
1.	Start of Frame (SOF)	2	0xAAAA
2.	Message Type	1	0x21
3.	Message Length	2	In Bytes from field "Message Type " to "CRC" (inclusive of both)
4.	Message Sequence	2	0-65535 (Last received KAVACH subsystem message sequence num-ber)
5.	Stationary KAVACH ID	2	
6.	NMS system ID	2	
7.	System Version	1	1
8.	Date	3	DD/MM/YY 00-99: official year; 100-254: not used; 255: year unknown 01-12: official month; 0,13 to 254: not used; 255: month unknown 01-31: official day; 0, 32-254: not used; 255: day unknown Eg: 27/04/18 → 0x1B-0x04-0x12

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Field No	Field Description	Field Width (Bytes)	Comment
9.	Time	3	HH:MM:SS (IST time) 00-23: official hour; 24-254: not used; 255: hour unknown 00-59: official minutes, 60-254: not used, 255: minutes unknown 00-59: official seconds, 60-254: not used, 255: seconds unknown Eg: 06:36:10 → 0x06-0x24-0x0A
10.	Loco KAVACH ID	3	Onboard for which RSSI sampling is under progress
11.	Onboard Radio-1 RSSI Sample Count	1	Total samples detected in last one minute
12.	Ref_RFID tag	2	Reference RFID
13.	Absolute location	3	in meters
14.	RSSI Value	2	Value received from Radio (16bit Signed) Eg: Value received from Radio is 0xBDBF = -132.5dBm (Value: 0xBDBF)
15.	Onboard Radio-2 RSSI Sample Count	1	Total samples detected in last one minute
16.	Ref_RFID tag	2	Reference RFID
17.	Absolute location	3	in meters
18.	RSSI Value	2	Value received from Radio (16bit Signed) Eg: Value received from Radio is 0xBDBF = -132.5dBm (Value: 0xBDBF)
19.	CRC	4	CCITT- 32 Bit CRC (0x04C11DB7) excluding SOF (0xAAAA) field.

G.4.12 **NMS Acknowledge message to KAVACH Subsystem**

Field No	Field Description	Field Width (Bytes)	Comment
1	Start of Frame (SOF)	2	0xBBBB for GPRS channel (Messages to be Ack on GPRS: 0x19) 0xAAAA for E1 channel (Messages to be Ack: 0x11, 0x12, 0x13, 0x14)
2	Message Type	1	0x1F

MANISH KUMAR GUPTA 2024.07.16 13:00:29 +05'30'	RAVINDRA NATH SINGH Digitally signed by RAVINDRA NATH SINGH Date: 2024.07.16 13:31:19 +05'30'	MADHUP MOHAN SRIVASTAVA Digitally signed by MADHUP MOHAN SRIVASTAVA		Page 28 of 38
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Field No	Field Description	Field Width (Bytes)	Comment
3	Message Length	2	In Bytes from field "Message Type" to "CRC" (inclusive of both)
4	Message Sequence	2	0-65535 Last received KAVACH subsystem message sequence number
5	NMS system ID	2	It is one of stationary KAVACH ID
6	KAVACH Sub system ID	3	Unique Code, Valid values from 1 to 65535 (Purchaser Railway to Decide)
8	KAVACH subsystem type	1	0x11 – Stationary KAVACH 0x22 – Onboard KAVACH 0x33 – TSRMS
9	CRC	4	CCITT- 32 Bit CRC (0x04C11DB7) excluding SOF field.

G.4.13   **Example of Signal Allocation Table in Mantatti Station:**

Signal ID as per SIP	Signal Logical ID (to be decided by the firm)
S1D	1
S1ID	2
S1	3
S3	4
S4	5
S6	6
S25	7
S26	8
S27	9

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Signal ID as per SIP	Signal Logical ID (to be decided by the firm)
S28	10
S30	11
S30ID	12
S30D	13
S1D of TDU (Next station Distant Signal in UP Direction)	14
S1D(2) of NAW (Next station Distant Signal in DN Direction)	15

G.4.14   **Example of Relay Address Allocation Table for Mantatti Station (MVH):**

Relay Name	Relay Address (to be decided by the firm)
Track Identification Relays (TINs)	0 to 127
26_28TPR	128
25TPR	129
3_4TPR	130
6TPR	131
S25LCPR	132
S6LCPR	133
DLTPR	134
DMTPR	135
UMTPR	136
CLTPR	137
1ATPR	138
30ATPR	139
S1DHHECR	140
S1DDECR	141
S1DHECR	142
S1IDHHECR	143

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Relay Name	Relay Address (to be decided by the firm)
S1IDDECR	144
S1IDHECR	145
S1DECR	146
S1UGR_CL	147
S1UECR	148
S1HECR	149
S1RECR	150
S1AHECR	151
S3DECR	152
S3HECR	153
S3RECR	154
S4HECR	155
S4RECR	156
S6DECR	157
S6RECR	158
S25DECR	159
S25RECR	160
S26HECR	161
S26RECR	162
S27HECR	163
S27RECR	164
S28DECR	165
S28HECR	166
S28RECR	167
S30DHHECR	168
S30DDECR	169
S30DHECR	170
S30IDHHECR	171
S30IDDECR	172

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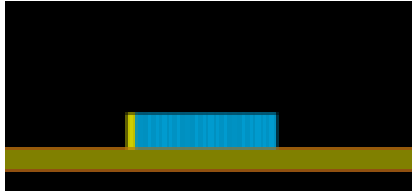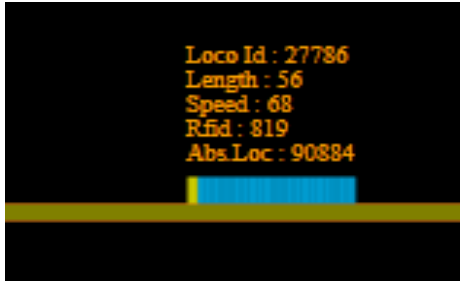
Relay Name	Relay Address (to be decided by the firm)
S30IDHECR	173
S30DECR	174
S30UGR_DL	175
S30UGR_CL	176
S30UECR	177
S30HECR	178
S30RECR	179
S30AHECR	180
11NWKR	181
11RWKR	182
12NWKR	183
12RWKR	184
13NWKR	185
13RWKR	186
18NWKR	187
18RWKR	188
19NWKR	189
19RWKR	190
20NWKR	191
20RWKR	192

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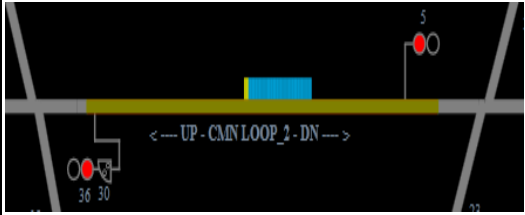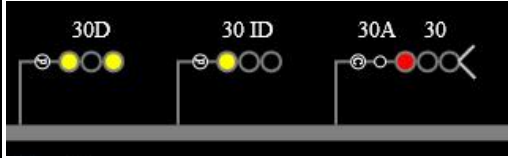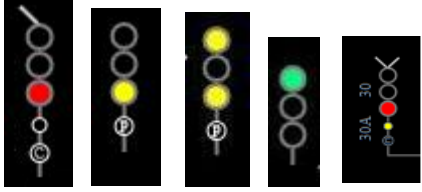| Relay Name	Relay Address (to be decided by the firm)
17KLNWKR	193
Total Event Relays (E) for Mantatti Station shall be 25 bytes. Relay Status Image for Mantatti Station shall be 200 bits. Status of 194th Relay to 200th Relay shall be filled with Zeros.	

G.5 **Color representation used for different elements in Stationary KAVACH VDU**

Color representation used for different elements in Stationary KAVACH is given below:

SNo	Element	Color	Screen shot
1	Screen Background	Black	
2	Track	Gray	
3	Train	Deep Sky Blue	

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4	Train Engine	Yellow	
5	Train Infor-mation	Orange	
6	Berth-ing Track (When Non-KA-VACH equipped Train is oc-cupied)	Red	
7	Text	White/ Gray	

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8	TIN Occupancy	Olive	
9	Signal Post	Gray	
10	Signal Aspects	Red Yellow Double Yellow Green Yellow (Calling-On Aspect)	
11	Route Indicator	Yellow	
12	Text Font	Text Name: Times New Roman/ Sans Serif Font Size: Station Name: 20 Other Text: 14	

G.6   **Features of NMS**

G.6.1   The following typical features shall be provided as part of NMS:

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G.6.1.1   Real time display of train movement on NMS monitors.

G.6.1.2   Offline display of train movement on NMS monitors at Normal, 2x, 4x, 8x, 16x & 32x speed.

G.6.1.3   Display of Datalog in Spreadsheet (Excel Format).

G.6.1.4   Display of "Permitted Speed+ Current Speed Vs Location" and" Permitted Speed+ Current Speed V/s Time" including information whether brake command is applied by KAVACH or not in Normal Mode - Pseudo Real-time and Offline.

G.6.1.5   Ability to watch the NMS at Distant Location through Internet (Password protected).

G.6.1.6   Ability to extract offline data log through NMS.

G.6.1.7   Support branching of incoming data stream to be forwarded to another port in interoperable manner.

G.6.1.8   Generation of Exception Reports – Onboard KAVACH Unit-wise, Stationary KAVACH Unit-wise.

G.6.1.9   Generation of Statistical data such as availability, category-wise braking cases.

G.6.1.10   Prompt through NMS for missing one of the two RFID tags of same set.

G.6.1.11   Prompt through NMS for missing both RFID tags of same set.

G.6.1.12   Prompt through NMS for missing communication packets overall below a set level (say 20%) for moving train in Communication mandatory zone.

G.6.1.13   SMS Alert for repeated same RFID tag missing events in Full Supervision Mode.

G.6.1.14   SMS Alert for any brake application command by KAVACH Loco forcing train to bring to dead stop in Full Supervision Mode.

G.6.1.15   SMS Alert for SPAD (Sample SMS Format: KAVACH NMS#01:<Enter>L:28016<Enter>SPAD at 15:07:37 on 3l-Jul-2014<Enter>Abs Location: km 69.70).

G.6.1.16   SMS Alert for SPAD Prevention by KAVACH.

G.6.1.17   Optional SMS Alert for Isolation Mode.

| MANISH KUMAR GUPTA 2024.07.16 13:00:29 +05'30' | RAVINDRA NATH SINGH Digitally signed by RAVINDRA NATH SINGH Date: 2024.07.16 13:31:19 +05'30' | MADHUP MOHAN SRIVASTAVA Digitally signed by MADHUP MOHAN SRIVASTAVA | | Page 36 of 38 |
| Manish Kumar Gupta SSE/S&T/RDSO | R. N. Singh ADE/S&T/RDSO | M. M. Srivastava Director/Signal-IV | G. Pavan Kumar ED/Telecom-II | |

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G.6.1.18 Optional SMS Alert for manually invoking SR Mode.

G.6.1.19 Optional SMS Alert for "Communication Failure between NMS and Stationery KAVACH" cases.

G.6.1.20 Filtering Stations with poor communication based upon missing data communication packets.

G.6.1.21 Filtering Locomotives with poor communication based upon missing data communication packets.

G.6.1.22 Capturing of speed restrictions imposed by TSR Management System from Stationary KAVACH after every update.

G.6.1.23 Capturing of health status and event log from Onboard KAVACH if LTE is available.

G.6.1.24 Following structure shall be used by Onboard KAVACH for transmitting Health bits to Stationary KAVACH in access request / regular packet.

Logical ID	Bit Number	Fault Description
1.	B0	System Internal Fault
2.	B1	Speed sensor1 Fault
3.	B2	EB Drive Fault
4.	B3	EB Application (Feedback) Fault
5.	B4	RFID Reader1 Link Fail
6.	B5	RFID Reader2 Link Fail
7.	B6	Radio1 Link Fail
8.	B7	Radio2 Link Fail
9.	B8	LP-OCIP (DMI)1 Link Fail
10.	B9	LP-OCIP (DMI)2 Link Fail
11.	B10	GPS1/PPS1 Fail
12.	B11	GPS2/PPS2 Fail
13.	B12	GPS1view not available since 2 hrs
14.	B13	GPS2 view not available since 2 hrs
15.	B14	Tag linking incorrect
16.	B15	GSM1 Fault
17.	B16	GSM2 Fault
18.	B17	Radio 1 RSSI Weak
19.	B18	Radio 2 RSSI Weak
20.	B19	Session Key Mismatch
21.	B20	Remaining keys < 5
22.	B21	BIU connectivity fault
23.	B22	Speed Sensor 2 fault
24.	B23	Cab Input fault

MANISH KUMAR GUPTA 2024.07.16 13:00:29 +05'30'	RAVINDRA NATH SINGH Digitally signed by RAVINDRA NATH SINGH Date: 2024.07.16 13:31:19 +05'30'	MADHUP MOHAN SRIVASTAVA Digitally signed by MADHUP MOHAN SRIVASTAVA		Page 37 of 38
Manish Kumar Gupta SSE/S&T/RDSO	R. N. Singh ADE/S&T/RDSO	M. M. Srivastava Director/Signal-IV	G. Pavan Kumar ED/Telecom-II	

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G.6.2   The Fault message structure from KAVACH System/Subsystem to NMS shall be as follows:

Field descriptor	Number of bytes	Remarks
Start of Frame	2	0xA5, 0xC3
Message Type	1	0xFC
Message Length	2	Length in terms of bytes from Date field to CRC field (inclusive of both)
Date	3	DD/MM/YY
Time	3	HH:MM:SS
Type of KAVACH subsystem	1	0x11 – Stationary KAVACH 0x22 – Onboard KAVACH 0x33- TSRMS
KAVACH Subsystem ID	3	Stationary KAVACH ID / Onboard KAVACH ID/TSRMS in Hex
Total Fault Codes (F)	1	Max number of faults shall be 10
Fault Code	2 * F	
32-Bit CCITT CRC	4	

G.6.3   The following structure shall be used to acknowledge receipt of Fault Message from NMS to KAVACH System/Sub system:

Field descriptor	Number of bytes	Remarks
Start of Frame	2	0xA5, 0xC3
Message Type	1	0xFD
Message Length	2	Length in terms of bytes from Date field to CRC field (inclusive of both)
Date	3	DD/MM/YY
Time	3	HH:MM:SS
Type of KAVACH subsystem	1	0x11 – Stationary KAVACH 0x22 – Onboard KAVACH 0x33-TSRMS
KAVACH Subsystem ID	3	Stationary KAVACH ID/Onboard KAVACH ID/TSRMS in Hex
32-Bit CCITT CRC	4	