

ISO 9001: 2015	Effective from 16.07.2024	RDSO/SPN/196/2020	Version 4.0
Document Title: Annexure-A2-Specification of Kavach (The Indian Railway ATP)- Onboard KAVACH Configurable Parameters			Amdt.-3



सत्यमेव जयते

GOVERNMENT OF INDIA
(भारत सरकार)

MINISTRY OF RAILWAYS
(रेल मंत्रालय)

Annexure – A2 Onboard KAVACH Configurable Parameters (Amdt-3)

Issued by

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



MANISH KUMAR GUPTA 2024.07.16 12:32:08 +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	Pavan Kumar Digitally signed by Pavan Kumar Date: 2024.07.16 16:04:59 +05'30'	Page 1 of 16
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Revision History

Amdt	Date of issue	Amendment
1	05.07.2023	- Cl. A2.1 – Introduction, new clause added. - Cl. A2.2- Scope - new clause added. Cl. A2.3.1- Onboard configuration parameter -Executive software version field, RFID reader offset parameter, location accuracy, L_DoubtOver, L_Doubt under, Loco Max acceleration, are added. - In Timeout section the following are added: Acknowledgement Time out for SR mode transition, Time out for display of multi DMI messages, GPS/GNSS failure and Re-al Time Clock (RTC), Request for KMS periodicity, Request for KMS Key set validity check, Randomized request mod value for Key.Timeout section the following are added: Acknowledgement Time out for SR mode transition, Time out for display of multi DMI messages, GPS/GNSS failure and Re-al Time Clock (RTC), Request for KMS periodicity, Request for KMS Key set validity check, Randomized request mod value for Key.
2	08.04.2024	- CL A2.4 Configuration of IP address and port number of KAVACH entity- New clause added by deleteing CL.35 of IP address. - CL 35.1.1- IP Address of NMS and port number. - CL 35.1.2 IP Address of KMS and port number - CL. 35.1.5 - 2nd octet of IP address of Red ring of Station KAVACH. - CL A2.14- New clause is added for CRC.
3	16.07.2024	- Cl A2.5 item 4&5: Loco wheel dia modified as 450 250. - Cl 6.3: Speed margin FSB is modified as 5 3 Km/h. - Cl 16.4: Speed margin EB is modified as 5 2 Km/h. - CL 20.1: LP Reaction time modifies as 8sec. - CL 21.2: Rear End collision margin distance added as 100m for suburban section and EMUs. - CL 21.6: Default Roll away or Roll Back Trigger Distance is modified as 10m. - Cl A2.10: Train configuration table is deleted.

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A2.1 Introduction

This annexure describes the KAVACH Onboard configuration parameter requirement data with system related limitation that characterise the implementation of KAVACH Onboard subsystem.

A2.2 Scope

This document defines the Onboard configuration parameter requirement data with onbaord system related.

In order to properly set the Indian Railway KAVACH onboard Values for braking curves, it is necessary to define the conditions under which the nominal emergency brake deceleration and build up time are determined for the rolling stock with type of onboard.

A2.3 Onboard KAVACH Configurable Parameters

The configuration parameter mentioned in this annexure are indicative only. Software developer may consider these parameters.

A2.4 Configuration of IP address and port number of KAVACH entity: (for LTE)

A2.4.1 All the vital entity shall be connected through redundant ring on Ethernet i.e. BLUE ring and RED ring. The 1st octet shall be **193**. The subnet mask of these rings shall be **255.0.0.0**.

A2.4.2 The 2nd, 3rd and 4th octet shall be calculated based on the unique ID of Onboard KAVACH entity. Unique ID number shall be converted into hexadecimal number and most significant byte shall be used as 2nd octet, 3rd octet and 4th octet after converting into decimal.

Example

Conversion of unique ID 188396 into Hex format = 0x2DFEC

Conversion of most significant byte into decimal i.e. 2=02

Conversion of middle byte into decimal i.e. DF=223

Conversion of least significant byte into decimal i.e. EC=236

2nd, 3rd and 4th octet IP address derived from Onboard KAVACH entity ID = 02.223.236 [0x02 .0xDF.0xF7]

Onboard KAVACH entity IP address - 193.02.223.236

A2.4.3 Port number of KAVACH entity shall be as per below table

SN	Primary partner	Secondary Partner	Port No start	Range
1.	Onboard KAVACH	LTE Router1	50001	50001-53999
2.	Onboard KAVACH	LTE Router2	50002	50001-53999

Note: All the numerical mentioned in above clauses shall be configurable.

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A2.5 Onboard KAVACH Configurable Parameters

S.no	Parameter	Description	Default	Min	Max	Units
1.	SOURCE LO-CO_VERSION	Executive software version field	2	1	7	Number
2.	Locomotive /Self Propelled Unit ID	Locomotive or self-Propelled Unit Unique ID	LD ¹	0	999999	Number
3.	Loco/Self Propelled Unit Max Speed	Max Speed of Locomotive or self-propelled Unit	LD	0	510	kmph
4.	Loco/Self Propelled Unit Wheel Dia(D1)	Wheel diameter in mm	LD	250	1220	mm
5.	Loco /Self Propelled Unit (D2)	Wheel diameter in mm	LD	250	1220	mm
6.	RFID Reader - 1 OFFSET in FRONT		3	0	20	Meter
7.	RFID Reader - 1 OFFSET in REAR		3	0	20	Meter
8.	RFID Reader - 2 OFFSET in FRONT		3	0	20	Meter
9.	RFID Reader - 2 OFFSET in REAR		3	0	20	Meter
10.	Location Accuracy of RFID Tag	This is difference between the location read from the Tag & its actual location	5	2	10	meter
11.	L_DOUBTOVER in reading	odometry error	5	2	10	%
12.	L_DOUBTUNDER in reading	odometry error	5	2	10	%
13.	Loco/Self Propelled Unit Max Acceleration	Max Acceleration of Loco or Self-Propelled Unit	LD	0.1	2.0	m/s ²

¹ LD means Locomotive or self Propelled unit dependednt

S.no	Parameter	Description	Default	Min	Max	Units
14.	Speed sensor 1					
14.1.	Tacho Puls- es/Rev	Tacho output of pulses per Revolu- tion	LD	30	700	Number
14.2.	Tacho type in num	Single pulse(0),Quadratur e out(1), Redun- dant Quad out- put(2)	LD	0	3	Number
14.3.	Tacho Mount- ing Dir	Left side(0)/ Right side(1) mount wrt CAB1/ Short Hood cab(Based on this Onboard KA- VACH may com- plement Feedback Direction)	LD	0	1	Number
15.	Speed sensor 2					
15.1.	Tacho Puls- es/Rev	Tacho output of pulses per Revolu- tion	LD	30	700	Number
15.2.	Tacho type	Single pulse (0), Quadrature out (1), Redundant Quad output (2)	LD	0	2	Number
15.3.	Tacho Mount- ing Dir	Left side (0)/ Right side (1) mount wrt CAB1/ Short Hood cab (Based on this OnboardKA- VACH may com- plement Feedback Direction)	LD	0	1	Number
16.	Speed margin					
16.1.	Speed Margin – Warning	Speed beyond per- mitted speed after which warning is to be displayed on DMI	2	0	10	kmph
16.2.	Speed Margin – NSB	Speed beyond per- mitted speed after which NSB to be applied	5	5	10	kmph
16.3.	Speed Margin – FSB	Speed beyond per- mitted speed after	3	2	10	kmph

S.no	Parameter	Description	Default	Min	Max	Units
		which FSB to be applied				
16.4.	Speed Margin – EB	Speed beyond permitted speed after which EB to be applied	2	2	15	kmph
17.	Restricted Speed					
17.1.	SOS speed Limit	SOS Speed limit	30	5	60	kmph
17.2.	SOS stop speed	Speed to maintain while reaching SOS originated loco	0	0	30	kmph
17.3.	Reverse mode Speed	RV mode speed limit	25	15	60	kmph
17.4.	Shunt Speed	SH mode speed Limit	15	5	50	kmph
17.5.	Wheel Sensor direction discrimination speed	Wheel Sensor direction discrimination speed	5	1	10	kmph
17.6.	Brake intervention with-drawal speed limit	When target speed is non-Zero, the brake command is released when actual speed is within this limit above permitted speed	5	2	10	kmph
17.7.	Slipping acceleration Limit	Slipping acceleration Limit	LD	0.5	2.5	m/s ²
17.8.	Slipping Duration	Duration of slipping time	90	60	180	sec
17.9.	Slipping Percentage	Slipping Percentage	5%	2%	10%	%
17.10.	Slip Limit 1	To detect slip in Kmph (PG1)	4	2	10	kmph
17.11.	Slip Limit 2	To detect slip in Kmph (PG2)	4	2	10	kmph
17.12.	Skid Limit 1	To detect skid in Kmph (PG1)	6	2	10	kmph
17.13.	Skid Limit 2	To detect skid in Kmph (PG2)	6	2	10	kmph

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S.no	Parameter	Description	Default	Min	Max	Units
18.	Warning Time margin in second					
18.1.	Warning indication before KAVACH brake intervention	Warning indication before KAVACH brake intervention	2	0	20	second
18.2.	Loco Pilot time margin in second	After warning indication, the LP reaction time margin before KAVACH brake intervention	04	0	30	second
19.	Time Out					
19.1.	Traction Cut off Time	The time delay between command to Traction cutoff	LD	0	30	second
19.2.	SoS Timeout	SoS clears after this time if SoS source not transmitting SoS	180	30	300	second
19.3.	Reverse mode Timeout	Reverse mode will be exited after this time out.	600	60	900	second
19.4.	Override Time out	Override mode will be exited after this time out	120	60	600	second
19.5.	Onsight MA expiry timeout	Onsight movement authority expires, if communication is not available for this time in communication mandatory zone.	240	30	600	second
19.6.	Communication time out – Absolute Block Section	The time up to which the loco shall remain in Full Supervision Mode when valid Radio packets are not received.	30	6	120	second
19.7.	Communication time out – Automatic Section	The time up to which the loco shall remain in Full Supervision Mode when valid Radio packets are not received.	10	6	120	second

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S.no	Parameter	Description	Default	Min	Max	Units
19.8.	Random number time out	Resetting the secured communication after communication failure	30	6	120	second
19.9.	Block stop announce time out	Time allowed for generating block stop SoS (Acknowledgement time for LP)	15	0	60	second
19.10.	Time out for Signal display	Time out to display description of signal aspect after previous signal foot tag/location crossed	8	2	20	second
19.11.	Slip Skid Time out	To detect slip/skid time out	90	10	180	second
19.12.	Acknowledgement Time out for SR mode transition	Time out for SR mode transition when train move KAVACH area to Non KAVACH area.	15	5	30	second
19.13.	Time out for display of multi DMI messages	First and second targets (for Head ON/Rear End Collision, Turnout PSR. TSRLC Gate Approach	2	1	10	second
19.14.	GPS/GNSS failure and Real Time Clock (RTC)	Post GPS/GNSS failure the time out Real Time Clock (RTC)	30	10	60	Minute
19.15.	Request for KMS periodicity	Request for Key Management System (Not having any key)	5	1	30	Minute
19.16.	Request for KMS Key set validity check	Request for KMS (having any key)	6	2	6	Hour
19.17.	Randomized request mode value for Key	Randomized request mode value for Key	120	30	240	Minute

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S.no	Parameter	Description	Default	Min	Max	Units
20.	Reaction Time					
20.1.	LP Reaction time	Loco pilot Time margin before KAVACH Intervention during mode change or unusual stop SoS in block section.	8	4	30	second
21.	Margin Distance					
21.1.	Overlap Distance	Overlap in addition to MA control (overlap through the application of EB)	80	0	400	meter
21.2.	Collision Margin Distance	For Rear End Collisions	300 for mainline and loco-hauled trains 100 for suburban section and EMUs	100	500	meter
21.3.	SOS Trig Distance	Distance for Acceptance of SOS from Station or other Loco	3000	500	6000	meter
21.4.	SOS Cancellation Distance	Distance for Clear of SOS from Station or other Loco	1500	500	5000	meter
21.5.	SOS Hold distance	Distance to clear SOS from the point of occurrence	1500	0	3000	meter
21.6.	Roll away or Roll Back Trigger Distance	Roll away or Roll Back Trigger Distance	10	5	30	meter
21.7.	Override Permit Distance	Override Permitted only when MA is Less than this limit	200	50	500	meter
21.8.	Unusual Stoppage Bypass MA Limit	SoS will not generate even if train stops in block section, If MA is less than this Distance limit	300	100	1000	meter

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S.no	Parameter	Description	Default	Min	Max	Units
21.9.	Signal foot Tag miss distance	Distance to declare signal foot crossed in case of tag missed	30	10	100	meter
21.10.	Other Tags Miss distance	Tolerance distance allowed for declaring other tag miss	50	10	100	meter
21.11.	Distance for Signal description display	Distance for display of signal aspect after previous signal foot tag/location crossed	50	10	200	meter
21.12.	Trip Margin Distance in mts	Distance to enter to TRIP mode after the End of MA	30	0	100	meter
21.13.	Block Stop Trigger MA distance	Minimum MA required to declare Block stop SOS	300	100	1000	meter
21.14.	LC Horn Enable Dist	Distance at which Horn to be enable at LC gate	600	0	1000	meter
21.15.	Grad Scan Distance	Distance upto which gradient is to be scanned	3000	1000	10000	meter
21.16.	PSR Scan Distance	Distance upto which PSR to be scanned	3000	1000	10000	meter
22.	Min Track Profile required distance	Minimum Track Profile distance required to go to LS/FS mode	3000	1000	10000	meter
23.	RV mode distance margin	RV mode distance to move the Train in reverse direction	500	100	1000	meter
24.	SoS					
24.1.	SoS Stop Speed	Speed to maintain while reaching SOS originated location	0	0	30	kmph
25.	Signal linking in OS mode	Target distance for availing Signal info e.g. Signal aspect, marker, description in OS mode	100	50	300	meter

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S.no	Parameter	Description	Default	Min	Max	Units
26.	Missed Valid Radio Packet	For Mode transition from FS to LS or OS/OV to SR in Absolute Block	14	5	30	cycle
27.	Missed Valid Radio Packet	For Mode transition from FS to LS or OS/OV to SR in Automati Block	5	1	30	cycle
28.	Missed Valid Radio Packet	For Mode transition from FS to LS or OS/OV to SR in Virtual Block	5	1	30	
29.	Reverse movement trigger distance	Cab input and wheel sensor direction discrimination distance	2	2	10	meter
30.	Periodicity of Packet Transmission					
30.1.	Radio packet transmission	Onboard-to- Stationary Radio Packet in Non-Leading mode	120	30	240	second
30.2.	Radio packet transmission	Onboard-to- Stationary Radio Packet in Isolation mode	120	30	240	second
30.3.	Threshold to update Train length after TLM		25	10	100	meter
31.	LC Gate Auto Whistling					
31.1.	LC Horn ON Time	Horn on time for whistling at LC gate	2	0	10	second
31.2.	LC Horn OFF Time	Horn OFF time for whistling at LC gate	3	0	10	second
32.	UHF Radio modem configuration					
32.1.	Power	Radio Transmission Power	10	1	20	watt
32.2.	Frequency Resoluion		KHz	Hz	MHz	Hz
32.3.	Base Frequency	Base Frequency	406	100	999	MHz
32.4.	f0 freq	Centre frequency Tx&Rx	427.625	100	999	MHz
32.4.1.	Channel Bandwidth	Channel Bandwidth	25	25	100	KHz

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S.no	Parameter	Description	Default	Min	Max	Units
32.4.2.	Channel switching time	Transmitter Turn-on time (Tx. Freq. stable)/ Channel Switching time	3	1	15	Milli sec
33.	Time slot Management					
33.1.	Frame cycle		2	0.5	2	second
33.2.	Number of slots in centre Frequency	Slot required for Access request packet and additional emergency packet	16	1	100	Number
33.3.	Time slot for access request packet	12 time slot are catered	P47, P48, P49, P50, P51, P52, P59, P60, P61, P62, P63 and P64	P47	P70	---
33.4.	Time slot for additional emergency Pakekt	4 time slots to cater	P53, P54, P65, P66	P47	P70	
33.5.	Time slot width	Time slot width	22.5	15	40	milli-second
33.6.	Time slot spacing	Spacing between the time slot	5	5	20	milli-second
33.7.	Time slot communicated by station to Loco		P2 to P45	P2	P45	
33.8.	Start time of P2	Start time of P2 slot in radio transmission	45	45	100	milli-second
33.9.	Start time of P47	Start time of P47 slot in radio transmission	1320	1200	1400	milli-second
34.	GSM Configuration					
34.1.	GSM 1 APN Name	Address to which GPRS packet to be sent				
34.2.	GSM 2 APN Name					
35.	IP Address					
35.1.1.	IP Address of NMS and port					

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S.no	Parameter	Description	Default	Min	Max	Units
	number					
35.1.2.	IP Address of KMS and port number					
35.1.3.	1 st octet of IP address (Station KAVACH)		192	1	255	Number
35.1.4.	2 nd octet of IP address of blue ring of Station KAVACH		254	1	255	Number
35.1.5.	2 nd octet of IP address of Red ring of Station KAVACH		255	1	255	Number
36.	Data Logging					
36.1.	Detailed Data Logging		72	24	240	Hours
36.2.	Maintenance Data logging		15	5	90	Days
36.3.	Critical fault Data		90	10	180	Days
36.4.	Time Zone		IST	--	--	
37.	LP OCIP					
37.1.	Min press time for button	Min time required for button to be pressed	500	100	10000	Milli second
37.2.	Max press time for button	Max time required for button to be pressed	6000	100	10000	Milli second
38.	RFID Missed Tag					
38.1.	Max consecutive miss count	Max consecutive miss count	3	1	10	No
38.2.	Onboard KAVACH for transmitting Health bits to Stationary KAVACH	Logical ID shall be configurable as per annexure-G				Logical ID
38.3.	Fault Code	Fault code shall be configurable as per annexure-G				Vendor specific

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A2.6 Train Braking Configuration Parameters

S.no	Parameter	Description	Bytes
1.	Train configuration Number	Serial Number for Train Configuration	1
2.	Train Class	Train Type 1 LE-1 ICF Passenger-2 LHB Passenger -3 EMU-4 Freight-5 Train set-06	1
3.	Train Description	Name of the Train configuration	40
4.	Train Max Speed	Max permitted Speed for this Train configuration	1
5.	Train Max acceleration	Maximum acceleration that a train formation can achieve	1
6.	Train Max deceleration	Maximum deceleration that a train formation can achieve	1
7.	Train Length	Length of train	2
8.	Train Load	Load of the selected train in tons	2
9.	Rolling Mass Percentage	Axle weight / Total Train Weight in % of the selected train	1
10.	FSB Propagation Lag	Full service brake propagation time	1
11.	FSB Build Lag	full service brake build time	1
12.	FSB Release Lag	full service brake release time	1
13.	EB Propagation Lag	Emergency brake propagation time	1
14.	EB Build Lag	Emergency brake build time	1
15.	EB Release Lag	Emergency brake release time	1
16.	K1	Intermediate deceleration percentage	1
17.	FSB DC1	FSB deceleration value upto speed limit1	1
18.	EB DC1	EB deceleration value upto speed limit1	1
19.	Speed Limit 1	speed limit 1	1
20.	FSB DC2	FSB deceleration value upto speed limit2	1
21.	EB DC2	EB deceleration value upto speed limit2	1
22.	Speed Limit 2	speed limit 2	1
23.	FSB DC3	FSB deceleration value upto speed limit3	1
24.	EB DC3	EB deceleration value upto speed limit3	1
25.	Speed Limit 3	speed limit 3	1
26.	FSB DC4	FSB deceleration value above speed limit3	1
27.	EB DC4	EB deceleration value above speed limit3	1
28.	Speed Limit 4	speed limit 4	2
29.	Spare2	Spare2	2

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- A2.7 The Onboard KAVACH and BIU needs to be installed as per the RDSO approved pre-commissioning checklist in the shed. After completion of the installation, proper functioning of the Onboard KAVACH shall be ensured by moving the locomotive in the shed itself.
- A2.8 Based on the request from Zonal Railways, S&T Directorate of RDSO should provide the information detailing braking characteristics for the type of trains, upto the maximum permissible train speed as represented in the figure A2.1 as obtained from Rolling stock directorate.

Loco WAP-5		Type of Braking: Emergency Braking Consist: 1 WAP-5 Light Loco Brake builds up time component used for calculation: Brake development (establishment) time for EBD train for the givent train i.e Light Loco :5 Sec Max Loco BC Pressure :2.5 Kg/cm ² Type of Brake Block: Loco ‘K’ type disc Brake Gradient Level													
Intial speed while commencing brake command	Distance covered since brake command to achieve speed reduction to speed indicated														
Speed in Kmph	150 Kmph	140 Kmph	130 Kmph	120 Kmph	110 Kmph	100 Kmph	90 Kmph	80 Kmph	70 Kmph	60 Kmph	50 Kmph	40 Kmph	30 Kmph	0 Kmph i.e BD	
160	344m (152)	577m (138)	720m (128.3)	853m (119.4)	976m (111)	1088m (102)	1242m (90)	1332m (79)	1451m (81.3)	1519m (61.3)	1605m (50)	1651m (42)	1705m (30)	1760m	
150		323m (142.1)	540m (128.3)	673m (119.3)	796m (111)	909m (102)	1062m (89.4)	1152m (81.3)	1271m (69.2)	1339m (61.3)	1425m (50)	1471m (42)	1525m (30.4)	1574m	
140			371m (128)	503m (119)	628m (110.3)	739m (102)	891m (89.2)	981m (81)	1099m (61)	1167m (61)	1252m (49.2)	1298m (42)	1352m (30)	1395m	
130				344m (118.4)	466m (110)	578 (101)	681m (93)	819m (80.4)	899m (72.4)	1003m (61)	1088m (49)	1134m (41.1)	1186m (30)	1223m	
120					317m (109)	428m (100.3)	531m (92)	667m (80)	746m (72)	849m (60)	907m (52)	977m (40.4)	1028m (29)	1075m	
110						290m (99.3)	391m (91)	525m (79)	604m (71)	705m (59)	762m (51)	831m (39.4)	866m (32)	923m	
100							263m (90)	353m (82)	472m (69.4)	540 m (62)	827m (50)	673 m (42.1)	728m (31)	761m	
90								236m (80)	315m (72)	419m (60.1)	476m (52.3)	548m (41)	600m (29.3)	648m	
80									208m (70.8)	309m (58.4)	365m (51)	434m (39.1)	469m (32)	525m	
70										181m (61)	266m (50)	311m (41.2)	364m (30)	414m	
60											154m (51)	222m (39.2)	257m (32)	314m	
50												126m (41)	179m (30)	227m	
40													99m (31.1)	154m	
30														101m	

Figure A2.1: Format for Typical Braking Parameters

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- A2.9 The train configuration parameters are to be derived after conducting trials for various formations.
- A2.10 If the train configuration parameters are not approved, then the loco shall be taken for a single trial as per the train configurations planned to be hauled in the nominated proven block sections and braking parameters shall be acquired. Further, the SAT of this locomotive shall be conducted as per SIF No.0524. The trials for 10 trips with these updated braking parameters shall be carried out for each train configuration.
- A2.11 The acquired braking characteristics shall be updated in the Onboard KAVACH configuration manual of the OEMs and send the same to S&T Directorate of RDSO along with SAT and trial reports for approval.
- A2.12 The configuration files shall be made separate for each type of locomotive, so as to maintain uniformity from Loco Pilot point of view.
- A2.13 If the train configuration is already approved, trials up to five trips and SAT at nominated trial section to be conducted to the satisfaction of OEMs.
- A2.14 Further, OEMs shall issue the certification to PCEE & PCSTE's of Zonal Railways, stating that the Onboard KAVACH is properly installed and can be made available for services on Indian Railways.
- A2.15 **Checksum**
- A2.15.1 Onboard Kavach may at least maintain individual Checksums for Executive Software, Event logger software, Train configuration related, braking configuration related and LP-OCIP Configuration details related.

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