

ISO 9001: 2015	Effective from 12.12.2023	RDSO/SPN/196/2020	Version 4.0 d3 Amdt-8
Document Title: Specification of Kavach (The Indian Railway ATP)- Multiple Access Scheme & Radio Communication Protocol			Annexure-C



सत्यमेव जयते

GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

Annexure – C

KAVACH

Multiple Access Scheme & Radio Communication Protocol

Amendment-8

Issued by

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



MANISH KUMAR GUPTA <small>Digitally signed by MANISH KUMAR GUPTA Date: 2023.12.12 16:04:06 +05'30'</small>	RAVINDRA NATH SINGH <small>Digitally signed by RAVINDRA NATH SINGH Date: 2023.12.12 16:07:34 +05'30'</small>	PAVANKUMAR GUDAVALLETTI <small>Digitally signed by PAVANKUMAR GUDAVALLETTI Date: 2023.12.12 16:11:01 +05'30'</small>	Page 1 of 67
Manish Kumar Gupta SSE/S&T	R. N. Singh ADE/Signal	G. Pavan Kumar ED/Tele-II	

ISO 9001: 2015	Effective from 12.12.2023	RDSO/SPN/196/2020	Version 4.0 d3 Amdt-8
Document Title: Specification of Kavach (The Indian Railway ATP)- Multiple Access Scheme & Radio Communication Protocol			Annexure-C

Amdt	Date of issue	Amendment
1	10.10.2022	<ul style="list-style-type: none"> C3.1.4 f_0 is named as center frequency. C3.1.6 & C3.1.7 -deleted. The limitation of maximum packet size of 1024 bits is no more applicable. Correction in Figure 1- 25 millisecc is corrected to 15 millisecc for minimum before commencement of transmission Over -The-Air. C 3.2 Multiple Access scheme- The time slots are changed from 78 to 68 each of width 432 bits (22.5 ms). Accordingly, the timeslot allocations are modified in C3.2.1, C3.2.2, C3.2.3, C3.2.4, C3.2.5 and C3.2.10 C5.2 Regular radio packet from station to onboard – <ul style="list-style-type: none"> (i) Stationary KAVACH unit shall send separate packet for each loco. MA Sub packet is updated every cycle. SSP and other packets are to be sent when MA is extended or modified. Header correction done accordingly. (ii) REF_PROFILE_ID is mentioned as Onboard Specific. (iii) No track profile packets to be sent when route is not known. (iv) Invalid RFID sequence SoS is removed as onboard knows RFID sequence. (v) Fouling mark clearance validation by Station is added. (vi) Only Single location reset is permitted in a given MA. (vii) Definitions for adj line count are clarified. Line TINs retained for 9 bits. (viii) Provision for missing padding bits are added at the end of each subpacket. C5.3 Onboard to station regular packet <ul style="list-style-type: none"> (i) Separate look up table for EMUs to be maintained. (ii) Parting SoS is added. (iii) Last_Ref_Profile_ID changed to Last_Ref_Prof_Num (iv) Packet CRC is made as 32 bit for C5.4 Access Authority Packet Version 2.0, C5.5 Additional Emergency Packet, C5.5 Access Request Packet. <ul style="list-style-type: none"> (i) Train speed corrected to 9 bits from 10 bits (ii) Parting SoS added. (iii) TIN Programmed in Last RFID Tag is sent instead of six TINs. (iv) CRC changed to 32 bits. <p>The timing diagram is deleted.</p>
2	06.12.2022	<ul style="list-style-type: none"> Clause C.5.2 - Regular Radio Packet from Station/ Interlocked LC Gate / IBS to Onboard Kavach <ul style="list-style-type: none"> i) Frame Offset as per version 3.2 added. Frame offset = (Stationary Kavach frame number - last received Onboard Kavach frame number)/2

MANISH KUMAR GUPTA <small>Digitally signed by MANISH KUMAR GUPTA Date: 2023.12.12 16:04:06 +05'30'</small>	RAVINDRA NATH SINGH <small>Digitally signed by RAVINDRA NATH SINGH Date: 2023.12.12 16:07:34 +05'30'</small>	PAVANKUMAR GUDAVALLETTI <small>Digitally signed by PAVANKUMAR GUDAVALLETTI Date: 2023.12.12 16:11:01 +05'30'</small>	Page 2 of 67
Manish Kumar Gupta SSE/S&T	R. N. Singh ADE/Signal	G. Pavan Kumar ED/Tele-II	

ISO 9001: 2015	Effective from 12.12.2023	RDSO/SPN/196/2020	Version 4.0 d3 Amdt-8
Document Title: Specification of Kavach (The Indian Railway ATP)- Multiple Access Scheme & Radio Communication Protocol			Annexure-C

		<p>Cyclic subtraction to be ensured at 00:00 hours.</p> <p>ii) Fouling_Mark_STS modified :-</p> <p>a) 0: No Fouling Tag Mark cleared by Train rear end</p> <p>b) 1: Fouling Mark Tag Read (Information shall be sent for 3 cycle)</p> <p>ii) DIST_NXT_RFID :- Distance of next RFID from previous RFID (first tag will be from last reference RFID) in meters i.e. 2047 meter.</p> <p>iii) ADJ_LINE_CNT – Modified as-</p> <p>0: No adjacent lines, Self block section TIN will follow.</p> <p>1-5: Number of Adjacent lines including occupied self block section TIN.</p> <p>iii) LINE_TIN- Modified- Self and Adjacent Line TIN</p> <p>Only If ADJ_LINE_CNT = 0 to 5, LINE_TIN variable will follow.</p> <ul style="list-style-type: none"> • Clause C.5.4- Access Authority Packet version 2.0 i) Allotted_UpLink_Freq – 7 bit-- New clause added ii) Allotted_DownLink_Freq- 7 Bit - New clause added. iii) Allotted_FDMA_FREQ – Clause deleted
3	20.03.2023	<ul style="list-style-type: none"> ▪ Clause C.3.2 is modified to accommodate only single frequency switching in a cycle to accommodate more slots. The no of slots are increased to 70 from 68. ▪ Clause C.3.2.1 is modified to accommodate 44 slots for stationary KAVACH and Onboard KAVACH communication. ▪ Clause C.3.2.2, C.3.2.3, C.3.2.4, C.3.2.5 and C.3.2.10 modified to incorporate new slot numbers. ▪ Clause 3.2.11 : Position marker start time in millisecond is newly added ▪ Clause 3.2.12: frame structure for FDMA/TDMA time frame cycle with position marker is modified. ▪ Clause C.5.2. : <ul style="list-style-type: none"> ○ CUR_SIG_INFO – ‘00000’ – to be sent when line number information is not applicable. ○ Permissive signals controlled by ON RUN Override permitted stop signals shall also be made ON RUN as 1. ○ Authorized speed 62 is to be coded as “8 Kmph for auto signal override during night”. ○ DUP_TAG_DIR and DIST_DUP_TAG are added in TLI subpacket. ○ ABS_LOC_RESET is reduced from 2 bits to 1 bit ○ Abs locotion reset field values ‘01’ and ‘10’ are modified as invalid from location correction +ve/-ve. ○ FOULING_MARK_STS is removed and Track Condition type “Fouling Mark location” is added in Station to Onboard regular packet. Sound Horn & Reversing Area track condition type BIT is corrected. ○ LM_Static_Speed_Type is deleted and LM_Static_Speed_Class &

MANISH KUMAR GUPTA <small>Digitally signed by MANISH KUMAR GUPTA Date: 2023.12.12 16:04:06 +05'30'</small>	RAVINDRA NATH SINGH <small>Digitally signed by RAVINDRA NATH SINGH Date: 2023.12.12 16:07:34 +05'30'</small>	PAVANKUMAR GUDAVALLETTI <small>Digitally signed by PAVANKUMAR GUDAVALLETTI Date: 2023.12.12 16:11:01 +05'30'</small>	Page 3 of 67
Manish Kumar Gupta SSE/S&T	R. N. Singh ADE/Signal	G. Pavan Kumar ED/Tele-II	

ISO 9001: 2015	Effective from 12.12.2023	RDSO/SPN/196/2020	Version 4.0 d3 Amdt-8
Document Title: Specification of Kavach (The Indian Railway ATP)- Multiple Access Scheme & Radio Communication Protocol			Annexure-C

		<ul style="list-style-type: none"> ○ LM_Static_Speed_Value added. ▪ Clause C 5.3: <ul style="list-style-type: none"> ○ Invalid SRC_Loco_ID, Invalid Abs_location ID are defined. ○ Location accuracy of RFID Tag is changed to 5m from 1m and Reader Offset is added in assessment of L_Doubtver and L_Doubtunder. ○ Side Collision word is removed. ○ TAG_DUP new field added. ○ TAG_LINK_INFO new field added. ○ "Brake_Applied" Normal Service Brake by Kavach (not to be sent when hardwire interface is not done. For ex: in EMUs and Trainsets) ○ "Specific_SoS_Ack" with field width of 1 bits changed to "INFO_ACK" with field width of 4 bits by LP ○ Loco_Health_Status (Only for NMS Logging and re-port generation) shall be as per prescribed in Clause 6.1.24 of Annexure-G) ▪ Clause C 5.4: <ul style="list-style-type: none"> ○ Allotted_UpLink_Freq & Allotted_DownLink_Freq is modified to suit frequency range of 406 to 470 MHz.
4	27.04.2023	<ul style="list-style-type: none"> • Clause C 5.2: <ul style="list-style-type: none"> ○ Movement Authority packet- Authority_type newly added as "11: SR Authority (When adjacent S-KAVACH communication failed, Authorised speed shall be Section Speed)". • Clause C 5.3: <ul style="list-style-type: none"> ○ In Info Ack field "Not Ack" is replaced by "No Ack" ○ Spare field - 3 bits corrected to 2 bits
04.05.2023	Amdt-5	<ul style="list-style-type: none"> • Clause C 3.2.8- deleted as per CoE letter No IRISSET/CoE/KAVACH/MISC dtd 30.04.2023. • Clause 3.2.9 – is modified with addition of desirable/preferably word. • New Clause added 3.2.13- Start of Frame is indicated. • New Clause added 3.2.14- Transmission when no loco is registered with Stationary KAVACH is clarified. • Clause 5.2- <ul style="list-style-type: none"> ○ LAST_REF_RFID- The following correction is carried out "Stationary and Onboard KAVACH shall not consider Adjustment tags, Foreign tags, Adjacent line tags and wrong line tags as LAST_REF_RFID". ○ Authority type- when SR Authority is provided, Authorized speed shall be unknown (63) and other details are specified.
16.08.2023	Amdt-6	<ul style="list-style-type: none"> • Clause 5.2 <ul style="list-style-type: none"> ○ SUB_PKT_LENGTH field is uniquely define for each type of sub packet.

MANISH KUMAR GUPTA <small>Digitally signed by MANISH KUMAR GUPTA Date: 2023.12.12 16:04:06 +05'30'</small>	RAVINDRA NATH SINGH <small>Digitally signed by RAVINDRA NATH SINGH Date: 2023.12.12 16:07:34 +05'30'</small>	PAVANKUMAR GUDAVALLETTI <small>Digitally signed by PAVANKUMAR GUDAVALLETTI Date: 2023.12.12 16:11:01 +05'30'</small>	Page 4 of 67
Manish Kumar Gupta SSE/S&T	R. N. Singh ADE/Signal	G. Pavan Kumar ED/Tele-II	

ISO 9001: 2015	Effective from 12.12.2023	RDSO/SPN/196/2020	Version 4.0 d3 Amdt-8
Document Title: Specification of Kavach (The Indian Railway ATP)- Multiple Access Scheme & Radio Communication Protocol			Annexure-C

		<ul style="list-style-type: none"> ○ New, Revised, spec. 3.2 are added in remarks coloum for confir-mity. ○ CUR_SIG_INFO <ul style="list-style-type: none"> ▪ a8 to a5 bits are define as line name. ▪ The following are newly added in a14 to a9 bit –(Type of Sig-nal)- <ul style="list-style-type: none"> • 101110- Gate cum IB Distant Signal. • 101111- Gate cum IB Inner Distant Signal ○ In CUR_SIG_ASPECT- AG marker off- Newly added. ○ In AUTHRISED_SPEED-LM_STATIC_SPEED_VALUE and TSR_UNIVERSAL SPEED, the following correction carried out for uniformity. <ul style="list-style-type: none"> ▪ 51-61 is modified to reserved for future. ▪ 62- as 8 Kmph ▪ 63 as Unknown. ○ Train integrity, MA shortening field are proposed for future use. ○ LM_GRADIENT_VALUE- is modified to confirm with Annexure-I. ○ TRACK_COND_TYPE-1001: KAVACH Territory Exit. (Not to vali-date RFID linking beyond this location).
26.10.2023	Amdt-7	<p>CL. C.3.2.2 – modified with addition of “ The time slot shall be changed by the onboard KAVACH at every cycle randomly.</p> <p>CL. C.5.2 – Current_Sig_info- a15 to 16 – is shifted after a14 to a9.</p> <p>CL. C5.3 - modified as Total TINs occupied by Train in entire train length section from front end. Max upto 6 TINs. Track identification number occupied by front end of onboard KAVACH and total bit is corrected.</p>
12.12.2023	Amdt-8	<ul style="list-style-type: none"> • CL 5.3 Onboard to Station Regular Packet: MOVEMENT_DIR is modified with deletion of (Normally Traffic Direction as UP & Normally Traffic Direction as DOWN)

MANISH KUMAR GUPTA <small>Digitally signed by MANISH KUMAR GUPTA Date: 2023.12.12 16:04:06 +05'30'</small>	RAVINDRA NATH SINGH <small>Digitally signed by RAVINDRA NATH SINGH Date: 2023.12.12 16:07:34 +05'30'</small>	PAVANKUMAR GUDAVALLETTI <small>Digitally signed by PAVANKUMAR GUDAVALLETTI Date: 2023.12.12 16:11:01 +05'30'</small>	Page 5 of 67
Manish Kumar Gupta SSE/S&T	R. N. Singh ADE/Signal	G. Pavan Kumar ED/Tele-II	

ISO 9001: 2015	Effective from 12.12.2023	RDSO/SPN/196/2020	Version 4.0 d3 Amdt-8
Document Title: Specification of Kavach (The Indian Railway ATP)- Multiple Access Scheme & Radio Communication Protocol			Annexure-C

C.1 Introduction

This document describes the requirements for data transmission over the air (through radio), Multiple Access scheme and Radio communication protocol for Onboard and Stationary KAVACH sub-systems.

C.2 Scope

This document defines the Radio communication transmission time slots and frequencies required for Stationary KAVACH and Onboard KAVACH system in UHF radio transmission.

Wherever KAVACH Sub-system is referred, it shall mean Onboard KAVACH and Stationary KAVACH.

C.3 Over the Air Requirements

C.3.1 Radio Modem Requirements

C.3.1.1 Communication between the Stationary KAVACH and Onboard KAVACH shall be Over-The-Air using Multiple Access.

C.3.1.2 Each Multiple Access frame cycle shall be of 2000 milli seconds.

C.3.1.3 It shall be suitable for communication in frequency range of 406 MHz to 470 MHz.

C.3.1.4 Onboard KAVACH shall use centre frequency (f_0) in block section and at the times of emergency situations (SoS, head-on, rear-end collisions).

C.3.1.5 Stationary KAVACH and Onboard KAVACH shall use their respective timeslot(s) in the Multiple Access with in their channel for the transmission of communication packet(s).

C.3.1.6 The transmission Over-The-Air from Radio shall be controlled by KAVACH Sub-systems using Request To Send signal in the RS232/RS 485/Ethernet.

C.3.1.7 KAVACH sub-system may transmit multiple Communication packets in a single transmission burst.

C.3.1.8 KAVACH sub-system shall transfer all the data for a single transmission burst to the Radio modem at least 20 milli second before commencement Over-The-Air.

C.3.1.9 KAVACH sub-system shall calculate the timings from commencement and completion of transmission by Radio Modem Over-The-Air by considering the preamble,

MANISH KUMAR GUPTA <small>Digitally signed by MANISH KUMAR GUPTA Date: 2023.12.12 16:04:06 +05'30'</small>	RAVINDRA NATH SINGH <small>Digitally signed by RAVINDRA NATH SINGH Date: 2023.12.12 16:07:34 +05'30'</small>	PAVANKUMAR GUDAVALLETTI <small>Digitally signed by PAVANKUMAR GUDAVALLETTI Date: 2023.12.12 16:11:01 +05'30'</small>	Page 6 of 67
Manish Kumar Gupta SSE/S&T	R. N. Singh ADE/Signal	G. Pavan Kumar ED/Tele-II	

communication packet, postamble and extra stuffed bits.

- C.3.1.10 KAVACH sub-system shall disable the RTS signal after completion of transmission of information data over-The-Air.
- C.3.1.11 Change of frequency or switch between the frequencies shall be completed well in advance i.e., 15 milliseconds before commencement of Data transmission Over-The-Air.
- C.3.1.12 In the bit-stream Over-The-Air, LSB shall be transmitted first.
- C.3.1.13 Refer the below timing diagram, for data transfer between KAVACH sub-system and radio modem.

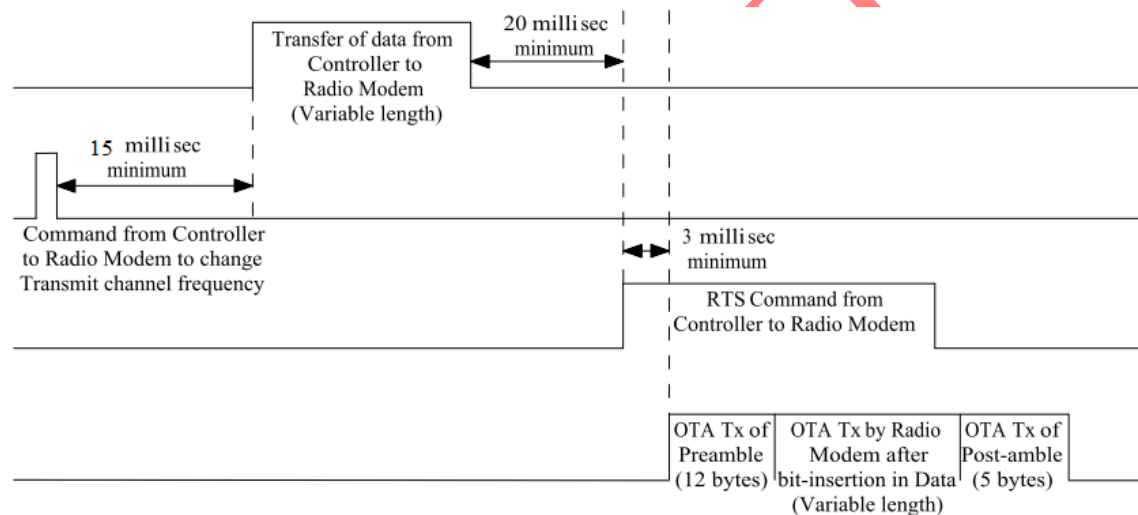


Figure 1: Timing Diagram to transfer the data between KAVACH and Radio modem

C.3.2 Multiple Access Scheme

The optimized frame cycle structure for the TDMA/FDMA/SDMA scheme is shown in figure-2. As shown frame cycle is divided into basic 70 time slot position markers (position nos. 1 to 70) each of width 432 bits (22.5 m-sec) except position nos 1 and 46. These are spaced 96 bits (5 m-sec) apart except for the four wider time slots to ensure proper frequency stabilization on change.

- C.3.2.1 Time slots from P2 to P45 shall be used for stationary KAVACH and Onboard KAVACH communication. These timeslots have been marked as M-1 to M-44.
- C.3.2.2 Time slots P47, P48, P49, P50, P51, P52, P59, P60, P61, P62, P63 and P64 shall be used by the Onboard KAVACH for broadcasting communication packets in the block

ISO 9001: 2015	Effective from 12.12.2023	RDSO/SPN/196/2020	Version 4.0 d3 Amdt-8
Document Title: Specification of Kavach (The Indian Railway ATP)- Multiple Access Scheme & Radio Communication Protocol			Annexure-C

section. Onboard KAVACH System shall switch its Tx frequency to f_0 in the block section and shall transmit the radio packet with reference to markers Mobile System MBS-1 to MBS-12. The time slot shall be changed by the onboard KAVACH at every cycle randomly.

- C.3.2.3 Time slots P53, P54, P65 and P66 in f_0 shall be used by the Onboard KAVACH for broadcasting messages Access Request Packet (additionally EMERGENCY_STATUS). These timeslots have been marked as Mobile Emergency ME-1 to ME-4.
- C.3.2.4 Time slots P55, P56, P67 and P68 in f_0 shall be used by the Stationary KAVACH for broadcasting additional emergency (SoS) messages. These timeslots have been marked as Stationary System Emergency SE-1 to SE-4.
- C.3.2.5 Time slots P57, P58, P69 and P70 in f_0 shall be used by the Stationary KAVACH for broadcasting Access Authority messages. These timeslots have been marked as Stationary System slot STS-1 to STS-4.
- C.3.2.6 Stationary KAVACH System shall transmit the Radio packet in its designated time slot.
- C.3.2.7 Onboard KAVACH System shall transmit the radio packet in its designated time slot and designated frequency channel received from stationary KAVACH Unit.
- C.3.2.8 It is desirable not to have Onboard time slots adjacent to each other for the same station (Preferably minimum one time slot gap may be kept).
- C.3.2.9 The time slot P1 and P46 shall be kept as reserve.
- C.3.2.10 P2 slot shall start exactly at 45 millisecond from cycle start. Subsequently every slot shall start at an interval of 27.5 ms till P-45. P-47 shall start at 1320 millisecond and subsequently every slot shall start at an interval of 27.5 millisecond till P-70.
- C.3.2.11 The frame structure for FDMA/TDMA time frame cycle with position marker is attached as Annexure-1.
- C.3.2.12 When Radio1 is transmitting, the prefix "0xF1 0xA5 0xC3" must be added as Start of frame. When Radio2 is transmitting, the prefix "0xF2 0xA5 0xC3" must be added as Start of frame.

MANISH KUMAR GUPTA <small>Digitally signed by MANISH KUMAR GUPTA Date: 2023.12.12 16:04:06 +05'30'</small>	RAVINDRA NATH SINGH <small>Digitally signed by RAVINDRA NATH SINGH Date: 2023.12.12 16:07:34 +05'30'</small>	PAVANKUMAR GUDAVALLETTI <small>Digitally signed by PAVANKUMAR GUDAVALLETTI Date: 2023.12.12 16:11:01 +05'30'</small>	Page 8 of 67
Manish Kumar Gupta SSE/S&T	R. N. Singh ADE/Signal	G. Pavan Kumar ED/Tele-II	

ISO 9001: 2015	Effective from 12.12.2023	RDSO/SPN/196/2020	Version 4.0 d3 Amdt-8
Document Title: Specification of Kavach (The Indian Railway ATP)- Multiple Access Scheme & Radio Communication Protocol			Annexure-C

C.3.2.13 When no Onboard KAVACH is registered, Stationary KAVACH shall be keep transmitting, Stationary KAVACH to Onboard KAVACH regular packet header with information upto SOURCE_STN_ILC_IBS_VERSION and pad other bits as zero. No MAC to be made applicable for this packet CRC is to be calculated for this packet.

The sample Data is shown below:

Packet Type:	STATION TO ONBOARD REGULAR PACKET
The Packet length in bytes is	16
Frame Number	86399
Source Station ID: (Range: 1 to 65535)	514
Station Version	Kavach Spec 4.0
Destination Loco ID: (Range: 1 to 999999)	0
Reference Profile ID: (Range: 0 to 15)	0
Last Reference RFID: (Range: 0 to 1024)	0
Distance Packet To Start: (Range: -16384 to 16383)	0
Packet Direction	Unidentified

The data transmitted through Radio1 shall be 0xF1, 0xA5, 0xC3, 0x90, 0x42, 0xA2, 0xFE, 0x04, 0x04, 0x88, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x0D, 0xFE, 0xEE, 0X62

MANISH KUMAR GUPTA <small>Digitally signed by MANISH KUMAR GUPTA Date: 2023.12.12 16:04:06 +05'30'</small>	RAVINDRA NATH SINGH <small>Digitally signed by RAVINDRA NATH SINGH Date: 2023.12.12 16:07:34 +05'30'</small>	PAVANKUMAR GUDAVALLETTI <small>Digitally signed by PAVANKUMAR GUDAVALLETTI Date: 2023.12.12 16:11:01 +05'30'</small>	Page 9 of 67
Manish Kumar Gupta SSE/S&T	R. N. Singh ADE/Signal	G. Pavan Kumar ED/Tele-II	

C.4 Radio Communication Protocol for Version 3.2 Version 1.0

C.4.1 Regular Radio Packet from Station/ Interlocked LC Gate / IBS to Onboard KAVACH units

Field	Size (Bits)	Possible Values
PKT_TYPE	4	<ul style="list-style-type: none"> - 0000 - Undefined - 0001 - Station to Onboard Regular Packet - 0010 - Onboard to Station Regular Packet - 0011 – Access Authority Packet - 0100 – Additional Emergency Packet - 0101 – Static Profile Packet - 0110 – Onboard Access Request / Block Section Packet -0111- 1xxx - Reserved for future use
PKT_LENGTH	7	<ul style="list-style-type: none"> - Packet Length is in terms of bytes - 000 0000 - 1 byte - 000 0001 – 2 bytes - 111 1111 – 128 bytes
FRAME_NUM	17	1 to 86400 ((hr * 3600 + mm * 60 + ss)+ 1) Example : 00:00:00 - Frame No 1 00:00:02 - Frame No. 3 23:59:58 - Frame No 86399
SOURCE_STN_ILC_IBS_ID	16	Unique Code, Valid values from 1 to 65535 (Purchaser Railway to Decide) (Cannot repeat within radial aerial distance of 500 Km)
SOURCE_STN_ILC_IBS_VERSION	3	0 to 7 (Reserved for Forward and Backward Compatibility)
STN_ILC_IBS_LOC	22	Absolute Location in meters
GEN_SOS_CALL	1	Value
		Description
		1 General SoS Call generated by Stationary unit
		0 No SoS
DEST_LOCO_CNT	4	1 to 15 : Number of Onboard dealt in this particular packet
Header_FILL_ZEROs	6	Spare bits to make it multiple of 8 bits (one byte – Octet)
DEST_LOCO_ID	17	1 to 99999
IN-FO_BASIS_FRAME_OF	4	0001 to 1110 1111 - Not known

FSET		= station frame number - last Onboard frame number	
DEST_LOCO_SOS	1	1 - SoS/ Emergency Condition to Specific Onboard 0 - No SoS /Emergency	
REF_FRAME_NUM_TL	17	1 1111 1111 1111 1111 Binary	No Train Length related information for this Onboard
		1 to 86400 ((hr * 3600 + mm * 60 + ss) + 1) Example : 00:00:00 - Frame No 1 00:00:02 - Frame No. 3 23:59:58 - Frame No 86399	To be used for Train Length calculation
REF_OFFSET_INT_TL	8	When REF_FRAME_NUM_TL = 1 1111 1111 1111 1111 Binary	1111 1111 Binary ("Don't Care")
		When REF_FRAME_NUM_TL is between 1 to 86400	0 to 200 (10ms resolution)
TRN_LEN_INFO_TYPE	1	When REF_FRAME_NUM_TL = 1 1111 1111 1111 1111 Binary	1 Binary ("Don't Care")
		When REF_FRAME_NUM_TL is between 1 to 86400	TRN_LEN_INFO_TYPE = 0 means REF_FRAME_NUM_TL and REF_OFFSET_INT_TL pertain to "Start" frame and offset. TRN_LEN_INFO_TYPE = 1 means REF_FRAME_NUM_TL and REF_OFFSET_INT_TL pertain to "END" frame and offset.

CUR_SIG_INFO	11	<p>a10a9a8a7a6a5a4a3a2a1a0</p> <p>a3 to a0 : (to be defined and displayed only for applicable Home / Routing Home / Starter / Intermediate Starter)</p> <p>0000 : Not defined (No direction, route not known and no communication) 1111 : Line Number in excess of 13 Decimal, in this case, no line number to be displayed on LP-OCIP (DMI). 1110: Goods Lines (in case of any Goods Line, no need to display Line Number on LP-OCIP (DMI), however, the information to be displayed on LP-OCIP (DMI) that the Train is going to Goods Line). It is clarified that even for multiple Goods Lines, Line Number shall not be communicated to Onboard KAVACH Unit and distinction among Goods Line would not be available through LP-OCIP (DMI) to Onboard Pilot.</p> <p>a4: Up / Down Signal (0: Up, 1: Down), this field is not to be used for any purpose other than display associated with signal (don't care when direction is not known)</p> <p>a10 to a5 : Type of Signal</p>	
		000000	Undefined - nothing to be displayed on LP-OCIP (DMI)
		010xxx	Various Distant Signals & Auto Signals
			010000 – Distant
			010001 - Inner Distant
			010010 - Gate Distant
			010011 - Gate Inner Distant
			010100 - IB Distant
			010101 - IB Inner Distant
			010110 - Automatic Signal (Excludes Gate Stop Signal in Auto Territory)
			010111- Semi-Automatic Signal with A-Marker Lit
			100100- Semi Automatic Signal without A marker Lit
		0110xx	Various Home Signals
			011000 - Main Home without Junction Route Indicator
			011001 - Main Home with Junction Route Indicator
			011010 - Routing Home without Junction Type Route Indicator

			011011 - Routing Home with Junction Type Route Indicator
		0111xx	Various types of Starter Signals
			011100 - Mainline Starter
			011101 - Loopline Starter
			011110 - Intermediate Starter
		x0xxxx	Other Misc Signals
			000001 - Advanced Starter
			000010 - IB Stop Signal
			000011 - Gate Stop Signal
			000100 - Calling-on Signal
			000101 - Advanced Starter-cum-Gate Signal
			000110 - Gate-cum-Distant
			000111 - Advanced Starter-cum-Distant Signal
			100011 - Gate Stop Signal in Auto Territory
			001000 - Only in RFID Tag, not in Radio Packet. Onboard KAVACH shall apply Brake when it crosses signal with this code (dead stop locations - such as end of berthing tracks with Shunt Signals) in Normal Mode.
			The full list of signals alongwith corresponding binary codes will be issued through a Technical Advisory Note
			001001 - Only in RFID Tag, not in Radio Packet. Onboard KAVACH shall apply Brake when it crosses signal with this 'Yard Exit' type (such as at BSLB) in other than SR mode.
CUR_SIG_ASPECT	5	Value	Description
		00000	Unidentified
		00001	Red
		00010	Yellow without Display of Route Indication
		00011	Yellow with Pos1 Junction Type Route Indication

		00100	Yellow with Pos2 Junction Type Route Indication
		00101	Yellow with Pos3 Junction Type Route Indication
		00110	Yellow with Pos4 Junction Type Route Indication
		00111	Yellow with Pos5 Junction Type Route Indication
		01000	Yellow with Pos6 Junction Type Route Indication
		01001	Yellow with other type (such as Stencil) type Route indication
		01010	Double Yellow
		01011	Green
		01100	Spare
		01110	Spare
		01111	Red with Calling-on at OFF
		11000	Stop Board / Buffer Stop
		01100 to 01110, 10000 to 10111 and 11001 to 11111	Reserved for future use
NEXT_SIG_ASPECT	5	Value	Description
		00000	In case current Signal Aspect is RED
		-	Codes as given in CUR_SIG_ASPECT above

MA_W_R_T_SIG	16	0 to 65534 in meters. 65535 : Undefined. The Movement Authority transmitted shall be the distance of End of Authority from actual Absolute Position of the train. In order to cater the delays and failure in acquiring information due to missing radio frames, the Movement Authority in Onboard shall be deduced as the Movement authority corresponding to particular frame received from Stationary KAVACH Unit minus the actual distance travelled by the Onboard since that frame.	
APPROACH- ING_STN_ILC_IBS_ID	16	Value	Description
		0	Next Signal to Signal on Approach is from same Source Interlocking.
		1 to 65535	Next Signal to Signal on Approach is from different Interlocking. APPROACHING_STN_ILC_IBS_ID is STN_ILC_IBS_ID of next signal.
Approaching_Sig_Dist	16	0 to 65535m	
TO_SPEED	4	Value	Description
		0000	Not Used
		0001	Upto 10 kmph
		0010	Upto 15 kmph
		0011	Upto 20 kmph
		0100	Upto 25 kmph
		0101	Upto 30 kmph
		0110	Upto 35 kmph
		0111	Upto 40 kmph
		1000	Upto 45 kmph
		1001	Upto 50 kmph
		1010	Upto 55 kmph
		1011	Upto 60 kmph
		1100	Upto 65 kmph
		1101	Upto 70 kmph
		1110	Upto 75 kmph
		1111	Unrestricted
DIFF_DIST_TO	11	If	DIFF_DIST_TO 1111111111 (Don't Care)

		TO_SPE ED is 1111 binary D is 1 to 14 in decimal	To be used for Distance to Turn Out value This parameter transmitted shall be the distance of commencement of Turnout with restricted speed from actual Absolute Position of the train. In order to cater the delays and failure in acquiring information due to missing radio frames, this distance in Onboard shall be deduced as the one corresponding to particular frame received from Stationary KAVACH unit minus the actual distance travelled by the Onboard since that frame
TO_SPEED_REL_DIST	8	If TO_SPEED is 1111 binary If TO_SPEED is 1 to 14 in decimal	TO_SPEED_REL_DIST 11111111 (Don't Care) Value in Decameters i.e. 0-2550
GRAD_MA_W_R_T_S G	6	Weighted Average gradient from current location for 2km or Movement Authority whichever is lower.	
FILL_ZEROs	6	Fill Zero before MAC filled to make packet size in multiple of Bytes (8 bit)	
LO- CO_Specific_MAC_CO DE	16	Message Authentication code for fields from PKT_TYPE to DEST_LOCO_CNT + respective DEST_LOCO_ID to just prior to LOCO_Specific_MAC_CODE + Additional fill Zeros to make block multiple of Byte	
CRC	16	CRC for Total packet	
Total	264		

C.4.2 Static Speed Profile Packet

Field	Size (Bits)	Possible Values
PKT_TYPE	4	<ul style="list-style-type: none"> - 0000 - Undefined - 0001 - Station to Onboard Regular Packet - 0010 - Onboard to Station Regular Packet - 0011 – Access Authority Packet - 0100 – Additional Emergency Packet - 0101 – Static Profile Packet - 0110 –Onboard Access Request / Block Section Packet - 1xxx - Reserved for future use
PKT_LENGTH	7	Packet Length is in terms of bytes <ul style="list-style-type: none"> - 000 0000 - 1 byte - 000 0001 – 2 bytes

Field	Size (Bits)	Possible Values	
	 - 111 1111 – 128 bytes (Total packet size shall not exceed 48 bytes for this packet)	
FRAME_NUM	17	1 to 86400 ((hr * 3600 + mm * 60 + ss)+ 1) eg: 00:00:00 - Frame No 1 00:00:02 - Frame No. 3 23:59:58 - Frame No 86399	
SOURCE_STN_ILC_IBS_ID	16	Unique Code, Valid values from 1 to 65535 (Cannot repeat within radial aerial distance of 500 Km)	
SOURCE_STN_ILC_IBS_VERSION	3	1 to 7	
DEST_LOCO_ID	17	1 to 99999	
STATIC_PROF_ID	6	1 to 62 63 - Spare	
STATIC_PROF_DIR	2	- 00 unidentified - 01 Nominal (Normally Traffic Direction as UP) - 10 Reverse (Normally Traffic Direction as DOWN) - 11 Spare	
SUB_STATIC_PROF_CNT	3	1 to 7	
SUB_STATIC_PROF_ID	3	1 to 7	
SUB_STATIC_PROF_START_ABS_LOC	19	Start Absolute Location of Segment in decameters	
SUB_STATIC_PROF_LEN	11	Distance beyond SUB_STATIC_PROF_START_ABS_LOC in decametres for which profile information applies i.e. span of segment.	
LM_Type = 001 (Static Speed)	3	Value	Description
		000	None
		001	Static Speed
		010	Gradient
		011	LC Gate (To be decided by Operator Railway whether to configure for LC Gates or not)
		100	Spare
		101	Spare
		110	Spare

Field	Size (Bits)	Possible Values		
		111	Spare	
LM_Speed_Info_C NT (When LM_Type=001)	5	LM_Type=001	1 to 31	Not to be sent when IN-FO_BASIS_FRAME_OFFSET is in excess of 2 seconds
LM_Static_Speed _Type	3	LM_Type=001	Value	Description
			000	Reserved
			001	Universal Static Speed
			010	Static Speed for Category A Trains (LE/Passenger Trains)
			011	Static Speed for Category B Trains (Loaded Goods Trains)
			100	Static Speed for Category C Trains (Empty Goods Trains)
			101	Spare
			110	Spare
			111	Spare
LM_Static_Speed _Distance (in Decameters)	9	LM_Type=001	Value in Decameters i.e. ranging from 0 - 5.11 km	
LM_Static_Speed _Value	5	LM_Type=001	Value	Speed in kmph
			00000	Reserved
			00001	5
			00010	10
			00011	15
			00100	20
			00101	25
			00110	30
			00111	35
			01000	40
			01001	45
			01010	50
			01011	55
			01100	60
			01101	65
			01110	70

Field	Size (Bits)	Possible Values		
			01111	75
			10000	80
			10001	85
			10010	90
			10011	95
			10100	100
			10101	110
			10110	120
			10111	130
			11000	140
			11001	150
			11010	160
			11011	170
			11100	180
			11101	190
			11110	200
			11111	Reserved
LM_Type = 010 (Gradient)	3	Value	Description	
		000	None	
		001	Static Speed	
		010	Gradient	
		011	LC Gate (To be decided by Operator Railway whether to configure for LC Gates or not)	
		100	Spare	
		101	Spare	
		110	Spare	
		111	Spare	
LM_Grad_Info_CNT (When LM_Type=010)	5	LM_Type=010	1 to 31	Not to be sent when INFO_BASIS_FRAME_OFFSET is in excess of 2 seconds
LM_Gradient_Distance (in Decameters)	9	LM_Type=010	Value in Decameters i.e. ranging from 0 - 5.11 km	
LM_GDIR	1	LM_Type=010	0 = downhill 1= uphill	
LM_GRADIENT_VALUE	5	LM_Type=010	This is the absolute value of the minimum gradient between two defined loca-	

Field	Size (Bits)	Possible Values		
			<p>tions.</p> <p>Values lie between 0 to 30. Value 31 : reserved.</p> <p>0 : Gradient not steeper than "1 in 1000". Includes Level Gradient</p> <p>1 : Gradient from "1 in 1000" to not steeper than "1 in 500"</p> <p>2 : Gradient from "1 in 500" to not steeper than "1 in 333"</p> <p>3 : Gradient from "1 in 333" to not steeper than "1 in 250"</p> <p>4 : Gradient from "1 in 250" to not steeper than "1 in 200"</p> <p>....</p> <p>n : Gradient from "1 in (1000/n)" to not steeper than "1 in {1000/(n+1)}"</p> <p>....</p> <p>30 : Gradient steeper than "1 in 33"</p> <p>31 : Reserved</p>	
LM_Type = 011 (LC Gate)	3	Value	Description	
		000	None	
		001	Static Speed	
		010	Gradient	
		011	LC Gate (To be decided by Operator Railway whether to configure for LC Gates or not)	
		100	Spare	
		101	Spare	
		110	Spare	
		111	Spare	
LM_LC_Info_CNT (When LM_Type=011)	5	LM_Type=011	1 to 31	Not to be sent when INFO_BASIS_FRAME_OFFSET is in excess of 2 seconds
LM_LC_Distance (in Decameters)	9	LM_Type=011	Value in Decameters i.e. ranging from 0 - 5.11 km	
LM_LC_ID_Numeric	10	LM_Type=011	Value	Speed in kmph
			00 0000 0000	Invalid

Field	Size (Bits)	Possible Values		
			00 0000 0001 to 11 1111 1101	LC Gate Number 1 to 1021
			11 1111 1110	LC Gate Number other than 1 to 1022 - out of range (Display xx on LP-OCIP (DMI))
			11 1111 1111	Spare
LM_LC_ID_Alpha_Suffix	3	LM_Type=011	Value	Suffix of Gate
			000	None
			001	a
			010	b
			011	c
			100	d
			101	e
			110	Out of Range (Display xx on LP-OCIP (DMI))
			111	Spare
LM_LC_Manning_Type	1	LM_Type=011	0 : Manned, 1 : Unmanned	
LM_LC_Class	3	LM_Type=011	Value	Suffix
			000	Spl
			001	A
			010	B1
			011	B2
			100	B (where not specified in terms of B1/B2)
			101	C
			110	D
			111	Spare
LM_LC_Auto_Whistling_Enabled	1	LM_Type=011	0 : No, 1 : Yes	
LM_LC_Auto_Whistling_Type	2	LM_Type=011	Value	Auto Whistling Type
			00	Distance Based
			01	Time Based (Not Used)
			10	Configured Pattern Based

Field	Size (Bits)	Possible Values
		(Not Used)
		11 Spare
FILL_ZEROs	7	Fill zeros before MAC Field to make packet size in multiple of bytes (8-bits)
MAC_CODE	16	Message Authentication code (MAC) from PKT_TYPE to just prior to MAC field + fill Zeros to make it block of multiple of 128 bits.
Packet CRC	16	
Total	232	

C.4.3 Static Profile Packet Example

C.4.3.1 Section Profile

Profile Length – 5KM	5KM
Profile Start location	18000
Profile Direction	Nominal
Unique Profile Id	1

Static Speed			
500	U-60		
1000	U-50		
1200	A=90	B=60	
400	U-75		
600	U-80		
500	A=85	B=70	C=50
800	U-80		

Gradient			
----------	--	--	--

Distance	Grad	Dir	%
600	100	Fall	10
400	250	Fall	4
300	300	Raise	3
1000	120	Raise	8
1500	0	Level	0
200	200	Raise	5
600	0	Level	0
400	300	Raise	3
LC Gate location	19300		

C.4.4 Corresponding Packets :

PKT_TYPE	4	5
PKT_LENGTH	7	49 bytes
FRAME_NUM	17	
SOURCE_STN_ILC_IBS_ID	16	
SOURCE_STN_ILC_IBS_VERSION	3	
TARGET_LOCO_ID	17	
STATIC_PROF_ID	4	1
STATIC_PROF_DIR	2	Nominal
SUB_STATIC_PROF_CNT	3	2
SUB_STATIC_PROF_ID	3	1
SUB_STATIC_PROF_START_ABS_LOC	19	1800
SUB_STATIC_PROF_LEN	11	370
LM_Type (Static_Speed)	3	0
LM_Speed_Info_CNT	5	6
LM_Static_Speed_Type	3	U
LM_Static_Speed_Distance	9	50
LM_Static_Speed_Value	5	01100
LM_Static_Speed_Type	3	U
LM_Static_Speed_Distance	9	100
LM_Static_Speed_Value	5	01010
LM_Static_Speed_Type	3	A
LM_Static_Speed_Distance	9	120
LM_Static_Speed_Value	5	10010
LM_Static_Speed_Type	3	B
LM_Static_Speed_Distance	9	120
LM_Static_Speed_Value	5	10010
LM_Static_Speed_Type	3	C

LM_Static_Speed_Distance	9	120
LM_Static_Speed_Value	5	10010
LM_Static_Speed_Type	3	U
LM_Static_Speed_Distance	9	40
LM_Static_Speed_Value	5	01111
LM_Static_Speed_Type	3	U
LM_Static_Speed_Distance	9	60
LM_Static_Speed_Value	5	10000
LM_Type (Gradient)	3	1
LM_Grad_Info_CNT	5	5
LM_Gradient_Distance	9	60
LM_Gradient_Dir	1	0
LM_Gradient_Value	5	10
LM_Gradient_Distance	9	40
LM_Gradient_Dir	1	0
LM_Gradient_Value	5	4
LM_Gradient_Distance	9	30
LM_Gradient_Dir	1	1
LM_Gradient_Value	5	3
LM_Gradient_Distance	9	100
LM_Gradient_Dir	1	1
LM_Gradient_Value	5	8
LM_Gradient_Distance	9	140
LM_Gradient_Dir	1	0
LM_Gradient_Value	5	0
LM_Type (LC gate)	3	2
LM_LC_Info_CNT	5	1
LM_LC_Distance	11	130
LM_LC_ID_Numeric	10	110
LM_LC_ID_Alpha_Suffix	3	C
LM_LC_Manning_Type	1	Manned
LM_LC_Class	3	C
LM_LC_Auto_Whistling_Enabled	1	Yes
LM_LC_Auto_Whistling_Type	2	Distance Based
FILL_ZEROs	6	Fill zeros before MAC Field to make packet size in octets
MAC_CODE	16	

Packet CRC	16		
	376		

C.4.5 Access Authority Packet

Field	Size (Bits)	Possible Values	
PKT_TYPE	4	- 0000 - Undefined - 0001 - Station to Onboard Regular Packet - 0010 - Onboard to Station Regular Packet - 0011 – Access Authority Packet - 0100 – Additional Emergency Packet - 0101 – Static Profile Packet - 0110 – Onboard Access Request / Block Section Packet 0111-1xxx - Reserved for future use	
PKT_LENGTH	7	Packet Length is in terms of bytes - 000 0000 - 1 byte - 000 0001 – 2 bytes - 111 1111 – 128 bytes	
FRAME_NUM	17	1 to 86400 ((hr * 3600 + mm * 60 + ss)+ 1) eg: 00:00:00 - Frame No 1 00:00:02 - Frame No. 3 23:59:58 - Frame No 86399	
SOURCE_STN_ILC_IBS_ID	16	Unique Code, Valid values from 1 to 65535 (Cannot repeat within radial aerial distance of 500 Km)	
SOURCE_STN_ILC_IBS_VERSION	3	1 to 7	
STN_ILC_IBS_LOC	22	Absolute Location in meters	
DEST_LOCO_ID	17	1 to 99999	
Allotted_FDMA_Freq	4	Value	Allotted Frequency Channel Pair used
		0000	FDMA Not Used
		0001	Pair f _{S1} -f _{M1}
		0010	Pair f _{S2} -f _{M2}
		0011	Pair f _{S3} -f _{M3}
		0100	Pair f _{S4} -f _{M4}
		0101	Pair f _{S5} -f _{M5}

Field	Size (Bits)	Possible Values	
		0110	Pair f_{S6} - f_{M6}
		0111	Pair f_{S7} - f_{M7}
		1000	Pair f_{S8} - f_{M8}
		1001	Spare
		1010	Spare
		1011	Spare
		1100	Spare
		1101	Spare
		1110	Spare
		1111	Spare
Allotted_TDMA_Timeslot	7	Value	Description
		0	Not nominated
		1 to 50	Allotted Transmit Timeslot in Frame
STN_RND_NUM_RS	16		
FILL_ZEROs	7	Fill Zeros before MAC Field to make packet size in multiple of bytes (8 bits).	
MAC_CODE	16	Message Authentication code from PKT_TYPE to STN_RND_NUM_RS + Fill Zeros to make block multiple of 128 bits.	
PKT_CRC	16	Packet CRC	
Total	152		

C.4.6 Stationary KAVACH Emergency Packet

Field	Size (Bits)	Possible Values
PKT_TYPE	4	<ul style="list-style-type: none"> - 0000 - Undefined - 0001 - Station to Onboard Regular Packet - 0010 - Onboard to Station Regular Packet - 0011 - Access Authority Packet - 0100 - Additional Emergency Packet - 0101 - Static Profile Packet - 0110 - Onboard Access Request / Block Section Packet - 0111- 1xxx - Reserved for future use
PKT_LENGTH	7	Packet Length is in terms of bytes <ul style="list-style-type: none"> - 000 0000 - 1 byte - 000 0001 - 2 bytes

Field	Size (Bits)	Possible Values
	 - 111 1111 – 128 bytes
FRAME_NUM	17	1 to 86400 ((hr * 3600 + mm * 60 + ss)+ 1) eg: 00:00:00 - Frame No 1 00:00:02 - Frame No. 3 23:59:58 - Frame No 86399
SOURCE_STN_ILC_IBS_ID	16	Unique Code, Valid values from 1 to 65535 (Cannot repeat within radial aerial distance of 500 Km)
SOURCE_STN_ILC_IBS_VERSION	3	1 to 7
STN_ILC_IBS_LOC	22	Absolute Location in meters
GEN_SOS_CALL	1	Value Description
		1 General SoS Call generated by Stationary unit
		0 No SoS
DEST_LOCO_ID	17	1 to 99999
DEST_LOCO_SOS	1	1 - SoS/ Emergency Condition to Specific Onboard 0 - No SoS /Emergency
DEST_LOCO_ID	17	1 to 99999
DEST_LOCO_SOS	1	1 - SoS/ Emergency Condition to Specific Onboard 0 - No SoS /Emergency
FILL_ZEROs	6	Fill Zero before MAC filled to make packet size in multiple of Bytes (8 bit)
PKT_CRC	16	Packet CRC
Total	128	

C.4.7 Onboard KAVACH regular Radio Packet to Stationary KAVACH Units

Field	Size (Bits)	Possible Values
PKT_TYPE	4	- 0000 – Undefined - 0001 – Station to Onboard Regular Packet - 0010 – Onboard to Station Regular Packet - 0011 – Access Authority Packet - 0100 – Additional Emergency Packet - 0101 – Static Profile Packet

Field	Size (Bits)	Possible Values	
		- 0110 – Onboard Access Request / Block Section Packet 0111- 1xxx – Reserved for future use	
PKT_LENGTH	7	Packet Length is in terms of bytes - 000 0000 – 1 byte - 000 0001 – 2 bytes - 111 1111 – 128 bytes	
FRAME_NUM	17	1 to 86400 ((hr * 3600 + mm * 60 + ss)+ 1) Eg: 00:00:00 – Frame No 1 00:00:02 – Frame No. 3 23:59:58 – Frame No 86399	
SOURCE_LOCO_ID	17	1 to 99999	
ABS_LOCO_LOC	22	Absolute Location in meters	
TRAIN_LENGTH	11	0: Unidentified/ Invalid 1 to 2047: Train length in mtrs	
TRAIN_SPEED	8	Value	Description
		0 to 254	Train Speed in kmph
		255	Train Speed unidentified
MOVEMENT_DIR	2	Value	Description
		00	Traffic Direction not established / unidentified
		01	Nominal (Normally Traffic Direction as UP)
		10	Reverse (Normally Traffic Direction as DOWN)
EMERGENCY_STATUS	3	Value	Description
		000	No Emergency – Regular Packet
		001	Unusual toppage (Unusual Stop-page)
		010	SoS
		011	Roll Back Detected
		100	Head On Collision
		101	Rear End Collision
		110	Spare

Field	Size (Bits)	Possible Values	
LOCO_MODE	4	111	Spare
		Value	Description of Mode
		0001	STAND_BY
		0010	STAFF_RESPONSIBLE_MODE
		0011	LIMITED_SUPERVISION
		0100	FULL_SUPERVISION
		0101	OVERRIDE
		0110	ON_SIGHT
		0111	TRIP
		1000	POST_TRIP
		1001	REVERSE
		1010	SHUNTING
		1011	NON_LEADING
		1100	SYSTEM_FAILURE
		1101	ISOLATION
LAST_RFID_TAG	10	Tag ID of Last RFID Tag Read other than special tags like Banner Tag, Caution Tag	
TIN	7	Value	Description
		0	Ignore / Don't Care
		1 to 125	Track Identity Number as per Track Section occupied
		126	Onboard shed TIN
		127	Reserved for future
Brake_Applied	3	000	No over speed, No brakes by KA-VACH
		001	Over speed but no brakes by KA-VACH
		010	Normal Service Brake by KAVACH
		011	Full Service Brake by KAVACH
		100	Emergency Brake by KAVACH
		101 to 111	Spare
Lat-est_STATIC_PROF_ID_from_STN	6	1 to 62	Latest Static Profile ID received and taken into cognizance by Onboard.
LM_STAT-IC_PROF_Info_upto_MA	1	1 : Yes, 0: No	Whether the Landmark Information related to Speed and Gradient available with Onboard is up-to Movement Authority or not.

Field	Size (Bits)	Possible Values
Loco Health Status (Only for NMS Logging and report generation)	6	Onboard KAVACH health shall be prepared for length of 24bits and same to be included in each radio packet as per below procedure. Each bit indicates status of each sub system in the Onboard KAVACH unit
		Frame Number in Binary
		Onboard KAVACH Health
		xxxx xxxx xxxx x001
		First 6 bits of Onboard Health
		xxxx xxxx xxxx x011
		Second 6 bits of Onboard Health
		xxxx xxxx xxxx x101
		Third 6 bits of Onboard Health
		xxxx xxxx xxxx x111
		Fourth 6 bits of Onboard Health
Padding Bit	8	Fill Zero before MAC filled to make packet size in multiple of Bytes (8 bit)
MAC_CODE	16	Message Authentication code from PKT_TYPE to LM_STATIC_PROF_Info_upto_MA + fill Zeros to make it multiple of 128 bits.
PKT_CRC	16	Packet CRC
Total	160	

C.4.8 Onboard KAVACH Access Request / Block Section Radio Packet from Onboard KAVACH to Stationary KAVACH units

Field	Size (Bits)	Possible Values
PKT_TYPE	4	<ul style="list-style-type: none"> - 0000 – Undefined - 0001 – Station to Onboard Regular Packet - 0010 – Onboard to Station Regular Packet - 0011 – Access Authority Packet - 0100 – Additional Emergency Packet - 0101 – Static Profile Packet - 0110 – Onboard Access Request / Block Section Packet 0111- 1xxx – Reserved for future use

Field	Size (Bits)	Possible Values
PKT_LENGTH	7	Packet Length is in terms of bytes - 000 0000 – 1 byte - 000 0001 – 2 bytes - 111 1111 – 128 bytes
FRAME_NUM	17	1 to 86400 ((hr * 3600 + mm * 60 + ss)+ 1) example: 00:00:00 – Frame No 1 00:00:02 – Frame No. 3 23:59:58 – Frame No 86399
SOURCE_ONBOARD_ID	17	1 to 99999
ABS_LOCO_LOC	22	Absolute Location in meters
TRAIN_LENGTH	11	0: Unidentified/ Invalid 1 to 2047: Train length in mtrs
TRAIN_SPEED	8	Value Description
		0 to 254 Train Speed in kmph
		255 Train Speed unidentified
MOVEMENT_DIR	2	Value Description
		00 Direction of Movement of Train not established / unidentified
		01 Nominal (Normally Traffic Direction as UP)
		10 Reverse (Normally Traffic Direction as DOWN)
		11 Reserved for future use
EMERGENCY_STATUS	3	Value Description
		000 No Emergency – Regular Packet
		001 Side Collision (Unusual Stoppage)
		010 SoS
		011 Roll Back Detected
		100 Head ON Collision
		101 Rear End Collision
		110 Spare
		111 Spare
LOCO_MODE	4	Value Description of Mode
		0001 STAND_BY
		0010 STAFF_RESPONSIBLE_MODE
		0011 LIMITED_SUPERVISION

Field	Size (Bits)	Possible Values	
		0100	FULL_SUPERVISION
		0101	OVERRIDE
		0110	ON_SIGHT
		0111	TRIP
		1000	POST_TRIP
		1001	REVERSE
		1010	SHUNTING
		1011	NON_LEADING
		1100	SYSTEM_FAILURE
		1101	ISOLATION
LAST_RFID_TAG	10	Tag ID of Last RFID Tag Read other than special tags like Banner Tag, Caution Tag	
TIN	7	Value	Description
		0	Ignore / Don't Care
		1 to 125	Track Identity Number as per Track Section occupied
		126	Onboard shed TIN
		127	Reserved for future
Brake_Applied	3	000	No over speed, No brakes by KAVACH
		001	Over speed but no brakes by KAVACH
		010	Normal Service Brake by KAVACH
		011	Full Service Brake by KAVACH
		100	Emergency Brake by KAVACH
		101 to 111	Spare
Latest_STATIC_PROF_ID_from_STN	6	1 to 62	Latest Static Profile ID received and taken into cognizance by Onboard.
LM_STATIC_PROF_Info_upto_MA	1	1 : Yes, 0: No	Whether the Landmark Information related to Speed and Gradient available with Onboard is upto Movement Authority or not.
Onboard Health Status (Only for NMS Logging and report generation)	6	Onboard KAVACH health shall be prepared for length of 24bits and same to be included in each radio packet as per below procedure. Each bit indicates status of each sub system in the Onboard KAVACH unit	
		Frame Number in Binary	Onboard KAVACH Health
		xxxx xxxx xxxx x001	First 6 bits of Onboard Health
		xxxx xxxx xxxx x011	Second 6 bits of Onboard

Field	Size (Bits)	Possible Values
		Health
		xxxx xxxx xxxx x101 Third 6 bits of Onboard Health
		xxxx xxxx xxxx x111 Fourth 6 bits of Onboard Health
LO-CO_RANDOM_NUM_RL	16	Onboard Random Number. Onboard has to transmit same Random Number in every cycle until commencement of process of Communication Session Establishment by Stationary KAVACH unit that is until Onboard receives a Packet from Stationary KAVACH Unit with ONBOARD_RANDOM_NUM_RS.
FILL_ Zero	*	Fill Zero before MAC filled to make packet size in multiple of Bytes (8 bit)
PKT_CRC	16	Packet CRC
Total	160	

FOR FIELD

C.5 Version 2.0 Protocol

(This Version 2.0 Protocol is applicable for RDSO/SPN/196/2020 version 4.0.).

C.5.1 Onboard KAVACH equipped with Version 2.0 Radio Protocol shall be able to travel seamlessly in the territory of Stationary KAVACH with Version 1.0 Protocol without any problem. The vice-versa is not applicable.

C.5.2 Regular Radio Packet from Station/ Interlocked LC Gate / IBS to Onboard Kavach units

Note:

- (i) Stationary KAVACH shall send separate packet for each Loco.
- (ii) Only MA sub packet shall be sent at every cycle. SSP and other sub packet shall be sent when MA is extended or modified.

Field	Size (bits)	VALUE	Description	Remarks
PKT_TYPE	4	1001(9)	- 0000- 0111: Radio packets for KAVACH V3.2	Revised
			Radio packets for KAVACH V4.0:	
			- 1000: Reserved for future use	
			- 1001: Station to Onboard Regular Packet	
			- 1010: Onboard to Station Regular Packet	
			- 1011: Access Authority Packet	
			- 1100: Additional Emergency Packet	
			- 1101: Onboard Access Request	
			- 1110 to 1111: Reserved for future use	
PKT_LENGTH	10		Packet Length is in terms of bytes	For LTE and to accommodate more info.
			- 00 0000 0000 - 1 byte	
			- 00 000 0001 – 2 bytes	
			
			- 11 1111 1111 – 1024 bytes	
FRAME_NUM	17		1 to 86400 ((hr * 3600 + mm * 60 + ss)+ 1)	
			eg: 00:00:00 - Frame No 1	
			00:00:02 - Frame No. 3	

ISO 9001: 2015	Effective from 26.10.2023	RDSO/SPN/196/2020	Version 4.0 d3	Amdt-8
Document Title : Specification of Kavach (The Indian Railway ATP)- Multiple Access Scheme & Radio Communication Protocol				Annexure-C

Field	Size (bits)	VALUE	Description	Remarks
			
			23:59:58 - Frame No 86399	
SOURCE_STN_ILC_IBS_ID	16		Unique Code, Valid values from 1 to 65535 (Purchaser Railway to Decide) (It will be unique for one KMS)	Spec 3.2
SOURCE_STN_ILC_IBS_VERSION	3		0: Not used 1 to 7: Kavach Version 1 : Kavach Specification 3.2 2 : Kavach Specification 4.0	Spec 3.2
DEST_LOCO_ID	20		1 to 999999	Modified
REF_PROF_ID	4		This is the Profile number of the below packets transmitted to Onboard KAVACH and is specific to it. On every update of MA, these packets are to be retransmitted. 0000: No profile information. On receipt of Access Authority Packet, the onboard KAVACH shall send '0000' retaining the profile already available for speed supervision. 0001 to 1111: Valid profile information This is associated with TurnOut_INFO, TSR_INFO, TAG_LINKING, NEUTRAL_INFO, etc., Onboard KAVACH is expected to acknowledge the receipt of this profile ID. Stationary KAVACH will stop transmission of this profile after the receipt of acknowledgement.	New

MANISH KUMAR GUPTA <small>Digitally signed by MANISH KUMAR GUPTA Date: 2023.12.12 16:04:06 +05'30'</small>	RAVINDRA NATH SINGH <small>Digitally signed by RAVINDRA NATH SINGH Date: 2023.12.12 16:07:34 +05'30'</small>	PAVANKUMAR GUDAVALLETTI <small>Digitally signed by PAVANKUMAR GUDAVALLETTI Date: 2023.12.12 16:11:01 +05'30'</small>	Page 35 of 67
Manish Kumar Gupta SSE/S&T	R. N. Singh ADE/Signal	G. Pavan Kumar ED/Tele-II	

Field	Size (bits)	VALUE	Description	Remarks
LAST_REF_RFID	10		Below track profile data is given from last RFID as a reference position. This RFID shall be one of the last ten tags read by Onboard KAVACH. Onboard KAVACH shall retain last 11 RFID Tags along with their location. From the last 10 RFID Tags reported by Onboard KAVACH, Stationary KAVACH shall send the profile with respect to the most recently received tag. Stationary KAVACH shall send the actual distances of start and end locations of each element in the profile with respect to LAST_REF_RFID. Stationary and Onboard KAVACH shall not consider Foreign tags and wrong line tags as LAST_REF_RFID.	New
DIST_PKT_START	15		<p>Signed Value.</p> <p>-16384m to +16383m.</p> <p>Distance in meters from LAST_REF_RFID from where below sub packets data starts. For this distance there is no profile or already profile might be given.</p> <p>When the value is negative, the onboard KAVACH shall supervise the profile from the REAR end of the train.</p> <p>When the value is positive, the onboard KAVACH shall merge with the existing profile, if available and supervise MRSP. Positive correction shall be sent by Stationary KAVACH in exceptional cases.</p> <p>When current Onboard route is unknown, this value to be from shifted position reference (eg. from approaching signal foot).</p>	New
PKT_DIR	2		<p>- 00 unidentified</p> <p>- 01 Nominal</p> <p>- 10 Reverse</p> <p>- 11 Spare</p>	New

Field	Size (bits)	VALUE	Description	Remarks
Padding Bits	3		If required to make header length as multiple of bytes	
MOVEMENT AUTHORITY PACKET				
SUB_PKT_TYPE	4	0000(0)	- 0000: Movement Authority	New
			- 0001: Static Speed Profile	
			- 0010: Gradient Profile	
			- 0011: LC gate profile	
			- 0100: Turnout Speed Profile	
			- 0101: Tag Linking Information	
			- 0110: Track Condition data	
			- 0111: Temporary speed Restrictions Profile	
			- 1000 to 1111: Reserved for future use	
SUB_PKT_LENGT H_MA	7		Length in bytes. Max 128 bytes (1024 bits).	New
FRAME_OFFSET	4	0001 to 1110	Frame offset = (Stationary Kavach frame number - last received Onboard Kavach frame number)/2 Cyclic subtraction to be ensured at 00:00 hours.	New
DEST_LOCO_SOS	4		SoS/ Emergency Condition to Specific Onboard	Revised
			under following conditions	
			0000: No SoS /Emergency	
			0001: Foreign RFID	
			0010: Reserved.	
			0011: Onboard Odo error is >= 120m	
			0100: Detection of SPAD	
			0101: Rear-end collision	
			0110: Head-On collision	
			0111: Violation of Shunting limits in shunt mode	
			1000 : Station General SoS	
			1001 to 1111: Reserved	
TRAIN_SECTION_ TYPE	2		00: Station Section	
			01: Absolute Block	
			10: Autoblock	
			11: Reserved	

Field	Size (bits)	VALUE	Description	Remarks
CUR_SIG_INFO	17		a16a15a14a13a12a11a10a9a8a7a6a5a4a3a2a1a0	modified
			a4 to a0 : (to be defined and displayed only for applicable Home / Routing Home / Starter / Intermediate Starter)	
			00000 : To be sent when line number information is not applicable..	
			11111 : Line Number in excess of 30 Decimal, in this case, no line number to be displayed on DMI.	
			11110 : Goods Lines (in case of any Goods Line > 30 Decimal, no need to display Line Number on DMI, however, the information to be displayed on DMI that the Train is going to Goods Line). It is clarified that even for multiple Goods Lines, Line Number shall not be communicated to Onboard KAVACH Unit and distinction among Goods Line would not be available through DMI to Onboard Pilot.	
			a8 to a5: Line Name 0000-Up Signal 0001-Down Signal 0010-Up Fast Signal 0011-Down Fast Signal 1000-Up Slow Signal 1001-Down Slow Signal 1010-Up Main Signal 1011-Down Main Signal 1100-Up Sub Signal 1101-Down Sub Signal 11xx-Future Use. This field is not to be used for any purpose other than display associated with signal.	

Field	Size (bits)	VALUE	Description	Remarks
		a14 to a9	Type of Signal	
		0	Undefined - nothing to be displayed on DMI	
		010xxx	Various Distant Signals & Auto Signals	
			010000 - Distant	
			010001 - Inner Distant	
			010010 - Gate Distant	
			010011 - Gate Inner Distant	
			010100 - IB Distant	
			010101 - IB Inner Distant	
			010110 - Auto Signal (Excludes Gate Stop Signal in Auto Territory)	
			010111 - Semi-Automatic Signal with A-marker lit	
		0110xx	Various Home Signals	
			011000 - Main Home without Junction Route Indicator	
			011001 - Main Home with Junction Route Indicator	
			011010 - Routing Home without Junction Type Route Indicator	
			011011 - Routing Home with Junction Type Route Indicator	
		0111xx	Various types of Starter Signals	
			011100 - Mainline Starter	
			011101 - Loopline Starter	
			011110 - Intermediate Starter	
		x0xxxx	Other Misc Signals	
			000001 - Advanced Starter	
			000010 - IB Signal	
			000011 - Gate Stop Signal	
			000100 - Calling-on Signal	
			000101 - Advanced Starter-cum-Gate Signal	
			000110 - Gate-cum-Distant	

Field	Size (bits)	VALUE	Description	Remarks
			000111 - Advanced Starter-cum-Distant Signal	
			100011 - Gate Stop Signal in Auto Territory	
			100100 - Semi Automatic Signal without A marker lit	
			100101- Advance Starter-cum-Gate Inner Distant Signal	
			100110- Gate-cum-Inner Distant Signal	
			100111- Gate Inner Distant-cum-Distant Signal	
			101000- IB Signal-cum-Gate Distant	
			101001- IB Signal-cum-Gate Inner Distant	
			101010- IB Signal-cum-Distant Signal	
			101011- Advanced Starter-cum- IB Distant	
			101100- Starter-cum- IB Distant Signal	
			101101- Stop Board/Buffer Stop	
			101110- Gate cum IB Distant Signal	
			101111- Gate cum IB Inner Distant Signal	
			001000 - Only in RFID Tag, not in Radio Packet.	
			OnboardKavach shall apply Brake when it crosses signal with this code (dead stop locations - such as end of berthing tracks with Shunt Signals) in normal mode.	
			The full list of signals along with corresponding binary codes will be issued through a Technical Advisory Note (TAN). Modification of nomenclature shall not result in change of Executive Software.	
CUR_SIG_ASPECT	6	Value	Description	6 bit uniformity required.
		0	Unidentified	
		000001	Red	
		000010	Yellow without Display of Route Indication	
		000011	Yellow with Pos1 Junction Type Route Indication (left)	

ISO 9001: 2015	Effective from 26.10.2023	RDSO/SPN/196/2020	Version 4.0 d3	Amdt-8
Document Title : Specification of Kavach (The Indian Railway ATP)- Multiple Access Scheme & Radio Communication Protocol				Annexure-C

Field	Size (bits)	VALUE	Description	Remarks
		000100	Yellow with Pos2 Junction Type Route Indication (left)	
		000101	Yellow with Pos3 Junction Type Route Indication (left)	
		000110	Yellow with Pos4 Junction Type Route Indication (right)	
		000111	Yellow with Pos5 Junction Type Route Indication (right)	
		001000	Yellow with Pos6 Junction Type Route Indication (right)	
		001001	Spare	
		001010	Double Yellow	
		001011	Green	
		001100	Double Yellow with Pos1 Junction Type Route Indication (left)	
		001101	Double Yellow with Pos4 Junction Type Route Indication (right)	
		001110	AG Marker OFF	
		001111	Red with Calling-on at OFF	
		'010000 to 010111	Spare	
		'011000	Stop Board / Buffer Stop	
		011001 to 011111	Spare	
		100000 to 111111	Yellow with Stencil route 1 to 32	
		a15:	Signal override permission when danger (0: at standstill, 1: while running- permissive signals controlled by such stop signals shall also be considered)	
		a16	Stop Signal (0: No, 1: Yes)	
NEXT_SIG_ASPECT	6	0	In case current Signal Aspect is RED (Undefined)	

MANISH KUMAR GUPTA <small>Digitally signed by MANISH KUMAR GUPTA Date: 2023.12.12 16:04:06 +05'30'</small>	RAVINDRA NATH SINGH <small>Digitally signed by RAVINDRA NATH SINGH Date: 2023.12.12 16:07:34 +05'30'</small>	PAVANKUMAR GUDAVALLETI <small>Digitally signed by PAVANKUMAR GUDAVALLETI Date: 2023.12.12 16:11:01 +05'30'</small>	Page 41 of 67
Manish Kumar Gupta SSE/S&T	R. N. Singh ADE/Signal	G. Pavan Kumar ED/Tele-II	

ISO 9001: 2015	Effective from 26.10.2023	RDSO/SPN/196/2020	Version 4.0 d3	Amdt-8
Document Title : Specification of Kavach (The Indian Railway ATP)- Multiple Access Scheme & Radio Communication Protocol				Annexure-C

Field	Size (bits)	VALUE	Description	Remarks
		-	Codes as given in CUR_SIG_ASPECT above	
APPR_SIG_DIST	15		Approaching signal distance in meter from the last reference RFID Tag (valid up to 32767m)	Spec 3.2
AUTHORITY_TYPE	2		00: Not to be used	New
			01: OS Authority (Distance allowed in OS mode with speed restriction)	
			10: FS Authority (Distance allowed in FS mode)	
			11: SR Authority. When MA is required to be extended beyond border signal and adjacent S-KAVACH communication failed, Authorised speed shall be unknown (63). Onboard KAVACH shall ignore APPR_SIG_DIST and MA_W_R_T_SIG.	
AUTHOR- IZED_SPEED	6		Only If AUTHORITY_TYPE = '01', AUTHORIZED_SPEED variables follows.	New
			0-50: 0 to 250 kmph, (in revolution of 5Kmph)	
			i.e 3: 15 kmph to be sent when ROUTE_RFID_CNT is 63 (unknown route), No Track profile packets to be sent.	
			51-61: Reserved for future use,	
			62: 8 Kmph (Configuarble) for auto signal override during night	
			63: Unknown	
MA_W_R_T_SIG	16		0 to 65534 in meters.	Spec 3.2
			65535: Unknown (Onboard Kavach continues in SR Mode).	

MANISH KUMAR GUPTA <small>Digitally signed by MANISH KUMAR GUPTA Date: 2023.12.12 16:04:06 +05'30'</small>	RAVINDRA NATH SINGH <small>Digitally signed by RAVINDRA NATH SINGH Date: 2023.12.12 16:07:34 +05'30'</small>	PAVANKUMAR GUDAVALLETTI <small>Digitally signed by PAVANKUMAR GUDAVALLETTI Date: 2023.12.12 16:11:01 +05'30'</small>	Page 42 of 67
Manish Kumar Gupta SSE/S&T	R. N. Singh ADE/Signal	G. Pavan Kumar ED/Tele-II	

Field	Size (bits)	VALUE	Description	Remarks
			The Movement Authority transmitted shall be the distance of End of Authority from reference RFID position. In order to cater the delays and failure in acquiring information due to missing radio frames, the Movement Authority in Onboard shall be deduced as the Movement authority corresponding to particular frame received from Stationary Kavach Unit minus the actual distance traveled by the Onboard from that reference RFID position.	
REQ_SHORTEN_MA	1		0: No request from trackside for shortening MA 1: New request from trackside for shortening MA	New (Future Use)
NEW_MA	16		Only If REQ_SHORTEN_MA = 1, NEW_MA variables follow. New MA due to signal cancellation request from EI	New (Future Use)
TRN_LEN_INFO_STS	1		0 – No Train Length Info, 1 – Train Length Info follows Only If TRN_LEN_INFO_STS = 1, TRN_LEN_INFO_TYPE and remaining variables follow.	Spec 3.2
TRN_LEN_INFO_TYPE	1		0 – means. REF_FRAME_NUM_TL and REF_OFFSET_INT_TL pertain to “Start” frame and offset. 1 - means REF_FRAME_NUM_TL and REF_OFFSET_INT_TL pertain to “END” frame and offset.	Spec 3.2

Field	Size (bits)	VALUE	Description	Remarks
REF_FRAME_NUM_TLM	17		1 to 86400 ((hr * 3600 + mm * 60 + ss) + 1) Example : 00:00:00 - Frame No 1 00:00:02 - Frame No. 3 23:59:58 - Frame No 86399	Spec 3.2
REF_OFFSET_INT_TLM	8		0 to 200 (10ms resolution)	Spec 3.2
NEXT_STN_COMM	1		0 – No next station handover 1 – Requires next station handover Only If NEXT_STN_COMM = 1, APPR_STN_ILC_IBS_ID variables follow.	Spec 3.2
APPR_STN_ILC_IBS_ID	16	1 to 65535	Approaching next stationary Kavach ID	Spec 3.2
Padding Bits	x		If required to make sub packet length as multiple of bytes	
STATIC SPEED PROFILE				
SUB_PKT_TYPE	4	0001(1)	- 0000: Movement Authority	New
			- 0001: Static Speed Profile	
			- 0010: Gradient Profile	
			- 0011: LC gate profile	
			- 0100: Turnout Speed Profile	
			- 0101: Tag Linking Information	
			- 0110: Track Condition data	
			- 0111: Temporary speed Restrictions Profile	
			- 1000 to 1111: Reserved for future use	
SUB_PKT_LENGTH_SSP	7		Length in bytes. Max 128 bytes (1024 bits).	New
LM_Speed_Info_COUNT	5		1 to 31	Spec 3.2
LM_Static_Speed_Distance	15		Value in meters i.e. ranging from 0 – 32.76 km	Revised

Field	Size (bits)	VALUE	Description	Remarks
LM_Static_Speed_Class	1		0 – Universal Speed will follow 1 – Classified Speeds A,B,C will follow	
LM_Static_Speed_Value		Class Value	Description	Revised
			0: Reserved 1- 50: 5-250 Kmph, Speed in steps of 5kmph. Max Speed = 250 kmph 51--61 : Reserved for future use 62 – 8 Kmph 63 : Unknown	
	6	0	Universal Static Speed	
	6	1	Static Speed for Category A Trains (LE / Passenger Trains)	
	6		Static Speed for Category B Trains (Loaded Goods Trains)	
	6		Static Speed for Category C Trains (Empty Goods Trains)	
Padding Bit	x		If required to make sub packet length as multiple of bytes	
GRADIENT PROFILE				
SUB_PKT_TYPE	4	0010 (2)	- 0000: Movement Authority	New
			- 0001: Static Speed Profile	
			- 0010: Gradient Profile	
			- 0011: LC gate profile	
			- 0100: Turnout Speed Profile	
			- 0101: Tag Linking Information	
			- 0110: Track Condition data	
			- 0111: Temporary speed Restrictions Profile	
			- 1000 to 1111: Reserved for future use	
SUB_PKT_LENGTH_GRAD	7		Length in bytes. Max 128 bytes (1024 bits).	New
LM_Grad_Info_COUNT	5		1 to 31	Spec 3.2
LM_Gradient_Distance	15		Value in meters i.e. ranging from 0 – 32.76 km	Revised
LM_GDIR	1		0 = downhill	Spec 3.2
			1 = uphill	

Field	Size (bits)	VALUE	Description	Remarks
LM_GRADIENT_VALUE	5		<p>This is the absolute value of the average gradient between two defined position as described in Annexure-I . Values lie between 0 to 30. Value 31 : reserved.</p> <p>0 : Gradient not steeper than “1 in 1000”. Includes Level Gradient</p> <p>1 : Gradient from “1 in 1000” to not steeper than “1 in 500”</p> <p>2 : Gradient from “1 in 500” to not steeper than “1 in 333”</p> <p>3 : Gradient from “1 in 333” to not steeper than “1 in 250”</p> <p>4 : Gradient from “1 in 250” to not steeper than “1 in 200”</p> <p>....</p> <p>n : Gradient from “1 in (1000/n)” to not steeper than “1 in {1000/(n+1)}”</p> <p>....</p> <p>30 : Gradient steeper than “1 in 33”</p> <p>31: Reserved</p>	
Padding	X		If required to make sub packet length as multiple of bytes	
LC Gate profile				
SUB_PKT_TYPE	4	0011(3)	- 0000: Movement Authority	New
			- 0001: Static Speed Profile	
			- 0010: Gradient Profile	
			- 0011: LC gate profile	
			- 0100: Turnout Speed Profile	
			- 0101: Tag Linking Information	
			- 0110: Track Condition data	
			- 0111: Temporary speed Restrictions Profile	
SUB_PKT_LENGTH	7		- 1000 to 1111: Reserved for future use	New
			Length in bytes. Max 128 bytes (1024 bits).	
LM_LC_Info_CNT	5		0 to 31	Spec 3.2
LM_LC_Distance	15		Value in meters i.e. ranging from 0 – 32.76 km	Revised

Field	Size (bits)	VALUE	Description	Remarks
			This is the start distance of the LC gate from reference position.	
LM_LC_ID_Numeric	10		0: Invalid	Spec 3.2
			1 – 1021: LC Gate Number	
			1022: LC Gate Number other than 1 to 1022 - out of range	
			(Display xx on DMI)	
			1023: Spare	
LM_LC_ID_Alpha_Suffix	3	Value	Suffix of Gate	Spec 3.2
		000	No suffix	
		001	a	
		010	b	
		011	c	
		100	d	
		101	e	
		110	Out of Range (Display xx on DMI)	
		111	Spare	
LM_LC_Manning_Type	1		0 : Manned, 1 : Unmanned	Spec 3.2
LM_LC_Class	3	Value	Suffix of Gate	Spec 3.2
		000	Spl	
		001	A	
		000	B1	
		011	B2	
		100	B (where not specified in terms of B1/B2)	
		101	C	
		110	D	
		111	Spare	
LM_LC_Auto_Whistling_Enabled	1		0 : No, 1 : Yes	Spec 3.2
LM_LC_Auto_Whistling_Type	2	Value	Auto Whistling Type 00 Distance Based 01 Time Based (Not Used) 10 Configured Pattern Based (Not Used) 11 Spare	Spec 3.2
Padding Bit	X		If required to make sub packet length as multiple of bytes	
TURNOUT SPEED PROFILE				

Field	Size (bits)	VALUE	Description	Remarks
SUB_PKT_TYPE	4	0100 (4)	- 0000: Movement Authority	New
			- 0001: Static Speed Profile	
			- 0010: Gradient Profile	
			- 0011: LC gate profile	
			- 0100: Turnout Speed Profile	
			- 0101: Tag Linking Information	
			- 0110: Track Condition data	
			- 0111: Temporary speed Restrictions Profile	
			- 1000 to 1111: Reserved for future use	
SUB_PKT_LENGTH_TSP	7		Length in bytes. Max 128 bytes (1024 bits).	New
TO_CNT	2		Number of turnouts from reference position	New
			0: No turnouts	
			1-3: No. of turnouts follow	
TO_SPEED	5	Value	Description	Revised
		00000	Not Used	
		00001	Upto 5 kmph	
		00010	Upto 10 kmph	
		00011	Upto 15 kmph	
		--		
		--		
		10010	Upto 90 Kmph	
		10011-11110	Reserved for future use	
		11111	Unrestricted	
DIFF_DIST_TO	15		Only If TO_SPEED = restricted, DIFF_DIST_TO variable follow. Starting Distance of the turnout from last reference RFID. Value in meters i.e. ranging from 0 – 32.76 km	Revised
TO_SPEED_REL_DISTANCE	12		Only If TO_SPEED = restricted, DIFF_DIST_TO variable follow. Turnout release distance. Value in meters i.e. ranging from 0 - 4095 m. Value to be given upto end of turnout or upto other location will be defined by railways.	Revised

Field	Size (bits)	VALUE	Description	Remarks
Padding Bits	x		If required to make sub packet length as multiple of bytes	
TAG LINKING INFORMATION				
SUB_PKT_TYPE	4	0101 (5)	- 0000: Movement Authority	New
			- 0001: Static Speed Profile	
			- 0010: Gradient Profile	
			- 0011: LC gate profile	
			- 0100: Turnout Speed Profile	
			- 0101: Tag Linking Information	
			- 0110: Track Condition data	
			- 0111: Temporary speed Restrictions Profile	
			- 1000 to 1111: Reserved for future use	
SUB_PKT_LENTH_TLI	7		Length in bytes. Max 128 bytes (1024 bits).	New
DIST_DUP_TAG	4		Distance between Main and duplicate tag. 0000 shall be sent when the tags are placed closer than 1 meter. 1111 is invalid In a yard, the distance between main and duplicate tag is mentioned in the RFID Tag data format. This distance shall be kept common for a yard and shall be sent by a stationary KAVACH in TLI sub-packet.	New
ROUTE_RFID_CNT	6		List of expected approaching RFID tags from reference position up to the End of Authority. Station updates the new list only when required.	New
			0: No tag shall be crossed by Onboard KAVACH. eg: In approach of danger signal.	
			1-62: expected route RFID count.	
			63 unknown route (15 Kmph speed restriction in OS mode).	
			Only If RFID_CNT = 1 to 62, RFID_TAG and LINK_REACTION variables follow.	

Field	Size (bits)	VALUE	Description	Remarks
<i>DIST_NXT_RFID</i>	11		Distance of next RFID from previous RFID (first tag will be from last reference RFID) in meters i.e. 2047 meter.	New
<i>NXT_RFID_TAG_ID</i>	10		Next RFID Tag ID	New
<i>DUP_TAG_DIR</i>	1		Linking Direction of Duplicate Tag w.r.t Main Tag 0: Duplicate Tag in Nominal Direction (+)/No Linking distance correction is required for T-Tag and A-Tag 1: Duplicate Tag in Reverse Direction (-)	New
ABS_LOC_RESET	1		0 – No Locational Error (The following bits will not be padded) 1 – Location Correction (New Section) Location shall get corrected in block section after 100m from Advance Starter. Onboard shall not apply brakes due to any of these reasons. When this information is not available, linking distance given in N-tag shall be used to avoid abnormal train trip due to location correction. Station shall able to transmit MA, SSP, TSR and maintain radio communication even after location reset. only If ABS_LOC_RESET>0, below variables follow. In Given MA, single location reset is considered.	
START_DIST_TO_LOC_RESET	15		This is the start distance of the Normal tag (from the Onboard current location) in which location correction is done. Value in meters.	
ADJ_LOCO_DIR	2		This is expected Onboard direction after passing location correction N-tag 00 – Not Known 01 – Nominal 10 – Reverse 11 – Deduce from Tags	

Field	Size (bits)	VALUE	Description	Remarks
ABS_LOC_CORRECTION	23		This is the new absolute location from Adjustment/Junction Tag location correction	
ADJ_LINE_CNT	3		Adjacent line TINs along the MA for unusual stoppage detection.	New
			0: No adjacent lines, Self block section TIN will follow.	
			1-5: Number of Adjacent lines including occupied self block section TIN.	
			6: Reserved 7: unknown	
LINE_TIN	9		Self and Adjacent Line TIN Only If ADJ_LINE_CNT = 0 to 5, LINE_TIN variable will follow.	New
Padding Bits	x		If required to make sub packet length as multiple of bytes	
TRACK CONDITION DATA				
SUB_PKT_TYPE	4	0110 (6)	- 0000: Movement Authority	New
			- 0001: Static Speed Profile	
			- 0010: Gradient Profile	
			- 0011: LC gate profile	
			- 0100: Turnout Speed Profile	
			- 0101: Tag Linking Information	
			- 0110: Track Condition data	
			- 0111: Temporary speed Restrictions Profile	
			- 1000 to 1111: Reserved for future use	
SUB_PKT_LENTH_TC	7		Length in bytes. Max 128 bytes (1024 bits).	New
TRACKCOND_CNT	4		Track condition in MA region from reference RFID	New
TRACK-COND_TYPE	4		- 0000: Not used	New
			- 0001: Dead Stop	

Field	Size (bits)	VALUE	Description	Remarks
			- 0010: Radio hole (MA is valid upto Comm. fail time out)	
			- 0011: Non stopping area	
			- 0100: Tunnel stopping area	
			- 0101: Powerless section (Neutral section)	
			- 0110: Sound horn	
			- 0111: Reversing area	
			-1000: Fouling Mark location	
			-1001: KAVACH Territory Exit. (Not to validate RFID linking beyond this location).	
			- 1010 to 1111: Reserved for future use	
START_DIST_TRACKCOND	15		Start distance to Track condition from reference RFID.	New
			Value in meters i.e. ranging from 0 – 32.76 km	
LENGTH_TRACKCOND	15		Length of the Track condition.	New
			Value in meters i.e. ranging from 0 – 32.76 km	
Padding Bit	X		If required to make sub packet length as multiple of bytes	
TEMPORARY SPEED RESTRICTIONS PROFILE				
SUB_PKT_TYPE	4	0111 (7)	- 0000: Movement Authority	New
			- 0001: Static Speed Profile	
			- 0010: Gradient Profile	
			- 0011: LC gate profile	
			- 0100: Turnout Speed Profile	
			- 0101: Tag Linking Information	
			- 0110: Track Condition data	
			- 0111: Temporary speed Restrictions Profile	
			- 1000 to 1111: Reserved for future use	
SUB_PKT_LENGTH_TSR	7		Length in bytes. Max 128 bytes (1024 bits).	New
TSR_STATUS	2		00 – No applicable TSR for the current MA	New

Field	Size (bits)	VALUE	Description	Remarks
			01 – No Latest TSR Information (Onboard KAVACH shall transit to SR Mode, No MA to be extended by Stationary KAVACH).	
			10 – Latest TSR Information	
			11 – Reserved	
TSR_Info_CNT	5		0 to 31	
TSR_ID	8		This is the ID of TSR received from TSR management system.	Revised
TSR_Distance	15		This is the distance to TSR starting point from reference RFID.	Revised
			Value in meters i.e. ranging from 0 – 32.76 km	
TSR_Length	15		Length of TSR.	Revised
			Value in meters i.e. ranging from 0 – 32.76km	
TSR_Class	1		0 – Universal Speed	
			1 – Classified Speed	
TSR_Universal_Speed	6		only if Q_TSR_CLASS = 0, LM_TSR_Universal_Speed variable follow	
		Value	Speed in kmph	
		0	Dead stop	
		N = 1 to 40	= 5*N (5,10,15, ...,200 kmph)	
		41 to 61	Reserved for future use	
		62	8 kmph	
		63	Unknown	
TSR_ClassA_Speed	6		only if LM_TSR_Class = 1, LM_TSR_ClassA_Speed variable follow.	
			Values are Same as LM_TSR_Universal_Speed.	
TSR_ClassB_Speed	6		only if LM_TSR_Class = 1, LM_TSR_ClassB_Speed variable follow.	
			Values are Same as LM_TSR_Universal_Speed.	
TSR_ClassC_Speed	6		only if LM_TSR_Class = 1, LM_TSR_ClassC_Speed variable follow.	

Field	Size (bits)	VALUE	Description	Remarks
			Values are Same as LM_TSR_Universal_Speed.	
TSR_Whistle	2		00: No Whistle	
			01: Whistle blow	
			10-11: Spare	
Padding Bits	x		If required to make sub packet length as multiple of bytes	
End of the sub packets				
LO-CO_Specific_MAC_CODE	32		Calculated from starting field PACKET_TYPE to last Sub-Packet padding bits	Modified
End of the packet				
PKT_CRC	32		Packet CRC	

C.5.3 Onboard to Station Regular Packet:

Field	Size (bits)	VALUE	Description	Remarks
PKT_TYPE	4	1010(10)	- 0000: Undefined	Revised
			- 0000- 0111: Radio packets for KAVACH V3.2	
			Radio packets KAVACH V4.0:	
			- 1000: Reserved for future use	
			- 1001: Station to Onboard Regular Packet	
			- 1010: Onboard to Station Regular Packet	
			- 1011: Access Authority Packet	
			- 1100: Additional Emergency Packet	
			Example :	
PKT_LENGTH	7		- 1110 to 1111: Reserved for future use	Spec 3.2
			- Packet Length is in terms of bytes	
			- 000 0000 - 1 byte	
			- 000 0001 – 2 bytes	

ISO 9001: 2015	Effective from 26.10.2023	RDSO/SPN/196/2020	Version 4.0 d3	Amdt-8
Document Title : Specification of Kavach (The Indian Railway ATP)- Multiple Access Scheme & Radio Communication Protocol				Annexure-C

Field	Size (bits)	VALUE	Description	Remarks
		 - 111 1111 – 128 bytes	
FRAME_NUM	17		1 to 86400 ((hr * 3600 + mm * 60 + ss)+ 1)	Spec 3.2
			Example :	
			00:00:00 - Frame No 1	
			00:00:02 - Frame No. 3	
		 23:59:58 - Frame No 86399	
SOURCE_LOCO_ID	20		1 to 999999 (Separate Look up table for EMU/DEMU) 0 is an invalid Loco ID.	
SOURCE_LOCO_VERSION	3		0: Not used	New
			1 to 7: Kavach Version	
			1: Kavach Specification 3.2	
			2: Kavach Specification 4.0	
ABS_LOCO_LOC	23		Absolute Location in meters 8388607 is invalid Location.	
L_DOUBTOVER	9		This is the over-reading amount plus the 5 m location accuracy of RFID Tag + 5% odometry error+Reader Offset in front (ROF). This information shall be used for distance supervision of targets on safe-side (eg. PSR, TSR, Linking, etc.)	New
L_DOUBTUNDER	9		This is the under-reading amount plus the 5 m location accuracy of RFID Tag + 5% odometry error+Reader Offset from Rear (ROR). This information shall be used for distance supervision of targets on safe-side (eg. PSR, TSR, Linking, etc.)	New

MANISH KUMAR GUPTA <small>Digitally signed by MANISH KUMAR GUPTA Date: 2023.12.12 16:04:06 +05'30'</small>	RAVINDRA NATH SINGH <small>Digitally signed by RAVINDRA NATH SINGH Date: 2023.12.12 16:07:34 +05'30'</small>	PAVANKUMAR GUDAVALLETTI <small>Digitally signed by PAVANKUMAR GUDAVALLETTI Date: 2023.12.12 16:11:01 +05'30'</small>	Page 55 of 67
Manish Kumar Gupta SSE/S&T	R. N. Singh ADE/Signal	G. Pavan Kumar ED/Tele-II	

Field	Size (bits)	VALUE	Description	Remarks
TRAIN_INT	2		Train Integrity status of the train 00: No Train Integrity information available 01: Train integrity confirmed by integrity monitoring device 10: Train integrity confirmed by Loco Pilot 11: Reserved	New (Future Use)
TRAIN_LENGTH	11		0: Unidentified/ Invalid 1 to 2047: Train length in mtrs	Spec 3.2
TRAIN_SPEED	9	Value	Description	New
		0 to 400	Train Speed in kmph	
		401 to 510	Reserved for future use	
		511	Train Speed unidentified	
MOVE-MENT_DIR	2	Value	Description	Spec 3.2
		00	Traffic Direction not established / unidentified	
		01	Nominal <i>(Normally Traffic Direction as UP)</i>	
		10	Reverse <i>(Normally Traffic Direction as DOWN)</i>	
		11	Reserved for future use	
EMERGENCY_STATUS	3	Value	Description	
		000	No Emergency - Regular Packet	
		001	Unusual Stoppage in block section	
		010	SoS	
		011	Roll Back Detected	
		100	Head On Collision	
		101	Rear End Collision	
		110	Parting SoS	
		111	Spare	
LOCO_MODE	4	Value	Description	
		0001	STAND_BY	
		0010	STAFF_RESPONSIBLE_MODE	
		0011	LIMITED_SUPERVISION	
		0100	FULL_SUPERVISION	

Field	Size (bits)	VALUE	Description	Remarks
		0101	<i>OVERRIDE</i>	
		0110	<i>ON_SIGHT</i>	
		0111	<i>TRIP</i>	
		1000	<i>POST_TRIP</i>	
		1001	<i>REVERSE</i>	
		1010	<i>SHUNTING</i>	
		1011	<i>NON_LEADING</i>	
		1100	<i>SYSTEM_FAILURE</i>	
		1101	<i>ISOLATION</i>	
LAST_RFID_TAG	10		Tag ID of Last RFID Tag Read	
TAG_DUP	1		0: Main Tag 1: Duplicate Tag	
TAG_LINK_INFO	3	000	No Tag missing	New
		001	Duplicate Tag missing	
		010	Main Tag missing	
		011	Both Tag missing	
		100	Tag position interchanged	
		101	Both Tags have same location info	
		110	Intertag distance less than DIST_DUP_TAG	
		111	Intertag distance greater than DIST_DUP_TAG	
TIN	9	Each TIN is 9 bits. Track identification number occupied by front end of onboard KAVACH.		
		Value	Description	
		0	<i>Ignore / Don't Care</i>	
		1 to 250	<i>Track Identity Number as per Track Section Occupied</i>	
		251	<i>Onboard shed TIN</i>	
		252-511	<i>Reserved for future use</i>	
Brake_Applied	3	Value	Description	
		0	No over speed, No brakes by Kavach	
		1	Over speed but no brakes by Kavach	
		10	Normal Service Brake by Kavach (not to be sent when hardwire interface is not done. For ex: in EMUs and Trainsets)	New

ISO 9001: 2015	Effective from 26.10.2023	RDSO/SPN/196/2020	Version 4.0 d3	Amdt-8
Document Title : Specification of Kavach (The Indian Railway ATP)- Multiple Access Scheme & Radio Communication Protocol				Annexure-C

Field	Size (bits)	VALUE	Description	Remarks
		11	Full Service Brake by Kavach	
		100	Emergency Brake by Kavach	
		101 to 111	Spare	
NEW_MA_REPLY	2		0: No request for Shorten MA from Station KAVACH 1: Request to Shorten MA granted 2: Request to Shorten MA rejected 3: reserved	New (Future Use)
LAST_REF_PROFILE_NUM	4	-	Indicates the last track profile number received. To ensure RFID linking and TSR data received and taken into cognizance by Onboard.	
			0: Indicates no track profile data with Onboard KAVACH in given MA. On receipt of Access Authority Packet, the onboard KAVACH shall send '0000' retaining the profile already available for speed supervision.	
SIG_OV	1		Request for OS MA to pass the approaching signal at danger when Authority to Proceed is available with LP.	New
			0: Signal Override Inactive	
			1: Signal Override Active	

MANISH KUMAR GUPTA <small>Digitally signed by MANISH KUMAR GUPTA Date: 2023.12.12 16:04:06 +05'30'</small>	RAVINDRA NATH SINGH <small>Digitally signed by RAVINDRA NATH SINGH Date: 2023.12.12 16:07:34 +05'30'</small>	PAVANKUMAR GUDAVALLETI <small>Digitally signed by PAVANKUMAR GUDAVALLETI Date: 2023.12.12 16:11:01 +05'30'</small>	Page 58 of 67
Manish Kumar Gupta SSE/S&T	R. N. Singh ADE/Signal	G. Pavan Kumar ED/Tele-II	

Field	Size (bits)	VALUE	Description	Remarks
Info_Ack	4	-	0: No Ack 1: Loco Specific SoS Ack by LP 2: FS to LS Ack by LP 3: LS to SR Ack by LP 4: FS to SR Ack by LP 5: OS to SR Ack by LP 6: OV to SR Ack by LP 7: Trip Ack by LP 8: PTRIP to SR Ack by LP 9: Auto horn Ack by LP 10: Train Length Measurement (TLM) Start packet received Ack from Onboard KAVACH 11: TLM End packet received Ack from Onboard KAVACH 12: Unusual Stoppage Ack by LP 13: Manual SoS Ack by LP 14: Spare 15: Spare When event is started, flag is to set and when event ends flag is to be reset. The Ack shall be sent for minimum 5 (five) cycle or as long as flag is set high. The expected functionality in the Stationary KAVACH (SVK), is to log the event in case of mode transitions. In cases of SoS acknowledgement, it would be released by SVK. In case of TLM Start/End acknowledgement, STCAS would act on transmission of TLM. Acknowledgement by LP for onboard specific sos and TLM Start/End can occur simultaneously.	
Spare	2		Future use	
Loco_Health_Status (Only for NMS Logging and report generation)	6		Onboard Kavach health shall be prepared for length of 24bits and same to be included in each radio packet as per below procedure. Each bit indicates status of each sub system in the Onboard-Kavach unit	

Field	Size (bits)	VALUE	Description	Remarks
			Frame Number in Binary	Onboard Kavach Health (as prescribed in Clause 6.1.24 of Annexure- G)
			xxxx xxxx xxxx x001	First 6 bits of Onboard Health
			xxxx xxxx xxxx x011	Second 6 bits of Onboard Health
			xxxx xxxx xxxx x101	Third 6 bits of Onboard Health
			xxxx xxxx xxxx x111	Fourth 6 bits of Onboard Health
MAC_CODE	32		Calculated from PKT_TYPE to Onboard_Health_Status fields	
PKT_CRC	32		Packet CRC	
Total	232 230			

C.5.4 Access Authority Packet Version 2.0

Field	Size (bits)	VALUE	Description	Remarks
PKT_TYPE	4	1011 (11)	- 0000- 0111: Radio packets for KAVACH V3.2	Revised
			Radio packets for KAVACH V4.0:	
			- 1000: Reserved for future use	
			- 1001: Station to Onboard Regular Packet	
			- 1010: Onboard to Station Regular Packet	
			- 1011: Access Authority Packet	
			- 1100: Additional Emergency Packet	
			- 1101: Onboard Access Request	
			- 1110 to 1111: Reserved for future use	
PKT_LENGTH	7		Packet Length is in terms of bytes	
			- 000 0000 - 1 byte	
			- 000 0001 – 2 bytes	
			

ISO 9001: 2015	Effective from 26.10.2023	RDSO/SPN/196/2020	Version 4.0 d3	Amdt-8
Document Title : Specification of Kavach (The Indian Railway ATP)- Multiple Access Scheme & Radio Communication Protocol				Annexure-C

Field	Size (bits)	VALUE	Description	Remarks
			- 111 1111 – 128 bytes	
FRAME_NUM	17		1 to 86400 ((hr * 3600 + mm * 60 + ss)+ 1)	
			eg: 00:00:00 - Frame No 1	
			00:00:02 - Frame No. 3	
			
			23:59:58 - Frame No 86399	
SOURCE_STN_ILC_IBS_ID	16		Unique Code, Valid values from 1 to 65535 (Purchaser Railway to Decide) (It will be unique for one KMS)	Spec 3.2
SOURCE_STN_ILC_IBS_VERSION	3		0: Not used	Spec 3.2
			1 to 7: Kavach Version	
			1 : Kavach Specification 3.2	
			2 : Kavach Specification 4.0	
STN_ILC_IBS_LO C	23		Absolute Location in meters	
DEST_LOCO_ID	20		1 to 999999 (Separate Look up table for EMU/DEMU)	
Allot- ted_UpLink_Fre q	12	Value	Allotted Frequency Channel for UpLink (L-Kavach to S-Kavach frequency)	New
		0	FDMA Not Used	
		1 to 2560	Base Frequency: 406 MHz (Configurable) Allotted Channel Frequencies at 25kHz space is Channel-1: $406 + 1*0.025 = 406.025$ MHz Channel-2: $406 + 2*0.025 = 406.050$ MHz -- -- Channel2560: $406 + 2560*0.025 = 470.000$ MHz	
		2561 to 4093	Reserved for future use	
		4094	Other Radio Communication systems used like WiFi/LTE/4G/5G Networks	
		4095	Not to be used	
Allot- ted_DownLink_F req	12	Value	Allotted Frequency Channel for Down-Link (S-Kavach to L-Kavach frequency)	New
		0	FDMA Not Used	

MANISH KUMAR GUPTA <small>Digitally signed by MANISH KUMAR GUPTA Date: 2023.12.12 16:04:06 +05'30'</small>	RAVINDRA NATH SINGH <small>Digitally signed by RAVINDRA NATH SINGH Date: 2023.12.12 16:07:34 +05'30'</small>	PAVANKUMAR GUDAVALLETTI <small>Digitally signed by PAVANKUMAR GUDAVALLETTI Date: 2023.12.12 16:11:01 +05'30'</small>	Page 61 of 67
Manish Kumar Gupta SSE/S&T	R. N. Singh ADE/Signal	G. Pavan Kumar ED/Tele-II	

ISO 9001: 2015	Effective from 26.10.2023	RDSO/SPN/196/2020	Version 4.0 d3	Amdt-8
Document Title : Specification of Kavach (The Indian Railway ATP)- Multiple Access Scheme & Radio Communication Protocol				Annexure-C

Field	Size (bits)	VALUE	Description	Remarks
		1 to 2560	Base Frequency: 406 MHz Allotted Channel Frequencies at 25kHz space is Channel-1: $406 + 1 \times 0.025 = 406.025$ MHz Channel-2: $406 + 2 \times 0.025 = 406.050$ MHz -- -- Channel-2560: $406 + 2560 \times 0.025 = 470.000$ MHz	
		2561 to 4093	Reserved for future use	
		4094	Other Radio Communication systems used like WiFi/LTE/4G/5G Networks	
		4095	Not to be used	
Allot- ted_TDMA_Tim eslot	7	Value	Description	
		0	Not nominated	
		1 to 68	Exact Time slot shall be sent by station-ary KAVACH excluding reserved slot in Frame	
STN_RND_NUM _RS	16		On reception of Access Request Packet from Onboard KAVACH Unit, Stationary KAVACH unit generates its own Random Number (RS).	
STN_TDMA	7	Value	Description	
		0 to 68	Station TDMA slot time in p-markers to capture RSSI.	
		100 to 125	Reserved for future use	
		126	Other Radio Communication systems used like WiFi/LTE/4G/5G Networks	
		127	Not to be used	
MAC_CODE	32		Calculated for PKT_TYPE to station TDMA	
PKT_CRC	32		Packet CRC	
Total	208			

C.5.5 Additional Emergency Packet

Field	Size (bits)	VALUE	Description	Re- marks
PKT_TYPE	4		- 0000- 0111: Radio packets for KAVACH V3.2	Re-

MANISH KUMAR GUPTA <small>Digitally signed by MANISH KUMAR GUPTA Date: 2023.12.12 16:04:06 +05'30'</small>	RAVINDRA NATH SINGH <small>Digitally signed by RAVINDRA NATH SINGH Date: 2023.12.12 16:07:34 +05'30'</small>	PAVANKUMAR GUDAVALLETTI <small>Digitally signed by PAVANKUMAR GUDAVALLETTI Date: 2023.12.12 16:11:01 +05'30'</small>	Page 62 of 67
Manish Kumar Gupta SSE/S&T	R. N. Singh ADE/Signal	G. Pavan Kumar ED/Tele-II	

Field	Size (bits)	VALUE	Description	Re- marks
		1100 (12)	Radio packets for KAVACH V4.0:	vised
			- 1000: Reserved for future use	
			- 1001: Station to Onboard Regular Packet	
			- 1010: Onboard to Station Regular Packet	
			- 1011: Access Authority Packet	
			- 1100: Additional Emergency Packet	
			- 1101: Onboard Access Request	
			- 1110 to 1111: Reserved for future use	
PKT_LENGTH	7		Packet Length is in terms of bytes	
			- 000 0000 - 1 byte	
			- 000 0001 – 2 bytes	
			
			- 111 1111 – 128 bytes	
FRAME_NUM	17		1 to 86400 ((hr * 3600 + mm * 60 + ss)+ 1)	
			eg: 00:00:00 - Frame No 1	
			00:00:02 - Frame No. 3	
			
			23:59:58 - Frame No 86399	
SOURCE_STN_ID LC_IBS_ID	16		Unique Code, Valid values from 1 to 65535 (Purchaser Railway to Decide)	Spec 3.2
			(It will be unique for one KMS)	
SOURCE_STN_ID LC_IBS_VERSION	3		0: Not used	Spec 3.2
			1 to 7: Kavach Version	
			1 : Kavach Specification 3.2	
			2 : Kavach Specification 4.0	
STN_ILC_IBS_LOCATION	23		Absolute Location in meters	
GEN_SOS_CALL	1	Value	Description	Spec 3.2
		0	No Station Manual SoS	
		1	General SoS Call generated by Stationary unit Conditions : Manual operation of SOS buttons provided on SOIP.	
Padding bits	1		If required to make sub packet length as multiple of bytes	
PKT_CRC	32		Packet CRC	

ISO 9001: 2015	Effective from 26.10.2023	RDSO/SPN/196/2020	Version 4.0 d3	Amdt-8
Document Title : Specification of Kavach (The Indian Railway ATP)- Multiple Access Scheme & Radio Communication Protocol				Annexure-C

Field	Size (bits)	VALUE	Description	Re- marks
Total	104			

C.5.6 Access Request Packet:

Field	Size (bits)	VALUE	Description	Remarks
PKT_TYPE	4	- 1101(13)	- 0000: Undefined	Revised
			- 0000- 0111: Radio packets for KAVACH V3.2	
			Radio packets KAVACH V4.0:	
			- 1000: Reserved for future use	
			- 1001: Station to Onboard Regular Packet	
			- 1010: Onboard to Station Regular Packet	
			- 1011: Access Authority Packet	
			- 1100: Additional Emergency Packet	
			- 1101: Onboard Access Request	
			- 1110 to 1111: Reserved for future use	
PKT_LENGTH	7		- Packet Length is in terms of bytes	Spec 3.2
			- 000 0000 - 1 byte	
			- 000 0001 – 2 bytes	
			
			- 111 1111 – 128 bytes	
FRAME_NUM	17		1 to 86400 ((hr * 3600 + mm * 60 + ss)+ 1)	Spec 3.2
			Example :	
			00:00:00 - Frame No 1	
			00:00:02 - Frame No. 3	
			
			23:59:58 - Frame No 86399	
SOURCE_LOCO_ID	20		1 to 999999	
SOURCE_LOCO_VERSION	3		0: Not used	New
			1 to 7: Kavach Version	
			1: Kavach Specification 3.2	
			2: Kavach Specification 4.0	
ABS_LOCO_LOCATION	23		Absolute Location in meters	Width changed
TRAIN_LEN GT	11		0: Unidentified/ Invalid	Spec 3.2

MANISH KUMAR GUPTA <small>Digitally signed by MANISH KUMAR GUPTA Date: 2023.12.12 16:04:06 +05'30'</small>	RAVINDRA NATH SINGH <small>Digitally signed by RAVINDRA NATH SINGH Date: 2023.12.12 16:07:34 +05'30'</small>	PAVANKUMAR GUDAVALLETTI <small>Digitally signed by PAVANKUMAR GUDAVALLETTI Date: 2023.12.12 16:11:01 +05'30'</small>	Page 64 of 67
Manish Kumar Gupta SSE/S&T	R. N. Singh ADE/Signal	G. Pavan Kumar ED/Tele-II	

H			1 to 2047: Train length in mtrs	
TRAIN_SPEED	9	Value	Description	Width changed from 8 to 10 bits
		0 to 400	Train Speed in kmph	
		401 to 510	Reserved for future use	
		511	Train Speed unidentified	
MOVE-MENT_DIR	2	Value	Description	Spec 3.2
		00	Traffic Direction not established / unidentified	
		01	Nominal (Normally Traffic Direction as UP)	
		10	Reverse (Normally Traffic Direction as DOWN)	
		11	Reserved for future use	
EMERGEN-CY_STATUS	3	Value	Description	New Added for parting SoS
		000	No Emergency - Regular Packet	
		001	Side Collision (Unusual Stoppage)	
		010	SoS	
		011	Roll Back Detected	
		100	Head On Collision	
		101	Rear End Collision	
		110	Parting SoS	
LOCO_MODE	4	Value	Description	
		0001	STAND_BY	
		0010	STAFF_RESPONSIBLE_MODE	
		0011	LIMITED_SUPERVISION	
		0100	FULL_SUPERVISION	
		0101	OVERRIDE	
		0110	ON_SIGHT	
		0111	TRIP	
		1000	POST_TRIP	
		1001	REVERSE	
		1010	SHUNTING	
		1011	NON_LEADING	
		1100	SYSTEM_FAILURE	
		1101	ISOLATION	
Approaching Station ID	16		Approaching Station ID as received from Tag	

LAST_RFID_TAG	10		Tag ID of Last RFID Tag Read – The combination of Approaching Station ID and LAST_RFID_TAG shall be used for detecting Head on Collision or Rear End Collision. For this purpose, LAST_Station_ID shall be also be used by the Onboard KAVACH as read from the Tag.	
TIN	9	TIN programmed in last RFID tag		
		Value	Description	
		0	Ignore / Don't Care	
		1 to 250	Track Identity Number as per Track Section Occupied	
		251	Onboard shed TIN	
		252-511	Reserved for future use	
Longitude	21	-180 to +180	Signed.	
			Degrees: First nine bits.	
			Minutes: six bits.	
			Seconds: six bits.	
Latitude	20	-90 to +90	Signed.	
			Degrees: First eight bits.	
			Minutes: six bits.	
			Seconds: six bits.	
LO-CO_RND_NUM_RL	16		Onboard Random number for session request. Change of this value by Onboard KAVACH indicates that requesting a fresh session from onboard KAVACH.	
Padding bits	5		If required to make sub packet length as multiple of bytes	
PKT_CRC	32		Packet CRC	
Total	232			

