सड़क परिवहन
एवं राजमार्ग मंत्रालय
MINISTRY OF
ROAD TRANSPORT
AND HIGHWAYS
सत्यमेव जयते

Global Expression of Interest (EOI) for Procurement of Toll Charger Software for Implementation of Global Navigation Satellite System (GNSS) - Based Electronic Toll Collection (ETC) Program in India

INDIAN HIGHWAYS MANAGEMENT COMPANY LIMITED

An Initiative of

National Highways Authority of India
(Ministry of Road Transport & Highways)
Government of India

07.06.2024

LETTER OF INVITATION

Indian Highways Management Company Limited (IHMCL), a Company promoted by National Highways Authority of India (NHAI) (an Autonomous Body Under the Ministry of Road Transport & Highways (MoRT&H), Government of India) invites Global EOI for procurement of Toll Charger Software for Implementation of Global Navigation Satellite System (GNSS) - Based Electronic Toll Collection (ETC) Program in India.

i. The EOI includes the following sections:

Section 1 - Disclaimer

Section 2 - Introduction

Section 3 - Pre-Qualification Criteria

Section 4 - Background

Section 5 - Objective of EOI

Section 6 - Scope of Work

Section 7 - Tentative RFP Parameters

Section 8 - Project Size

Section 9 - Schedule of EOI process & Contact details

Section 10- Appendices

ii. Interested Applicants (Sole/Joint Venture (JV)/Consortium) shall submit their application along with covering letter and all supporting documents/ information as per **Appendix-B** in soft copies addressed to Email ID indicated in the contact details (Section-9) on or before last date of Submission.

Contents

SECTION-1

Disclaimer

(i) The purpose of this EOI document is to provide the Applicant(s) with information to assist them in formulation of their applications. This EOI document does not purport to contain all the information, each Applicant may require. Each Applicant should conduct their own investigations and analysis and should check the accuracy, reliability and completeness of the information in this EOI document and where necessary obtain independent advice from appropriate sources.

(ii) IHMCL, its employees and advisors make no representation or warranty and shall incur no liability under any law, statute, rules or regulations as to the accuracy, reliability or completeness of the EOI document.

(iii) IHMCL may, in its absolute discretion, but without being under any obligation to do so, annul, modify, amend or supplement the information in this EOI document.

(iv) An applicant means a Business Entity or their Joint Venture/ Consortium thereof, who have sufficient experience in accordance with the Conditions of Eligibility as detailed in EOI is permissible.

(v) The issue of this EOI does not imply that IHMCL is bound to select and shortlist Applicants to enter into tie-up agreements with shortlisted Applicants.

(vi) The Applicant shall bear all costs associated with or relating to the preparation and submission of its EOI application including but not limited to the preparation, copying, postage, delivery fees, expenses associated with any

demonstrations/technical discussion/presentation and submission of EOI, IHMCL shall in no case be responsible or liable for these costs regardless of the conduct or outcome of the EOI process.

(vii) Canvassing in any form by the Applicant or by any other agency on their behalf may lead to disqualification of their EOI.

(viii) Governing Laws & Jurisdiction: The EOI process and its outcome shall be governed by, and construed in accordance with, the laws of India and the Courts at New Delhi (India) shall have exclusive jurisdiction over all disputes arising under, pursuant to and / or in connection with the EoI process and its outcome.

SECTION-2

Introduction

IHMCL, a promoted Company of National Highways Authority of India (NHAI), an Autonomous body under the Ministry of Road Transport & Highways (MoRT&H) invites Global Expression of Interest (EOI) from Applicants in the field of GNSS based Electronic Toll Collection meeting the criteria set forth in **Section-3** to submit their Technical Application for procurement of the Central Toll Charger Software broadly as per the proposed Concept Note enclosed at **Appendix-C**. The EOI also seeks inputs/suggestions/modifications on the proposed Concept Note and Service Level Agreement (SLA) and any other attributes which the applicant thinks are useful for implementation of GNSS based Electronic Toll Collection in India.

SECTION-3

Pre-Qualification Criteria

1. The Sole applicant or All the Members of a Consortium/Joint Venture (JV), must be a business entity incorporated in India under the Companies Act, 1956/2013 or the Limited Liability Partnerships Act, 2008 or equivalent law(s) in the country of jurisdiction of the entity subject to the condition that the maximum number of members in the JV/Consortium shall be Three;

2. The Sole applicant or All the Members of Consortium/Joint Venture should be working in the field of Software Development/Technology/Geo-Spatial Technology/Artificial Intelligence/Fintech.

3. The Sole Applicant or Any Members of Consortium/Joint Venture should have successfully implemented GNSS Based Tolling in abroad in any of the following Role:

(i) Development, Implementation, Operation & Maintenance of Central Toll Charger Software with map matching features serving 2000Km of GNSS based Tolled Highways.

(ii) Implementation of complete end to end GNSS based Tolling in at least 2000Km of Highways.

4. The Sole applicant or All Members of Consortium/Joint Venture should have combined Average Annual Turnover during the last three Financial Years of INR* 1000 Crore (10,000 million (INR Ten Thousand Million)) or equivalent foreign currency. In case the financial figures are in foreign currency current market exchange rate (State Bank of India BC Selling rate as on last date of submission

of the EOI application i.e., 22.07.2024) will be applied for the purpose of conversion of amount in foreign currency into Indian Rupees.

***Indian Rupees**

SECTION-4

Background

The Ministry of Road Transport & Highways (MoRTH) envisages to implement Global Navigation Satellite System (GNSS) based Electronic Toll Collection (ETC) in India to increase the efficiency of the Tolling operation in line with the global practices. In this regard, the National Highways Authority of India (NHAI), an Autonomous Body under MoRTH, through its promoted Company M/s Indian Highways Management Company Ltd (IHMCL), which oversees the National Electronic Tolling Collection (NETC) program, has been entrusted with the responsibility to implement the GNSS based ETC across India.

National Highways Authority of India (NHAI) is responsible for the development, maintenance, and management of the National Highways entrusted to it, as well as related matters. Currently, out about 1,50,000 km of National Highways declared by the Ministry of Road Transport & Highways, about 70,000 km are managed by NHAI. Additionally, NHAI is mandated to collect user fees (tolls) on these highways in accordance with the National Highway Fee (Determination of Rates and Collection) Rules, 2008. At present, User fee is collected for approximately 45,000 km of National Highways (NH) and Expressways in approx. 1200 Toll Plazas maintained by NHAI / Concessionaires.

Presently Electronic Toll Collection in India is done through Radio Frequency Identification (RFID) technology, branded as FASTag, which was launched in India in 2015. Since February 2021, FASTag has been made mandatory for the payment

of user fees at National Highway toll plazas, with a provision for a 100% penalty for cash or non-FASTag payments. As of March 2024, more than 98% of user fee payments are made through FASTag at the Toll Plazas. The year-on-year collection through FASTag and the corresponding transactions are detailed below:

Financial Year	ETC Count (In Numbers/ Lakh*)	ETC Collection (In Rupees/Crore*)
FY 16-17	236	661
FY 17-18	1,271	3,352
FY 18-19	2,544	5,760
FY 19-20	5,639	10,828
FY 20-21	12,402	21,282
FY 21-22	21,385	33,893
FY 22-23	28,631	46,821
FY 23-24	31,755	54,750

***1 Crore = 10 Million || 1 Lakh = 0.1 Million**

IHMCL plans to implement the GNSS-based Electronic Toll Collection (ETC) system within the existing FASTag ecosystem, initially using a hybrid model where both RFID-based ETC and GNSS-based ETC will operate simultaneously. Dedicated GNSS lanes will be available at toll plazas, allowing vehicles using the GNSS-based ETC to pass through freely. As GNSS-based ETC becomes more widespread, all lanes will eventually be converted to GNSS lanes.

SECTION-5

Objective of EOI

The objective of this global EOI is to identify qualified and experienced agencies for procurement of robust, scalable and efficient Toll Charger Software. The EOI will also serve as the foundation for drafting a comprehensive and robust bid document with state of the art & world class unique solution suited to Indian tolling system.

SECTION-6

Scope of Work

a. IHMCL invites technical applications broadly as per **Appendix-A** from applicants in the field of GNSS based Electronic Toll Collection.

b. IHMCL envisages to implement a Toll Charger Dominant GNSS based ETC System. The Scope of Work broadly includes the precise geo-referenced map making and development of a scalable and robust real time GNSS based Toll Charger Software with roles and responsibilities broadly mentioned in the proposed Concept Note attached at **Appendix-C.**

c. The EOI also seeks inputs/suggestions/modifications on the proposed Concept Note and Service Level Agreement (SLA) and any other attributes which the applicant thinks are useful for implementation of GNSS based Electronic Toll Collection in India.

SECTION-7

Tentative RFP Parameters (Post EOI)

A. Tentative Bidding Process proposed after EOI

The Bidding is proposed to be done in three-stage;

S.No.	Stage	Description
1.	Stage-1	Pre-Qualification. Based on Pre-Qualification Criteria to be firmed up subsequently.
2.	Stage-2 For those who qualify Stage-1:	Live Demonstration of Toll Charger Software with all desired features for which suitable time would be provided.
3.	Stage-3 For those who qualify Stage-2:	Financial Bid.

B. Tentative Implementation Schedule during the Contract Period

The Tentative Implementation Schedule during the Contract Period is proposed as under:

Description of Event	Time Period
Signing of Contract Agreement	T
Go-Live of First 2000 Km of identified stretches	T+3 Months
Go-Live of 10000 Km of identified stretches	T+9 Months
Go-Live of 25000 Km of identified stretches	T+15 Months
Go-Live in Pan-India (50000 Km)	T+24 Months
Operation and Maintenance Period	T+120 Months

C. Tentative Payment Schedule

(a) A Single amount for entire contract period has to be quoted by the bidder.

- Graded Monthly Payment (say for first year ‘x’ % of quoted amount, for second year ‘y’ % of the quoted amount and so on.)

(b) Fixed per Km. charge on addition of any new stretch beyond those mentioned in bid documents.

Note: For avoidance of doubt, the above details are mentioned to give ideas to prospective applicants regarding the Bidding Process to be initiated in future.

SECTION-8

Project Size

The following Data may also be utilized for preparation of Technical Application:

- Tolled roads: Present- 45000km scalable to around 1,00,000 Km in next 10 years
- Frequency of Ping to be received by Toll Charger- 1s to 5s
- Present Tollable Vehicles – 50 million scalable to suffice for 10-year growth
- Number of toll plazas: Approx. 1200 units scalable in proportion of length of Highways

SECTION-9

Schedule Of EOI Process & Contact Details

1. Issue of EOI Document

EOI Document is issued on 07.06.2024

2. Pre-EOI Meeting

A pre-EOI meeting is scheduled for June 26, 2024, at 3:00 PM Indian Standard Time at the NHAI Headquarters, G-5 & 6, Sector 10, Dwarka, New Delhi – 110075, India. Applicants may also join via video conference by requesting access through email at tenders@ihmcl.com.

3. EOI Submission

The applicant shall submit the EOI application via the official email ID of the Power of Attorney (PoA) holder by July 22, 2024, at 3:00 PM Indian Standard Time. Submissions should be sent to tenders@ihmcl.com . If the application size exceeds 20 MB, the applicant shall provide a Google Drive link that is not password-protected.

4. Address for communication and EOI submission:

Shri. A R Chitranshi,
Chief Operating Officer (COO)
Indian Highways Management Company Limited (IHMCL)
NHAI, G-5 & 6, Sector 10, Dwarka,
New Delhi – 110075, India
Email: tenders@ihmcl.com

SECTION-10

APPENDICES

Appendix-A

Technical Application

1. Company profile, including experience and expertise in relevant projects as per **Section-3**.
2. Detailed Applications outlining the following but not limited to:
    a) approach to system design,
    b) approach to map making,
    c) approach to development of Toll charger,
    d) approach to all the modules of Toll Charger vis-à-vis broad functionality mentioned in **Appendix-C**,
    e) implementation methodology,
    f) scalability, Data Center/Cloud Management, Dispute Resolution, Gap Analysis, Digital Routing, interoperability,
    g) approach to onboarding protocol of AIS-140 Device as OBU through Issuer Entity, maintenance and any other attribute.
    h) Integration with existing Toll Plaza / GNSS Lanes
    i) Any other relevant information.
3. Compatibility of Toll Charger Software with AIS 140 Device as OBU
4. Precision of Map Making

5. Precision of Map matching especially in boundary cases like elevated main carriageway, adjacent service road etc.
6. Compliance of **tentative** SLA Parameter as detailed below:

1. Service Availability

Uptime Guarantee: The software will maintain an uptime of 99.9% per Month. The Toll Charger shall ensure that there is no revenue loss to the Authority during the system downtime.

2. Accuracy Rate:

- **Map Making and Matching:** $\geq$ 99.9%
- **Distance Calculations:** $\geq$ 99.9%
- **Toll Charges:** $\geq$ 99.9%

3. Issue Resolution and Support

Support Availability: 24/7 support to road user via phone and email

Resolution Time:

- **Critical Issues:** Resolution within 4 hours
- **High Priority:** Resolution within 8 hours
- **Medium Priority:** Resolution within 2 business days
- **Low Priority:** Resolution within 5 business days

4. Updates

Map Updates: The toll charger shall update any new highway within 15 days of intimation by the Authority.

5. Service Reporting

Reporting: Weekly performance reports will be provided, detailing uptime, response times, issue resolution statistics, and compliance with SLA. The Toll Charger shall provide a web portal for the same.

6. Non-Adherence to SLA

Damages: - In the event of SLA breaches, damages will be imposed as under:

- Non-Performance upto 95% of Defined SLA Score per month: 25% of Monthly Payable Charges
- Non-Performance upto 90% of Defined SLA Score per month: 35% of Monthly Payable Charges
- Non-Performance upto 80% of Defined SLA Score per month: 50% of Monthly Payable Charges
- Non-Performance from 75% to 80% of Defined SLA Score per month: No Monthly Payment
- Non-Performance below 75% of Defined SLA Score per month: Liable for Debarment, Encashment of Performance Security and Termination.

Note: SLA Score to be formulated based on SLA criterion.

Appendix-B

Document Requirements for EOI

1. Company(ies) Incorporation Details
2. Experience Certification issued to the Company(ies) apostille at foreign origin, if any.
3. Financial details of Company(ies) including net worth along with annual turnover for the last 3 financial years duly vetted by Statutory Auditor
4. Relevant experience in last 10 years in successful implementation and operation of GNSS based ETC:
    a. Country (or countries) and date(s) of implementation
    b. Name of Partner having experience (In case of consortium/JV)
    c. Name(s) of Client(s)
    d. Number of km of GNSS ETC implemented
    e. Details of Solution:
    f. Any other relevant information supporting the firm's capabilities and qualifications
    g. References from previous clients, particularly in similar projects.
5. Relevant experience in last 10 years in development and successful implementation of GNSS based Toll Charger Software for GNSS based Electronic Toll Collection
    a. Country (or countries) where Toll Charger Software is used for GNSS based ETC:

b. Name of Partner having experience (In case of consortium/JV)

c. Name(s) of Client(s)

d. Number of km in GNSS ETC implemented

e. Details of Toll Charger Software (Map making features, AI based features, fraud management etc)

f. Any other relevant information supporting the firm's capabilities and qualifications

g. References from previous clients, particularly in similar projects.

Proforma for the above information is as under:

Proforma 1: Covering Letter

[On the Letterhead of the Applicant or Lead Member in case of a Consortium]

[Date]
<<Address>>

Dear Sir,

Ref: Expression of Interest (EoI) for Toll Charger Software for Implementation of Global Navigation Satellite System - Based Electronic Toll Collection (GNSS ETC) Program in India

With reference to your EOI Document dated *****, I/we, having examined the Documents and understood their contents, hereby submit our EOI for the aforesaid Project. The EoI is unconditional and unqualified.

i. We propose to submit our EOI in individual capacity as _____

Or

We propose to submit our EOI as a Consortium comprising of Members as follows:
_____ (Lead Member)
_____ (Consortium Member 1)
_____ (Consortium Member 2)

ii. All information provided in the EOI and in the annexures & appendices is true and correct and the documents accompanying are in original or true copies of their respective originals, as the case may be.

iii. We shall make available to IHMCL/NHAI/MoRTH any additional information it may find necessary or require to supplement or authenticate our proposal in response to the EOI.

iv. We acknowledge the right of IHMCL/NHAI/MoRTH to reject our EOI without assigning any reason or otherwise and hereby waive our right to challenge the same on any account whatsoever.

v. We acknowledge that the issue of this EOI does not imply that IHMCL is bound to select and shortlist Applicants to enter into tie-up agreements with shortlisted Applicants.

vi. We certify that in the last three years, we/ any of the Consortium Members have neither failed to perform on any contract, as evidenced by imposition of a penalty or a judicial pronouncement or arbitration award, nor been expelled from any project nor contract nor have had any contract terminated for breach on our part.

vii. We understand that you may cancel the EOI Process at any time and that you are neither bound to accept any EoI that you may receive nor to invite the Applicants to submit a Proposal for the Project, without incurring any liability to the Applicants.

viii. We believe that we/ our Consortium/ proposed Consortium satisfy(ies) the eligibility criteria and meet(s) the requirements as specified in the EOI document.

ix. We declare that we/ any Member of the Consortium are/ is not a member of a/ any other Consortium submitting an EoI for the Project.

On Behalf of (Name of the Applicant/ Lead Member)

_____
Signature of the Authorized Person
Name:
Designation:

Note: Paragraphs in square parenthesis may be omitted, if not applicable.

Proforma 2 : Applicant Details

i. Details of the Firm/ Applicant
   - Name of Firm/ Applicant: _____ _____
   - Address: _____
   - Tel No. (with code): _____
   - Contact person: _____
   - Name and Designation: _____
   - Address, Telephone No. and Email address: _____

ii. Type of Company (Public Limited/ Private Limited) : *[with supporting]*

iii. Date of incorporation with documentary evidence (or equivalent certificate):

iv. Registration detail of firm with documentary evidence (or equivalent certificate):

v. State whether applying as Sole Applicant or Lead Member of a Consortium:

vi. If the Applicant is Lead Member of a Consortium, state the following for each of the other Member Firms:
   - Name of the Firm:
   - Legal Status and country of incorporation:
   - Registered address and principal place of business:

vii. Brief description of the firm and organization structure and business.

viii. Any other details which the firm wish to give

On Behalf of (Name of the Applicant/ Lead Member)

_____
Signature of the Authorized Person
Name:
Designation:

Proforma 3 : Power of Attorney

Power of Attorney

(On the letter head of Sole Applicant/Consortium/Joint Venture)

We …….. (name of Sole Applicant/All Members of Consortium/Joint Venture along with registered address) do hereby constitute, appoint and authorize Mr/Ms…… (name of Power of Attorney Holder) who is presently employed with …….. (name of Sole Applicant/Member of Consortium or Joint Venture) as our attorney, to do in our name and on our behalf, all such acts, deeds, and things necessary in connection with or incidental to our application for the Global Expression of Interest for…….. including signing and submission of all documents and providing information / responses to the Indian Highway Management Company Ltd (IHMCL), representing us in all matters before the IHMCL in all matters in connection with our application for the said Global Expression of Interest. We hereby agree to ratify all acts, deeds and things lawfully done by our said attorney pursuant to this Power of Attorney and that all acts, deeds, and things are done by our aforesaid attorney shall and shall always deemed to have been done by us.

Dated this the …… day of …… 2024

For
(Signature of the Authorized Signatory of Sole Applicant)
Name of Authorized Signatory
Designation……
Address……

OR

(Signature of the Authorized Signatory of Member 1 of Consortium/JV))
Name of Authorized Signatory
Designation……
Address……

(Signature of the Authorized Signatory of Member 2 of Consortium/JV))
Name of Authorized Signatory
Designation……
Address……

(Signature of the Authorized Signatory of Member 3 of Consortium/JV))
Name of Authorized Signatory
Designation……
Address……

Accepted

(Signature of Power of Attorney Holder)
Name
Designation

Proforma 4: Detailed experience format

SUCCESSFUL IMPLEMENTATION AND OPERATION OF GNSS BASED ETC IN LAST 10 YEARS :-

OR

SUCCESSFUL DEVELOPMENT AND IMPLEMENTATION OF GNSS BASED TOLL CHARGER SOFTWARE FOR GNSS BASED ETC IN LAST 10 YEARS :-

[Formats to be filled for each reference experience/ project individually along with verifiable documentary proof]

Credential Format

Sole Applicant/Lead Member and/or Consortium members are requested to furnish the credentials in the following format for Pre-qualification criterion. All credentials should be followed by relevant documentary proof.

Name of the Work and Location/ Country	
Name of the Partner having experience (in case of Consortium/JV)	
Client's Name(s) and Complete Address	
Successful Implementation And Operation Of Gnss Based Etc In Last 10 Years **Or** **Successful Development And Implementation Of Gnss Based Toll Charger Software For Gnss Based ETC In Last 10 Years**	[*Select one of the two*]
Narrative description of project/ Details of Solution/ Details of Toll Charger Software (Map making features, AI based features, fraud management etc.)	[*only brief to be submitted here; details may be provided separately in the EOI application]*
Length in Km of GNSS based ETC implemented (mandatory)	
Date of Start	
Current Status (On-going/ if Completed then Date of Completion)	
Activities undertaken by Sole Applicant or Lead member and/or consortium members	

Proforma 5: Financial capability

FORMAT FOR FINANCIAL CAPABILITY OF THE APPLICANT

Name of Sole Applicant/ Lead Member/Consortium members of Consortium: ……..

Annual Turnover (in INR or Equivalent Foreign currency*)

	Last 3 Preceding year		
Name of the Applicant/ Lead Member of Consortium			
Name of the Consortium Member, if any			
Average Turnover for 3 years			

Date:

_____

Signature of the Authorized Person
Name:
Designation:
[Name and rubber seal of the Applicant/ Lead Member]

**In case the financial figures are in foreign currency current market exchange rate (State Bank of India BC Selling rate as on last date of submission of the EOI application) will be applied for the purpose of conversion of amount in foreign currency into Indian Rupees.*

Proforma 6: Applicant's submission and recommendations

Applicants should provide suggestions and recommendations including but not limited to the following aspects of each component as mentioned in the EoI:

1. Suggestions/ Deviations on EOI and proposed Concept Note (**Appendix-C**)
2. Implementation Methodology
3. Scope & Extent of Coverage of all the initiatives
4. Efficiency, operability, maintainability features involved
5. Collaboration Approach with all Ecosystem Stakeholders
6. Procurement & Financing Models
7. Any other Suggestions on Scope of work for prospective bidder (post EOI), project deliverables and timelines, consortium conditions, etc. as per the prescribed format mentioned below:

Sl. No.	Section/ reference in the ToR	Comments/ Proposed suggestion with justification
1		
2		
. . .	. . .	. . .
N	Any other information	

Draft Concept Note of Proposed GNSS Based ETC

Version 1.0 Date: 29.05.2024

Draft Concept Note of proposed GNSS based ETC in India

1. Introduction

a. Global Navigation Satellite System (GNSS) based Tolling is a barrier free method of Electronic Toll Collection wherein the road users are charged on the distance they have travelled on the tolled Highway stretch. The system uses Satellite or Constellation of Satellites to track vehicle's movement and calculate tolls based on the distance travelled on tolled Highways.

b. The Ministry of Road Transport & Highways envisages to implement Global Navigation Satellite System (GNSS) based Electronic Toll Collection (ETC) in India to increase the efficiency of the Tolling operation in line with the global practices. In this regard, the National Highways Authority of India (NHAI) through its promoted Company M/s Indian Highways Management Company Ltd (IHMCL), which oversees the National Electronic Tolling Collection (NETC) program, has been entrusted with the responsibility to devise the action plan and implement the GNSS based ETC across India.

2. General

a. The proposed Indian GNSS based Tolling Solution is a hybrid system in which the existing Toll Plazas will have two or more dedicated "GNSS Lanes" wherein the default position of barriers will be open for free flow of GNSS Vehicles. The lanes will have advance readers to identify GNSS vehicles. Additional fees will be charged from non-GNSS vehicles entering GNSS lanes.

b. The Toll Plaza will itself act as the Stationary Enforcement Gantry in the system.

c. The system architecture includes a Centralized Toll Charger responsible for distance & toll calculation of GNSS vehicles travelling on GNSS stretch.

d. The Toll Charger will receive pings (distance and time stamp) of GNSS vehicles through On Board Unit (OBU) fitted in the GNSS vehicles.

e. The OBUs of GNSS vehicles will be onboarded with the Toll Charger through Fintechs to be called "Issuer Entity" similar to the Issuer Banks under FASTag System.

f. The payment mechanism shall be similar to the existing FASTag ecosystem.

g. It is also proposed to start GNSS based Tolling with Commercial Vehicles. Private Car/Jeep/Van may be included in phased manner.

3. **Role of Centralized Toll Charger**

a. **Map Making of GNSS stretch**- The Toll Charger entity shall make the geo-referenced map of the GNSS stretches and nearby roads/highways with precision upto decimeter level. The map shall clearly demarcate the median edges, main-carriageway edges (upto shoulder) and service road on each side. The Geo-reference shall also capture the elevation which would ensure that the distance is calculated on the flyovers/elevated portions and not on the service road below it. The ownership of the map shall lie with NHAI.

b. **Correlation / Validation of Chainage and Geo-Reference:** The Toll Charger shall validate the chainage wise details given by NHAI with the geo-referenced map.

c. **Receiving Anonymised Pings from AIS AIS 140 VLT Device (OBU)** – Fully compliant AIS AIS 140 VLT Device (OBU) fitted in a vehicle shall be the OBU for GNSS based Tolling. The Toll Charger shall be capable of receiving per second anonymised pings from the OBU consisting of Time-Location Stamp of OBU, Virtual-ID associated with Vehicle/Vehicle Class etc. Any data not falling on the National Highway network shall be not be stored or processed further and discarded immediately. The toll-charger will operate with principle of purpose-limitation with objectivity of calculating toll. The customer information will be with the IssuerEntity.

d. **Map Matching** – Tracing the precise location of the vehicle on the geo-referenced map through the time-location stamp received from the OBU. With state of art AI based digital routing/Gap analysis tools to validate de-routing / fraud / loss of signal / OBU malfunction cases.

e. **Network based Digital Routing**: The Toll Charger should have capability of AI based digital routing of Vehicles through Cellular Network also.

f. **Calculation of Distance travelled**: The Toll Charger shall calculate the distance travelled by the OBU fitted vehicle based on the time-location stamp. The software shall ensure that the distance is measured only on the tollable portion of highway i.e the distance shall be measured only on the main carriageway and not on the service road. For elevated Highways where service road is under the elevated portion the distance shall be

calculated only on the elevated portion and not if the vehicles is travelling on service road below it.

g. **Toll Parameter**: The Toll Charger shall calculate the User Fee based on Toll Parameters defined by the Authority from time to time. The Toll Parameter varies stretch to stretch depending upon type of structures, bypass, expressway etc. The Toll parameter for every stretch is revised once in a year.

h. **Calculation of User Fee based on distance travelled:** The Toll Charger shall calculate user fee based on the distance travelled by the GNSS Vehicle using the Vehicle Class of OBU and toll parameter. The User Fee is proposed to be calculated real time on following occasions although the list is not exhaustive:

1) Whenever Vehicle crosses the influence length of particular Toll Plaza(s)
2) Whenever vehicle makes a U-Turn
3) Whenever vehicle leaves the GNSS stretch
4) Whenever OBU turns red (no balance/OBU malfunctions)
5) Vehicle Stopped on Highway beyond defined time limit
6) Any other occasion decided by the Authority

The calculation of User Fee should trigger payment module and conclude with SMS being sent to the Road User by Issuer Entity.

i. **Send calculated User Fee to Acquirer Bank:** The Toll Charger shall send the calculated User Fee to be charged to a GNSS Vehicle to the Acquirer Bank which will then follow same payment protocol as FASTag system. The Toll Charger will also facilitate the road user to see the path travelled by their GNSS vehicle on a map by clicking a link shared to them by Issuer Entity through SMS.

j. **Creation of User Fee Portal for each Toll Plaza**: The Toll Charger shall create a Web based Portal for each Toll Plaza on the GNSS Stretch to provide the GNSS based toll transaction of each GNSS based vehicle in the influence length of the toll plaza.

k. **Exemption of minimum distance travelled**: The Toll Charger shall ensure that no toll is charged if vehicles are travelling less than minimum Tollable length of the GNSS stretch. Say 'X' km per day in each direction.

l. **AIS-AIS 140 VLT Device VLT Device Device (OBU) Onboarding Protocols:** The Toll Charger in consultation with the Authority, shall prepare necessary software level protocols (like FIFO, Information sequence, encryption etc) required to onboard AIS AIS 140 VLT Device (OBU) fitted in vehicle to the Toll Charger through Issuer Entity. The Toll Charger shall create a central mapper for onboarding all registered OBUs with Issuer Entity.

m. **AIS AIS 140 VLT Device (OBU) Status Protocols:** The Toll Charger shall define the AIS AIS 140 VLT Device (OBU) status protocols (green/red cases) for the Issuer Entity. The red OBU cases should be reported to the Issuer Entity through open standard APIs.

n. **Integration with GNSS Lane:** The Toll Charger shall integrate with the GNSS Lanes of the Toll Plaza

o. **Setting up of Dispute Redressal Setup:** The Toll Charger shall set up an Online Dispute Redressal mechanism/Support Center which will integrate data from Enforcement Gantries, OBUs, Toll Plazas and Issuer/Acquirer Entity to allow for easy resolution of customer complaints. The same shall be integrated with NHAI 1033 Helpline/Rajmarg Yatra App.

p. **Adhere to the SLAs:** The Toll Charger shall adhere with the highest standards of uptime/availability, precision, integrity, dispute redressal and other SLAs defined in Contract Agreement.

q. **Redundancy and Disaster Recovery**: The Toll Charger shall have appropriate redundancy, availability and disaster recovery protocols so that there is no loss of Toll Revenue.

r. **Interoperability among Toll Chargers**: The Authority may appoint region / pan India wise multiple Toll Chargers. The Toll Charger shall have open standard API based interoperable solution with other Toll Charger to ensure seamless GNSS based Toll collection between different region/pan India.

s. **Data Center / Cloud**: The Toll Charger shall establish Data Center in India for the purpose of all the services under the Contract. For any Cloud Services, the Toll Charger shall comply with the latest guidelines of Ministry of Electronics and Information Technology (MeitY), Government of India. The Toll Charger shall retain the data as per the archival policy decided by the Authority.

t. **Operation & Maintenance, Development and Training**: The Toll Charger shall operate & maintain the Toll Charger services for the entire contract period. The Toll Charger shall also make important developments in the Software so as to meet the latest requirement. The Toll Charger shall impart trainings to the officials/representatives of the Authority so that they can undertake operation of the Toll Charger.

4. **GNSS On Board Unit (OBU):**
   a. **OBU:** Fully compliant AIS 140 VLT Device fitted in a vehicle shall be the OBU for GNSS based Tolling in India.

   b. **Proposed modification in AIS 140 VLT Device (OBU) Specifications:** The Authority also aims modify few attributes of AIS 140 VLT Device (OBU) specifications like increasing the inbuilt memory for storage of geo-polygons and time-location stamp in no network/power scenario, increasing an IP port for TCP/IP communication with Toll Charger, etc along with Virtual-ID and other necessary information.

   c. **Onboarding of OBUs with Toll Charger**: The Issuer Entity shall onboard the Vehicle fitted with AIS 140 VLT Device (OBU) to the Toll Charger after doing KYC, mapping its FASTag and generating Virtual-ID.

   d. **Identification of GNSS Vehicle at Toll Plaza/GNSS Stretch**: The GNSS Vehicle shall be identified through the Virtual-ID linked with the OBU device and ANPR Cameras that will be installed at GNSS Lanes. An OBU with Valid FASTag shall find free flow at GNSS lane whereas an OBU with blacklisted FASTag shall find the barrier closed based on the reading of FASTag by reader/VRN by ANPR Camera.

   e. The AIS 140 VLT Device (OBU) shall be suitably programmed as per the protocols set by Toll Charger like FIFO (first in first out) pings etc.

   f. The existing version of AIS 140 VLT Device VLT Device Device specifications are enclosed at **Annexure-1**

5. **Role of Issuer Entity:**
   a. **Accreditation of Issuer Entity**: Fintechs/Banks/Insurance Cos etc who wish to act as Issuer Entity needs to get accredited by IHMCL.

b. **Onboarding of OBUs with Toll Charger**: The Issuer Entity shall onboard the Vehicle fitted with AIS 140 VLT Device (OBU) to the Toll Charger after doing KYC, mapping its FASTag and generating Virtual-ID. The Issuer Entity shall register the Vehicles fitted with fully compliant AIS 140 VLT Device (OBU) with the Toll Charger after thorough checking of the AIS 140 VLT Device (OBU). The Issuer Entity shall also retrofit the fully compliant AIS 140 VLT Device (OBU) in vehicles registering with the Toll Charger.

c. **Anonymised Pings**: The Issuer Entity shall ensure transfer of anonymised pings from the onboarded Vehicle OBU/proxy server to the Toll Charger. The Issuer Entity may empanel/tie up with compliant OBU Manufacturers in this regard.

d. **Link with FASTag ID**: The Issuer Entity shall maintain with itself the link between the existing FASTag of the Vehicle and the Virtual-ID generated.

e. **AIS 140 VLT Device (OBU) Status Management**: The Issuer Entity shall ensure that a vehicle fitted with Valid OBU (FASTag with balance + Functional OBU) shall be charged only per km wise if it crosses the toll plaza or otherwise. Suitable mechanism shall be developed to ensure that there is no double charging when the vehicle fitted with valid OBU crosses the Toll Plaza.

f. **Linking of Payment System:** The Issuer Entity shall be responsible for linking Bank Account / Wallet /Credit Card of the GNSS Vehicle with FASTag wallet linked to the OBU of GNSS Vehicle. The Issuer-Entity will be responsible to reveal the FASTag ID mapped to Virtual-ID when requested by Acquirer Bank for processing payment.

g. **Payment Creditor:** The Issuer Entity shall be obliged to credit the calculated User Fee to the Acquirer Bank whenever demand raised through the Central Clearing House (CCH) / NPCI.

h. **Commercial Terms with Owner:** The Issuer Entity may provide value added services like free OBU, free Insurance etc based on consent-based data sharing and other commercial terms with the owner.

i. **Customer Support:** The Issuer Entity shall send SMS, Voice Call, IVR based reminders to its customers in case there is OBU malfunction/low balance/power snap of OBU or other issues with OBU. The Issuer Entity shall also provide Customer Support and dispute redressal for chargeback /wrong deduction and other ETC related disputes

j. **SMS Information:** Issuer Entity shall send SMS to the Customer whenever Toll is Charged under following scenario:

1) Whenever Vehicle crosses the influence length of particular Toll Plaza(s)
2) Whenever vehicle makes a U-Turn
3) Whenever OBU turns red (no balance/OBU malfunctions)
4) Vehicle Stopped on Highway beyond defined time limit Whenever vehicle leaves the GNSS stretch
5) Any other occasion decided by the Authority

Typically the SMS should contain the following information:

- Vehicle Number
- Distance Travelled
- User Fee Charged
- Link provided by Toll Charger showing path of vehicle on map

Illustration:

Rs.30.98 charged for 16.57 km travelled by vehicle DL1LAG1162. For trip details click https://t.ly/9owgU For enquiry call 1033. Kotak Bank.

The Issuer Entity shall also create APIs to integrate with Rajmargyatra such that User can use Rajmargyatra app to access above information within app.

6. **Role of Acquirer Bank**
   a. **Validation of Toll Parameter:** The Acquirer Bank will validate the Toll Parameter of particular stretch.
   b. **Payment to Toll Collection Agency:** Acquirer Bank shall pay the settled User Fee to the Toll Collecting Agency similar to FASTag system

7. **Role of NPCI**
   a. **CCH and User Fee feed to TMCC:** NPCI shall continue to act as the Centralised Clearing House (CCH) for the Acquirer-Issuer system in GNSS ecosystem similar to FASTag system. NPCI shall create a separate GNSS head for GNSS based user fee collection and send the information to TMCC.
   b. **Onboarding of GNSS Lanes:** NPCI shall make necessary integrations to onboard the GNSS Lanes as per defined protocols at plaza level.

8. **Role of NHAI**
   a. **To furnish the list of proposed GNSS Stretches to the Toll Charger:** NHAI shall provide the list of stretches proposed under GNSS Tolling to the Toll charger with all the details like structures, bypasses, location of Toll Plaza etc.

b. **To Furnish Toll Parameter**: NHAI shall furnish Toll Parameter to the Toll Charger for each GNSS stretch.
c. **Validation of GNSS Stretch**: NHAI shall validate the geo-reference of the GNSS Stretch with the chainages of the Highway.
d. **Lane Level Changes at Toll Plaza:** NHAI shall undertake required lane level changes at the Toll Plazas.
e. **Develop GNSS Toll Collection field in TMCC:** NHAI shall develop a GNSS User Fee field in the existing TMCC wherein the user fee collection from GNSS based ETC shall be reflected as shared by NPCI.

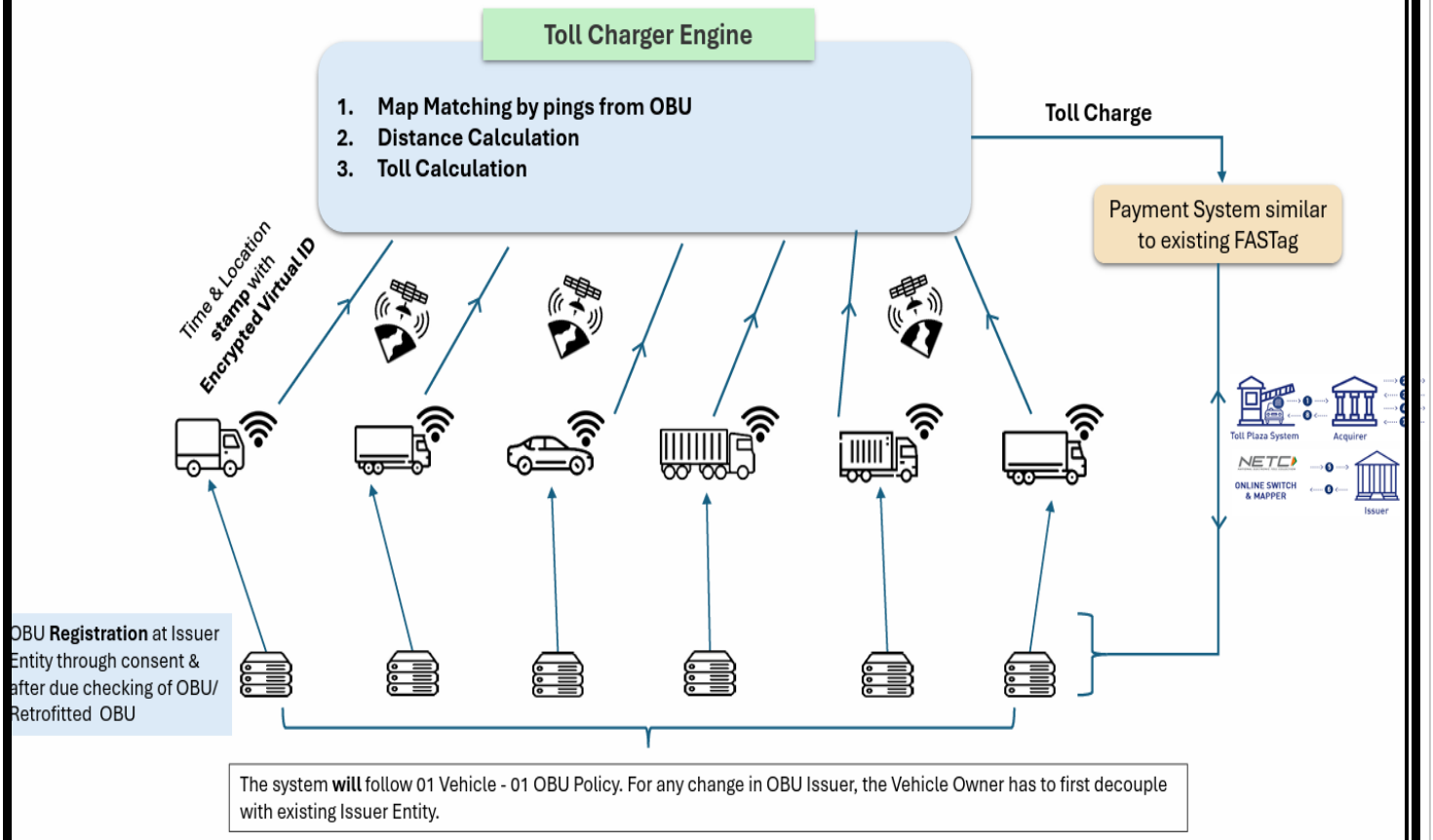

Fig 1 GNSS System Architecture

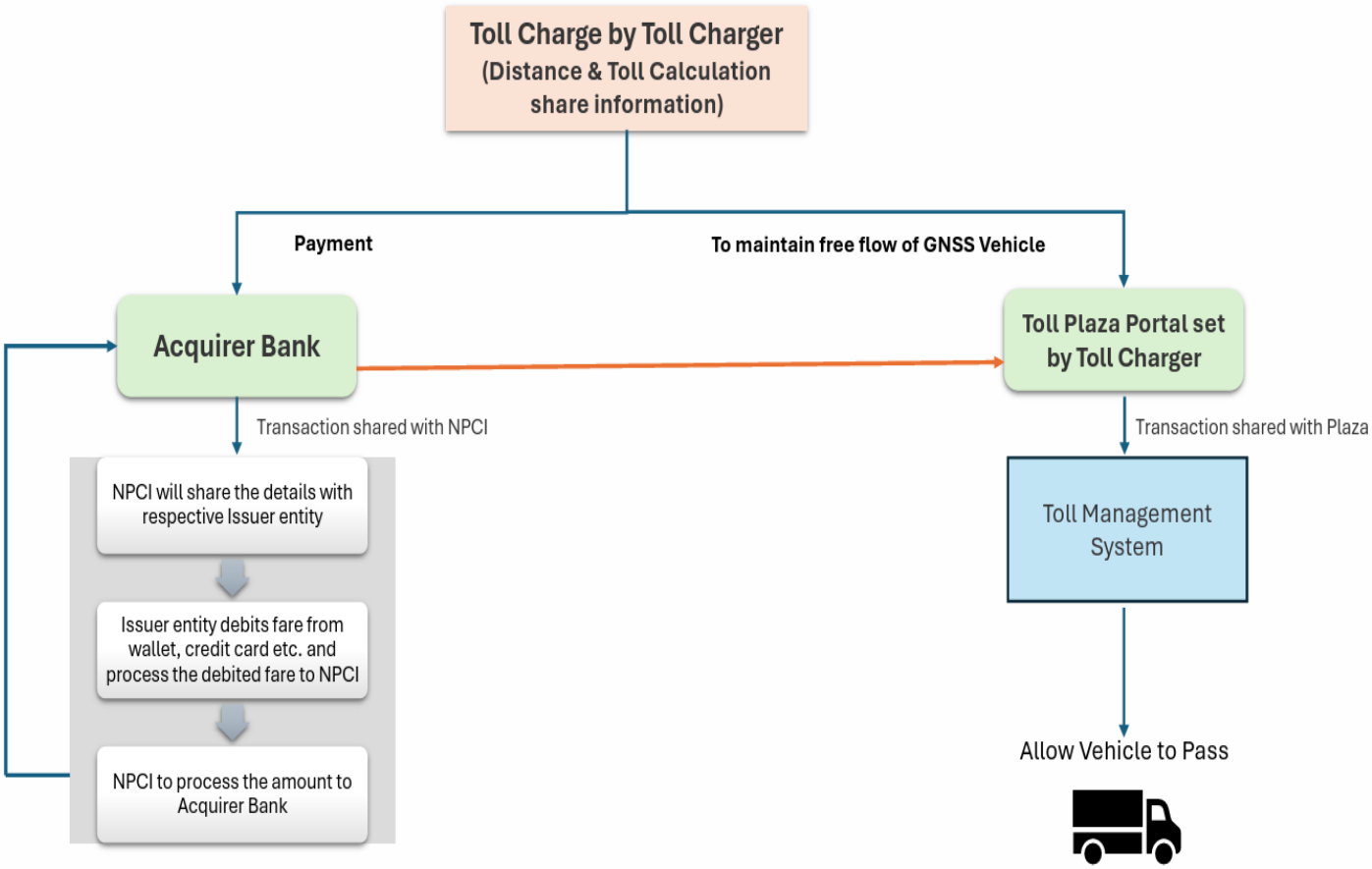

Fig 2 Payment Architecture

Amendment No. 2 (5th December 2018)
To
AIS-140: Intelligent Transportation Systems (ITS) - Requirements for Public Transport Vehicle Operation

1. Page 3, Clause No 2.2.1,

Substitute following text for existing text:

Device Approval: Approval provided at Device level for compliance to this standard. These approved devices can be fitted / retro-fitted by manufacturer/ dealer/ permit holder/system integrator in any vehicle model provided it shall meet installation requirements as mentioned in Clause No. 5 of this standard.

2. Page 4 , First paragraph

Substitute following text for existing text:

Table below (Table 4A) contains the listing of fields that the vehicle tracking devices would be required to send to the Backend Control Centre. The first 3 fields (Start character, Header for VLT with Emergency Buttons and Vendor ID, who has supplied the device) must be fixed in position as well as format (Header part of frame). Rest all other fields are required to be present in the location data sent by the devices to the backend, but can be in any sequence and with any separator between fields. The data value can be either in American Standard Code for Information Interchange (ASCII) or in HEX format. Device must transmit the Login message whenever it establishes (re-establishes after disconnection) its connectivity with Server with the specified fields. Login Message will carry following information:

3. Page 5, Clause 3.1.1.1, Sub clause 'a'

Substitute the following text for the existing text:

a. Device shall be capable for operating in L and/or S band and include support for NAVIC/IRNSS (Indian Regional Navigation Satellite System) for devices installed on vehicles on or after 1st April 2019. However VLT devices shall be compliant as per other GNSS constellation in the interim period.

4. Page 16, Clause 5.0

Substitute following text for existing text:

CONSTRUCTION AND INSTALLATION

5. Page 16, Clause 5.1

Substitute the following test for the existing text:

Requirements on vehicle interface for VLT with Emergency Button
(This requirement is only a guideline for fitment and shall not be checked during component approval or on vehicle)
Connector for Power
The requirements for interface shall be as agreed between vehicle manufacturer and device manufacturer

6. Page 16, Clause 5.2

Substitute the following test for the existing text:

Requirement of Emergency System
(To be verified on component level)
Emergency button shall be one time press type. Separate release action from authorized server shall be required to bring back the emergency button to normal mode or clear emergency flag.

7. Page 16, Clause 5.3

Substitute the following text for the existing text:

Physical Mounting
(This requirement is only a guideline for fitment and shall not be checked during component approval or on vehicle)

The VLT system shall be mounted in a suitable location such a way that it is not easily accessible /exposed to passengers.

This requirement shall not be applicable in case of combined systems VLT with HMI (Human Machine Interface) display in front of driver.

Emergency button(s) shall be fitted in such a way that every passenger including driver shall be able to access the Emergency button(s).

Passenger Car shall have at least one emergency buttons on each passenger row easily accessible by each of the passenger. There shall also be one dedicated emergency button for the driver row.

Passenger Transport bus shall have emergency buttons at locations easily visible & accessible to all the passengers such as every 2 meters on both the sides on passenger seating area. For seats reserved for ladies there shall be a dedicated panic button for each row.

It shall be permissible to have a single emergency button for two successive ladies' rows on both sides of the vehicle provided each lady passenger in either rows are able to reach and operate the emergency button.

In case of passenger transport bus which has a glass window covered between two pillars having pitch 2m or more, the emergency buttons shall be provided on each pillar

National Permit Trucks, shall have one dedicated emergency button for the driver row.

8. Page 17, Clause 5.4

Substitute the following test for the existing text:

Power Supply
(The requirements related to vehicle are only a guideline for fitment and shall not be checked during component approval or on vehicle)
The vehicle tracking device will be installed on vehicles in which the power supply voltage from vehicle battery is widely varying (12V, 24V etc.) and also the power supply is not as stable as that in case of fixed locations, especially during engine start-up and braking when the voltage can fall to as low as 9V. Typically electronic devices are very sensitive to power surges and spikes, and equipment may fail if they do not receive stable power supply. The devices will need to have a resilient power supply unit that can withstand such fluctuations and the devices also need to have power backup so that they continue to function for some duration when the vehicle battery is not functional or is disconnected from the devices.

Vehicle power interface shall have

- One common ground linked to vehicle chassis
- One permanent power Supply (12/24V) connected to the vehicle battery (+Vbat).
- One non-permanent power line (12/24V) connect to the battery after ignition (IGN).

9. Page 17, Clause No 6.1, 6.1.1, 6.1.2

Delete these clauses and renumber subsequent clauses.

10. Page 18, Clause No 6.2.1.3

Substitute following text for existing text:

The system shall transmit Emergency request information to one IP and PVT information to other IP of backend Control Center at user configurable frequency (minimum 5 seconds) via GSM/Cellular

11. Page 18

Add following new clause 6.2.1.6 and 6.2.1.7 after clause 6.2.1.5 :

6.2.1.6 System shall communicate to control center on the occurrence of the alerts captured in Communication Protocol Section 4.

6.2.1.7 When Emergency Button is pressed, emergency request message shall be sent from the system and received at the control center.

12. Page 31 ,Clause No 7.0

Add Below Text at the end of first paragraph

The Communication from Device to backend should happen on a Secure channel over TCPIP protocol preferably on socket based connections where sessions are managed to send commands over the same connection to the device and are authenticated, identifiable, so as to prevent spoofing on IMEI/ Unique ID.

13. Page 33

Add following new clause 8.0 after clause 7.0:

8.0 CODE OF PRACTICE for Implementation of Vehicle Location Tracking (VLT) Device, Emergency Button(s) and Command and Control Centres

This Code of Practice for AIS-140 has been formulated for facilitating smooth Implementation of Vehicle Location Tracking (VLT) Device, Emergency Button(s) and Command and Control Centres for the guidance of the stakeholders concerned.

8.1 General

a. The VLT device manufacturers will get their devices tested and certified from the testing agencies referred to in rule 126 of the CMVR for compliance to the rule 125 H of CMVR

b. The Backend System shall mean the backend Command and Control Centre set up/ authorized by State/UT or VLT manufacturers, providing interface to various stakeholders/systems such as State emergency response centre, the transport department or Regional Transport Offices, Ministry of Road Transport and Highways and its designated agency, Vahan (or any other State/UT system used for registration of vehicles and/or issuance of permits), VLT device manufacturers and their authorised dealers, testing agencies, permit holders, etc. In the absence of State/UT backend system, the registration, activation, health check and alert updates of VLT devices shall be through a common layer for updation in Vahan.

The details of each VLT device (VLT device manufacturer code, device serial number, IMEI number, IccID number and other details as notified by the Central Government/State Government) shall be uploaded on the Vahan directly or through backend system by the VLT device manufacturer using its secure authenticated access.

The VLT device manufacturers or their authorised dealers shall install the VLT devices in vehicles and register/activate the devices along with details

of vehicle and permit holder on the corresponding backend systems in real-time as per the process set out below.

The backend system/common layer will update the details of device in the Vahan system against the respective vehicle record at the time of installation and registration/activation of VLT device.

c. The VLT device manufacturers or their authorised dealers, at the time of installation of VLT device in vehicles, shall configure the IP address and SMS gateway details in the device for sending emergency alerts to the emergency response system of the State/UT concerned.

d. The VLT device manufacturers or their authorised dealers, at the time of installation of VLT device in vehicles, shall configure the configuration parameters mentioned in AIS-140 in the device such as IP address and SMS gateway details for sending required data to the backend system.

e. The VLT device manufacturers shall ensure that a control mechanism is established for the secure data transfer from VLT to the backend system and that only the authorized devices transfer data to the backend system. The VLT device manufacturers shall also ensure that the mechanism for authenticating the vehicle owner and devices is followed as per the protocol specified in AIS-140 or such additional requirements as specified by the States/UTs. Authentication of vehicle shall be done through an OTP sent on vehicle owner's mobile number from the corresponding backend system.

f. In case of press of an emergency button, the VLT device will send data directly to the emergency response system of the respective State/UT. In addition, the backend system will send the alert to the respective permit holder, as decided by the State/UT.

g. VLT device manufacturers shall get their devices tested for conformity of production every year from the date of first certification, from the testing agencies referred to in rule 126 of the CMVR.

h. VLT device manufacturers shall get their backend systems certified for the States/UTs from the testing agencies referred to in rule 126 of the CMVR/ STQC/NIC.

i. The VLT device manufacturers or their authorised dealers, at the time of installation of VLT devices in vehicles, shall configure the VLT device to send a secure authenticated activation message directly to the State/UT backend system/common layer as per the details provided in this section 8

j The VLT device manufacturers shall ensure that the Health Check parameters are configured in the VLT device to send Health Check messages, on request from the State/UT backend system/common layer, to the respective backend system through SMS as per reference protocol mentioned in this section 8

k. VLT device manufacturers or their authorised dealers shall provide comprehensive warranty/maintenance support for the VLT device and facilitate cellular connectivity in accordance with the guidelines issued by

central government vide Motor Vehicles (Vehicle Location Tracking Device and Emergency Button) Order, 2018 as amended from time to time.

l. The testing agencies will verify the conformity of production for the VLT devices as prescribed in section 8.5.

8.2 Installation, Registration, Activation and Service Process for VLT Device

a. VLT device manufacturers or their authorised dealers shall install VLT devices on permit holder's vehicles (only tested and approved model).

b. VLT device manufacturers shall ensure necessary uploading/integration of the installation/activation data to the backend system/Vahan.

c. In case of any problem in updating Vahan, it will be VLT device manufacturer's responsibility to resolve the same.

d. VLT device manufacturers or their authorised dealers will also provide necessary print of installation/activation report to permit holder from the respective backend system.

e. Regional Transport Offices shall be able to verify the registration/activation/functional status of VLT device in the Vahan/corresponding backend system at the time of fitness testing.

f. The permit holder will have option to check the installation and device working status in the Vahan.

g. The VLT device manufacture may offer value added services, in addition to the mandatory performance requirements to the permit holders as per the mutual agreement between them. Mandatory performance requirements shall mean the following:

i. Uploading device data in Vahan
ii. Updating registration and activation data of VLT device
iii. Sending device health status to the backend system
iv. Sending emergency alerts to the corresponding State/UT emergency response system
v. Sending over speeding alerts to the backend system
vi. Other performance requirements as per AIS 140 and as notified by central government vide Motor Vehicles (Vehicle Location Tracking Device and Emergency Button) Order, 2018 as amended from time to time.

h. The VLT device manufacturers may create their own system to monitor their supplied devices, emergency button/s & connectivity working / non-working status for managing warrantee / AMC and Cellular services.

i. The VLT device manufacturers or their dealers will update the SIM numbers and their validity/renewal details in the backend system.

8.3 VLT Device Manufacturers Backend Application/System Requirements

In case VLT device manufacturer offers to provide its backend system for State/UT, the same will need to meet the following requirements, in addition to those specified in Clause 7 of AIS 140:

a) The application will provide the ability to locate a vehicle at a given time.

b) Facility to track defined vs. actual movement of vehicles, capture deviations if any. (For vehicles where scheduled movement can be defined on GIS map)

c) The application should provide ability to track vehicle location on map. The map engine and data should comply with applicable regulations including guidelines as set out by Survey of India from time to time.

d) Facility for users to access and view position / location information on GIS maps near real-time through web interface with historic data displayed on maps.

e) Facility for providing current information location on demand.

f) Facility for playing back the recorded details of the vehicle movement along the authorized route (where applicable).

g) Provide facility of alert generation

i. Ability to define new alerts on specific events
ii. From the on-board devices in case of tampering
iii. Speed exceeds the permissible limit
iv. Vehicle moves out of its designated route or area
v. Data feed not received from the on-board device

h) Provide facility to define rules for alerts/ notification and their delivery mode like SMS, email, pop-up etc.

i) Management of notifications to various stakeholders by way of email or SMS e.g. permit holders, RTO about device not working, over-speed etc.

j) Notification to the permit-holder through SMS in case any device stops functioning/sending data to the application.

k) Capability to update the on-board devices' firmware from the backend.

l) Capability to configure on-board device parameters from the backend.

m) The tracking data will be kept live in the system for at least 90 days. Utilities will be provided to support archive and restore functions for older data. Alerts/reporting shall be available for one year in the backend.

n) The backend will store VTS time-related data at the same resolution as received in the live application. The archived data after 90 days can also be restored using utilities provided.

o) From a security perspective, the devices will not communicate to any IP address located outside India whether it be the manufacturer's application or for purposes of configuration or firmware updates.

p) Firmware of the device needs to be available for auditing to notified testing agencies. Firmware binary should be made available with version matching one in the device as well as binary size & modification timestamp and/ or checksum should match for the binary provided and one installed on device. Backend System should be able to remotely read the existing version number of the firmware via an OTA configuration read command. A new version of the firmware should be pushed over the air from the VLT manufacturer's application. This shall be verified by the backend system remotely reading the new version number of the firmware in the device via and OTA configuration read command.

q) The device will communicate only to whitelisted set of IP addresses located in India and will receive communication and commands also from whitelisted set of IP addresses located in India.

r) The application and all key components like device management, firmware control, GIS map shall be hosted at a data centre/ cloud in India and it will be available for auditing by regulatory agencies.

s) The system shall provide > 99% availability and adhere to Infrastructure Security, Vulnerability Assessment and Penetration Testing guidelines as set out by Ministry of Electronics, Information and Technology, GoI.

t) No data should flow out of the country under any circumstances in compliance with applicable laws/regulations/guidelines.

u) The common layer shall be got tested from the testing agencies specified in CMVR Rule 126/STQC/NIC for the following minimum functionalities:

i. Registration and activation of the device(s) fitted on the vehicle, including the details of vehicle registration number, engine number, chassis number, vehicle make and model, device make and model, and connectivity details (telecom service provider's name, ICCid, SIM Nos., IMSI, date of validity, etc.).

ii. Publish VLT device details in the Vahan/ any other State/UT system used for registration of vehicles and/or issuance of permits

iii. Re-registration/re-activation of the device(s) fitted on the vehicle in case of any change in device or telecom service provider, etc.

iv. Periodic health check of the device(s) fitted on the vehicle through SMS, as per section 8.4.

v. Receiving alerts from VLT devices in case of defined deviations by vehicle such as over-speeding, etc. Publish alerts and health check received from VLT device in the Vahan/ any other State/UT system used for registration of vehicles and/or issuance of permits.

vi. Provide interface to Vahan, respective State/UTs, RTOs, testing agencies, VLT device manufacturer's and their dealers.

8.4 Activation message and Health Check Message Protocol

The protocols for activation message and health check message are given below. Device shall send the activation and health check messages on request as specified below directly to the backend system (i.e. backend Command and Control Centre set up/ authorized by State/UT or a Common Layer system providing interface to VLT device manufacturers' backend applications).

A. Activation SMS Format from Backend System to Device

For completion of the installation process, the VLT device shall undergo Activation process as per below:

- Activation Message Request Format from the Backend System to the Device (Through SMS): ACTV, Random Code, Reply SMS Gateway no.

- Activation Message Reply Format from Device to the Backend System (Through SMS) as per Table 1 below:

Table-1:
Activation & Health Check Response SMS Format from Device to Backend System

Field Name	Characters	Activation Example	Health Check Example
Header	5	ACTVR	HCHKR
Separator	1	,	,
Random code	6	343434	474747

Separator	1	,	,
Vendor ID	4		
Separator	1	,	,
Firmware version	6	V1.6.1	V1.6.1
Separator	1	,	,
IMEI	15	012345678912345	012345678912345
Separator	1	,	,
Alert ID	2	1	1
Separator	1	,	,
Latitude	12	14.034533	14.034533
Separator	1	,	,
direction	1	N	N
Separator	1	,	,
Longitude	12	79.32045	79.32045
Separator	1	,	,
Direction	1	E	E
Separator	1	,	,
GPS fix	1	1	1
Separator	1	,	,
Date and Time	15	16112018 120317	16112018 120317
Separator	1	,	,
Heading	6	263.19	263.19
Separator	1	,	,
Speed	4	25.4	25.4
Separator	1	,	,
GSM Strength	2	23	23
Separator	1	,	,
Country Code (MCC)	3	404	404
Separator	1	,	,
Network Code (MNC)	4	10	10
Separator	1	,	,
LAC	4	d6d6	d6d6
Separator	1	,	,
Main Power	1	1	1
Separator	1	,	,
IGN Status	1	1	1
Separator	1	,	,

Battery Voltage	4	24.6	24.6
Separator	1	,	,
Frame Number	6	100000	100000
Separator	1	,	,
Vehicle mode	2	ID	ID
Total Characters	**139**		

B. Health Check Random Messages from Backend System to Device

Frequency: Twice Daily (Recommended),
Health Check Message Request Format from the Backend System to the Device (Through SMS): HCHK, Random Generated ID, Reply SMS Gateway no.
Health Check Message Reply Format from Device to Backend System (Through SMS): As per Table 1 above.

C. Publish Data to Common Layer by VLT Device Manufacturers' Applications (Sample)

Requirement to be complied with by VLT device manufacturers' applications

Application shall publish the data to common layer in a specified frequency and format as mentioned below

Services to publish data to the common layer

a. Push Offence Details

Type	REST web service
Data Type	JSON Array
Frequency	1 Hour

A single request may contain JSON Array of maximum 500 JSON Objects of the following format.

Sl No	Key	Value Length in bytes	Description
In Parameters			
1.	oftyp	2	Offence Type OS= Overspeed
2.	vno	16	Vehicle number without any delimiter like hyphen (-) or space.
3.	imei	15	IMEI number.
4.	date	8	Date in format DDMMYYYY
5.	time	6	UTC in format hhmmss

6.	lat	12	Latitude,decimal not less than 6 places
7.	latd	1	Latitude Direction. N=North, S= South
8.	lon	12	Longitude,decimal not less than 6 places
9.	lond	1	Longitude Direction. E=East, W= West
10.	spd	6	Speed in km/hrs, Upto One Decimal Value.
11.	loc		Location (Reverse Geo-coded)
12.	rto		RTO Code
13.	state		State Code
Response			
14.	resp		OK/ Error

b. Push Alert Details	
Type	REST web service
Data Type	JSON Array
Frequency	1 Hour

A single request may contain JSON Array of maximum 500 JSON Objects of the following format.

Sl No	Key	Value Length in bytes	Description
In Parameters			
1.	alrtid	2	Alert ID as per AIS-140
2.	vno	16	Vehicle number without any delimiter like hyphen (-) or space.
3.	imei	15	IMEI number.
4.	date	8	Date in format DDMMYYYY
5.	time	6	UTC in format hhmmss
6.	lat	12	Latitude,decimal not less than 6 places
7.	latd	1	Latitude Direction. N=North, S= South
8.	lon	12	Longitude,decimal not less than 6 places

9.	lond	1	Longitude Direction. E=East, W= West
10.	spd	6	Speed in km/hrs, Upto One Decimal Value.
11.	loc		Location (Reverse Geo-coded)
12.	rto		RTO Code
13.	state		State Code
Response			
14.	resp		OK/ Error

8.5 Conformity of Production - Testing Parameters

a. The VLT device manufacturers will get their devices tested and certified for conformity of production from the testing agencies referred to in rule 126 of the CMVR for compliance to the rule 125 H of CMVR every year from the date of first certification. The parameters for testing shall be as specified in Table 1 of this section.

b. The VLT device manufacturers shall get their backend applications audited from the testing agencies referred to in rule 126 of the CMVR/STQC/NIC or by the agencies specified by States/UTs every year from the date of first certification. The parameters for auditing shall be as specified in Table 2 of this annexure.

c. The testing agencies shall provide the details of the VLT devices and backend applications certified by them to the States/UTs by uploading the same on the respective backend systems or any other means.

Table 1: **Test for COP of VLT Device and Emergency Buttons**	
Sl. No.	**Test Details (As per AIS-140)**
1.	Emergency button functionality (Clause No. 3.1.2.4)
2.	SMS fall back (Clause 3.1.5)
3.	Table 6A: Functional Testing (Sr. No. 1-9, Clause 6.3.1)
4.	Performance Parametric Test of Table 6B (Clause 6.3.2, Sr. No.10)
5.	Protocol & alerts verification as per -Clause No 4.1 and Table no 4A, -Clause No 4.2 and Table no 4B, 4C -Clause No 3.1.4 & Table no 3B - OTA Commands verification
6.	Ingress Protection (IP) Test as per Sr. No. 3 of Table 6B

Table 2: Test Parameters for Auditing of VLT Device Manufacturer's Backend Application/System	
Sl. No.	**Test Details**
1.	Firmware over the air update. Backend application should be able to remotely read the existing version number of the firmware via an OTA configuration read command. A new version of the firmware should be pushed over the air. This should be verified by reading the new version number of the new firmware in the device via and OTA configuration read command.
2.	Application availability test to be conducted over a 7 days' period by periodic check of availability randomly or at specified intervals in an automated or manual manner.
3.	Test functionality of application to allow user to map & un-map a device to a vehicle.
4.	Test functionality to track a vehicle on a map over a period of 8 hours given either a device ID or vehicle registration number. The device ID and vehicle should be mapped beforehand.
5.	Test replay of a vehicles location by specifying a start and end date and time and device ID or vehicle registration number. The start and end date and time should be from within the last 3 months at date of test. In case 3 months of historical data is not available, the VLT manufacturer can pre-populate test data for the duration.
6.	Firmware binary should be made available with version matching one in the device as well as binary size & modification timestamp and/ or checksum should match for the binary provided and one installed on device.
7.	Test to confirm geographical location of IP addresses, the device communicates with by IP Geolocation for all IPs configured into the device to confirm they are in India. The IPs configured should be read from the firmware configuration via configuration read command and also separately confirmed against a list of IPs provided by the VLT manufacturer.
8.	VLT manufacturer to provide a certificate, statement or affidavit certifying the location of data centre/ cloud hosting region in India for user, device and vehicle data.
9.	VLT manufacturer to provide a Vulnerability Analysis and Penetration Testing report from a 3rd party test agency authorised by CERT-In/STQC.

14. Page 34 ANNEXURE A

Delete clause no 6.2

15. Page 35 ANNEXURE B

Substitute the following test for the existing text:

ANNEXURE B: CRITERIA FOR EXTENSION OF TYPE APPROVAL

B1.0 In case of following changes, Functional, Performance, Durability and Environmental Tests which are necessary for establishing compliance are listed below

	Changes in System	**Tests to be conducted**
B1.1	Change in Make, Model, Type, accompanied with or without a Part No of Vehicle Location Tracking (VLT) and Vehicle Health Monitoring.	Applicable tests as per Section 6 and Functional verification at system integration level or component level as applicable
B1.2	Change in software of ITS System	Functional verification at system integration level.
B1.3	Change in wiring harness	Wiring harness requirements specified in this standard

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P. B. NO. 832, PUNE 411 004
ON BEHALF OF

AUTOMOTIVE INDUSTRY STANDARDS COMMITTEE
UNDER

CENTRAL MOTOR VEHICLES RULES - TECHNICAL STANDING COMMITTEE
SET-UP BY

MINISTRY OF ROAD TRANSPORT & HIGHWAYS
(DEPARTMENT OF ROAD TRANSPORT & HIGHWAYS)
GOVERNMENT OF INDIA

5th December 2018

Amendment 1 (11th December 2017)

To

AIS-140: Intelligent Transportation Systems (ITS) - Requirements for Public Transport Vehicle Operation

1. Page 2

Replace Clause 1.B.7, Substitute the following text for the existing text:

1.B.7 **"Global Navigation Satellite System (GNSS)"** refers to a space-based radio navigation system. It provides positioning, navigation and timing services to military and civilian user on a continuous basis.

2. Page 2

Add new sub clause 1.B.12:

1.B.12 "SIM/UICC" refers to Subscriber Identification Module (SIM)/ Universal integrated circuit card (UICC) as per GSMA guidelines / DoT (TEC) Guidelines. Embedded SIM/UICC is a PCB soldered SIM/UICC/eUICC.

3. Page 2

Add new sub clause 1.B.13:

1.B.13 "Cellular Technology" such as GPRS/UMTS/HSPA/LTE etc.

4. Page 5

Clause 3.1.1.1. a, Substitute the following text for the existing text:

a. Device shall be capable for operating in L and/or S band and include support for NAVIC/IRNSS (Indian Regional Navigation Satellite System) for devices installed on vehicles on or after 1st October 2018. However VLT devices shall be compliant as per other GNSS constellation in the interim period.

5. Page 5

Clause 3.1.1.1. d, Substitute the following text for the existing text:

d. Device shall have an acquisition sensitivity of minimum (-) 145 dBm with GNSS/ (-) 140 dBm with IRNSS (NAVIC as applicable).

6. Page 5

Clause 3.1.1.1. e, Substitute the following text for the existing text:

e. Device shall have a tracking sensitivity of minimum (-) 160 dBm with GNSS / (-) 153 dBm with IRNSS (NAVIC as applicable).

7. Page 5

Clause 3.1.1.1. f, Substitute the following text for the existing text:

f. Device shall have an internal antenna; however, if in case of Integrated systems with vehicle OEM fitted kits if the fitment location prevents the internal antenna from functioning, then additional external antenna may be provided.

8. Page 5

Clause 3.1.1.2, Substitute the following text for the existing text:

3.1.1.2 Device shall support standard minimum I/Os as mentioned: 4 Digital, 2 Analog Input and 1 Serial Communication (e.g. RS232) for interfacing external systems (E.g. Digital input for Emergency request button interfacing).

9. Page 5

Clause 3.1.1.3, Substitute the following text for the existing text

3.1.1.3 Device shall be capable of transmitting data to Backend Control Server (Government authorized server) via Wide Area (Mobile) Communications network (Cellular) as per Communication Protocol in Section 4.

10. Page 5

Clause 3.1.1.4, Substitute the following text for the existing text :

3.1.1.4 Device shall be capable of transmitting Position, Velocity and Time (PVT data) along with heading (direction of travel) to a Backend Control Server (Government authorized server) at configurable frequency as per Communication Protocol of Section 4.

The fixed frequency shall be user configurable. Highest data transmission rate shall be 5 sec during vehicle operation and not less than 10 minutes in sleep/IGN OFF) as per the protocol defined in Communication Protocol of Section 4.

11. Page 5

Clause 3.1.1.6, Substitute the following text for the existing text :

3.1.1.6 On pressing of Emergency button, the system implementing VLT function shall send emergency Alert (Alert ID 10 as mentioned in Sub-section 4.2.1 of Communication Protocol Section 4) to the configured IP address(s) as per the Communication Protocol mentioned in Section 4. In the absence of Cellular network, the emergency alert shall be sent as SMS message along with vehicle location data to configured control center number(s). The SMS shall consist parameters as given in Sub-section 4.2.2.

12. Page 6

Clause 3.1.1.12, Substitute the following text for the existing text:

3.1.1.12 The Device shall have a unique identifier for identifying the VLT device and data. The unique ID shall be stored in a read only memory area so that it cannot be altered or overwritten by any person. The unique identifier is IMEI (International Mobile Station Equipment Identity) Number.

13. Page 6

Clause 3.1.1.14, Substitute the following text for the existing text:

3.1.1.14 Device shall have an Embedded SIM/UICC.

14. Page 6

Clause 3.1.1.15, Substitute the following text for the existing text:

3.1.1.15 Device shall be designed to operate 12V DC and or 24 V DC.

15. Page 6

Clause 3.1.1.16, Substitute the following text for the existing text:

3.1.1.16 Device shall have a sleep mode current ≤ 50 mA.

16. Page 6

Clause 3.1.1.18, Substitute the following text for the existing text:

3.1.1.18 The Device shall support:

- Location on Cellular /SMS
- Non-volatile memory to store min 40,000 positional log
- Configurable backup SMS facility in case of Cellular failure
- Capability to send serving and adjacent cell ID as well as network measurement report (NMR)

17. Page 7

Clause 3.1.1.19, Substitute the following text for the existing text:

3.1.1.19 The VLT Device shall have:

- The capability of Hot start < 10s
- The capability of Warm start : < 60 s
- The capability of Cold start < 120 s

18. Page 7

Clause 3.1.1.20, Substitute the following text for the existing text:

3.1.1.20 Device shall support data Outputs as per protocol covered in this standard.

19. Page 7

Clause 3.1.1.21, Substitute the following text for the existing text:

3.1.1.21 The Device Cellular module shall have:

- Multi slot Cellular with In – built Quad-band Cellular module/Modem
- Cellular class 10 or above
- Support Embedded SIM/UICC to cater to the operational requirement such as vibration, temperature and humidity and provide long life span with at least 10 years life and more than 1 million read/write cycles
- Cellular module & Embedded SIM/UICC shall support
  - SMS, Data (Cellular, TCP/IP) and
  - Support multiple network OTA switching (on-demand / automatic) capabilities.

20. Page 7

Clause 3.1.1.23, Substitute the following text for the existing text:

3.1.1.23 Device shall be manufactured by manufacturer whose quality management system has been certified for compliance to ISO / TS 16949 or ISO 9001 or any equivalent National or International standard.

21. Page 8

Clause 3.1.2.3, Substitute the following text for the existing text:

3.1.2.3 The Emergency Buttons will be such that disconnection between switch and controller should be detected through controller logic or 'Normally Closed' (NC) Type Switch. For Emergency button, there shall be indication of its working status visible for passengers in Ignition ON Condition. The form factor of Emergency Buttons will be such that the button is easy to press in the case of an emergency, and simultaneously also minimizes the possibility of accidental or unintended press thereby causing a false alert.

22. Page 8

Clause 3.1.2.4, Substitute the following text for the existing text :

3.1.2.4 On pressing of Emergency button, the system implementing VLT function shall send emergency Alert (Alert ID 10 as mentioned in Sub-section 4.2.1 of Communication Protocol Section 4) to the Backend Control Server (Government authorized server) as per the Communication Protocol mentioned in Section 4. In the absence of Cellular network, the alert shall be sent as SMS message along with vehicle location data to configured control center number. The SMS shall consist of parameters as given in Sub-section 4.2.2.

23. Page 8

Clause 3.1.2.5, Substitute the following text for the existing text :

3.1.2.5 In absence of both Cellular and GSM networks and on pressing of Emergency Button, the system implementing VLT function shall store the emergency Alert (Alert ID 10 as mentioned in Sub-section 4.2.1 of Communication Protocol Section 4). Once the Cellular or GSM is available, this alert information shall be sent on high priority to the configured IP addresses as per the communication protocol mentioned in Section 4 or as SMS message along with vehicle location data to configured control center number. The SMS shall consist of parameters as given in Sub-section 4.2.2.

24. Page 8

Clause 3.1.3, Substitute the following text for the existing text :

3.1.3 **Configuration of Device Parameters Over the Air (OTA)**

The device shall support at least the below parameters to be configurable over the air (through SMS and Cellular). The updation/ configuration shall be allowed only over an 'authenticated' channel:

1. Setting/ Change of the Primary or Secondary IP and port number
2. Setting/ Change of the APN
3. Set configuration parameter like sleep time, over speed limit, harsh braking, harsh acceleration, rash turning threshold limits etc.
4. Emergency control SMS Centre Number(s)
5. Configuring the vehicle registration number

6. Configuring the frequency of data transmission in normal / Ignition state / OFF state sleep mode/ Emergency state, etc.
7. Configuring the time duration for Emergency state
8. Capability to reset the device
9. Command to get the IMEI of the device Configurable commands must involve the following features:
   9.1. SET: For setting the parameters.
   9.2. GET: For enquiring regarding the parameters such as mobile number, GSM strength, vehicle number and other important parameters.
   9.3. CLR: For clearing certain commands, alarms, alerts etc. except emergency alert

After each SET, GET, CLR command the device should send alert to Backend Control Centre, as mentioned in Section 4 Alert 12, giving the details of Mode, mobile no/ IP of control center sending commands.

25. Page 9

Clause 3.1.5, Substitute the following text for the existing text :

3.1.15 In case of emergency state, (i.e. on pressing of Alert button), the device will shift to the SMS mode in case Cellular connectivity is not available. In such case, the device will send the Alert message and tracking data through SMS mode. Since SMS has the limitation of sending only 160 characters, so the tracking data to be sent in one SMS will have fields - IMEI, Latitude, Direction, Longitude, Direction, location fix, speed, Cell ID, LAC (Location Area Code), Date and Time as per emergency alert . The details is provided in Sub-section 4.2.2.

26. Page 12

In Table 4 A , for the item Checksum and entries thereof, substitute the following:

Checksum	Ensures No error in transmission (optimal)	16

27. Page 13

In Table 4 B, for the item – Alert Id 2. Location Update (history) and entries thereof, substitute the following:

2.	Location Update (history)	Would be sent, if Cellular is not available at the time of sending the message in protocol format Zero, BLANK, NIL, etc.

28. Page 14

Clause 4.2.2, For first paragraph substitute the following text for the existing text:

4.2.2 In case of emergency alert, the alert message shall be sent to 2 different IP addresses hence the device shall support minimum 2 IP addresses (1 IP address for regulatory purpose (PVT data) and 1 IP address for Emergency response system other than the IP's required for Operational purpose. The PVT data will send the emergency alert to the system. Only Primary alert data will go to the emergency response Backend Control Centre (NERS/ MHA) as may be notified by the Government of India in the schema below:

29. Page 14

Substitute the following Table 4 C for existing Table 4 C :

Table 4C:		
Indicative Format for Alert to Emergency Response System		
Attribute	**Value / Description**	**Size**
Start Character	$	1 Byte
Packet Header	EPB, The unique identifier for all messages from VLT	Character, 3 bytes
Packet Type	Message Types supported. Emergency Message (EMR) or Stop Message (SEM)	Character, 3 bytes
IMEI Number	Unique ID of the Vehicle (IMEI Number)	Character,15 bytes
Packet Status	NM – Normal Packet, SP – Stored Packet	Character, 2 bytes
Date	Date and time of location the location obtained from the data in DDMMYYYY hhmmss format	Character,14 bytes
GPS Validity	A – Valid, V – Invalid	Character, 1 byte
Latitude	Latitude in decimal degrees - dd.dddddd format	Double, 12 bytes
Latitude Direction	N – North, S – South	Character, 1 byte
Longitude	Longitude in decimal degrees - dd.dddddd format	Double, 12 bytes
Longitude Direction	E – East W – West	Character, 1 byte
Altitude	Altitude in meters (above sea level)	Double, 12 bytes
Speed	Speed of Vehicle as Calculated by GPS module in VLT. (in km/hr)	Float, 6 bytes
Distance	Distance calculated from previous GPS data	Float, 6 bytes

Provider	G - Fine GPS N - Coarse GPS or data from the network	Character, 1 byte
Vehicle Regn. No	Registration Number of the Vehicle	Character, 16 bytes
Reply Number	The mobile number to which Test response needs to be sent. (Emergency Mobile No. as specified by MHA/MoRTH/States.)	0 Note: No number needs to be sent. This field will with value 'zero'
End Character	*	1 byte
Check sum	Ensure no error in transmission	8 bytes
*Above format is indicative only. These Format will be notified by the Government of India time to time.		

30. Page 15

In Clause 4.3, for the words:

"• CLR: For clearing certain commands, alarms, alerts etc."

Substitute the following text:

"• CLR: For clearing certain commands, alarms, alerts etc. except emergency alert."

31. Page 16

Clause 5.1, Substitute the following text for the existing text :

5.1 **Requirements on vehicle interface for VLT with Emergency Button**

Connector for Power

The requirements for interface shall be as agreed between vehicle manufacturer and device manufacturer.

32. Page 16/17

Clause 5.3, Substitute the following text for the existing text :

5.3 **Physical Mounting**

The VLT system shall be mounted in a suitable location such a way that it is not easily accessible /exposed to passengers.

This requirement shall not be applicable in case of combined systems VLT with HMI (Human Machine Interface) display in front of driver.

Test agency to verify this on vehicle level approval.

Emergency button(s) shall be fitted in such a way that every passenger including driver shall be able to access the Emergency button(s).

Passenger Car shall have at least one emergency buttons on each passenger row easily accessible by each of the passenger. There shall also be one dedicated emergency button for the driver row.

Passenger Transport bus shall have emergency buttons at locations easily visible & assessable to all the passengers such as every 2 meters on both the sides on passenger seating area. For seats reserved for ladies there shall be a dedicated panic button for each row.

It shall be permissible to have a single emergency button for two successive ladies' rows on both sides of the vehicle provided each lady passenger in either rows are able to reach and operate the emergency button.

Test agency to verify this on vehicle level approval.

33. Page 17

Clause 5.4, Substitute the following text for the existing text :

5.4 The vehicle tracking device will be installed on vehicles in which the power supply voltage from vehicle battery is widely varying (12V, 24V etc.) and also the power supply is not as stable as that in case of fixed locations, especially during engine start-up and braking when the voltage can fall to as low as 9V. Typically electronic devices are very sensitive to power surges and spikes, and equipment may fail if they do not receive stable power supply. The devices will need to have a resilient power supply unit that can withstand such fluctuations and the devices also need to have power backup so that they continue to function for some duration when the vehicle battery is not functional or is disconnected from the devices.

Vehicle power interface shall have

- One common ground linked to vehicle chassis
- One permanent power Supply (12/24V) connected to the vehicle battery (+Vbat).
- One non-permanent power line (12/24V) connect to the battery after ignition (IGN).

34. Page 17

Clause 6.1.1.2, Substitute the following text for the existing text :

6.1.1.2 System transmits PVT information to Backend Control Center (2 different IPs) at user configurable frequency (minimum 5 seconds) via GSM / Cellular.

35. Page 18

Clause 6.2.1.1, Substitute the following text for the existing text :

6.2.1.1 Standard connector provided for Power and other signals as per clause no 5.1.

36. Page 18

Clause 6.2.1.5, Substitute the following text for the existing text :

6.2.1.5 Updating of the firmware of the system from Backend Control Centre only.

37. Page 19

Substitute the following Table 6 A for existing Table 6 A :

Table 6A:		
Functional Testing		
Sl. No	**Test**	**Test Procedure**
1	Tracking Functionality Test	The test shall be conducted on VTL to determine the proper functioning of VLT with Emergency Button by testing its connectivity to Backend Control Centre (Government authorized server). Procedure: The VLT with Emergency Button shall be connected to vehicle battery to switch it on. The VLT with Emergency Button shall be tested for the connectivity to server and its capability to send two location messages
2	Location Accuracy Test	This test shall be conducted on VLT with Emergency Button.  The receiver is placed into a cold start state – usually by a command sent to the receiver through a test connection – and then a fairly strong navigation signal simulating in L and/or S band is sent. The time it takes for the receiver to determine its first good location fix is recorded. Test is done many times (>15 times) over many conditions and the results are averaged. **Acceptance Criteria**: 2.5 m CEP or 6 m 2DRMS.

3	Acquisition Sensitivity Test	This test shall be conducted on VLT with Emergency Button. **Procedure:** Set the simulator to output navigation signal simulating L and/or S band to a particular location with a very level so that the tracking is not possible. Gradually increase the signal level that allows the receiver to successfully perform a cold start TTFF. The minimum signal level that allows acquisition is referred as to the acquisition sensitivity. **Acceptance Criteria**: The acquisition sensitivity shall be minimum (-)145 dBm with GNSS/ (-) 140 dBm with IRNSS (NAVIC as applicable.).
4	Tracking Sensitivity Test	This test shall be conducted on VLT. **Procedure:** The device under this test is locked on to the simulator's output frequency (navigation signal simulating L and/or S band) and the simulator power output is lowered until the lock is lost. Multiple repetition of the test with different satellite geometries ensures that an accurate average measure is recorded. **Acceptance Criteria:** The tracking sensitivity shall be equal to or better than (-) 160 dBm with GNSS / (-) 153 dBm with IRNSS (NAVIC as applicable).
5	Cold-Start Time to First Fix (TTFF) Test	The device in this test is placed into a cold start state. The time it takes for the device to determine its first good location fix is recorded. The cold start test is performed several times and the results are averaged. **Acceptance Criteria*:*** The cold start TTFF shall be less than 120 seconds at Open Sky condition or (-) 130 dBm.
6	Warm-Start Time to First Fix Test	In this test the device is started in warm start mode and time taken by device to determine the first valid location fix is recorded. This is done several times and results are averaged. **Acceptance Criteria:** The warm start TTFF shall be less than 60 seconds at Open Sky condition or (-) 130 dBm.

7	Hot-Start Time to First Fix Test	In this test the device is started in Hot start mode and time taken by device to determine the first valid location fix is recorded. This test is performed several times and results are averaged. **Acceptance Criteria:** The hot start TTFF shall be less than 10 seconds.
8	Embedded SIM/ UICC Test	This test is to check the suitability of the embedded SIM/ UICC and communication module. The test shall be conducted to determine the effectiveness and operation of the Cellular module with OTA network switching capabilities on demand as well as automatically in real-time. The test consist of two type of testing as below: **1.** The device would be tested to perform as per the protocol using an embedded SIM/UICC. **2.** The Cellular module & embedded SIM/UICC, shall support: o SMS, Data (Cellular, TCP/IP) and o Support multiple network OTA switching capabilities (On Demand as well as Automatic Switching on real-time basis) **Acceptance Criteria:** In the testing, vendors has to demonstrate the embedded SIM/UICC based tracking and multiple network OTA switching capabilities (On Demand as well as Automatic Switching on real-time basis) for effective network management and transmission.
9	Functional Endurance Test	VLT device shall be operated for 96 hours with external power supply and internal battery connected to device. PVT data monitoring will be done for complete duration of test with data frequency defined after IGN switch ON mode. VLT device shall function successfully during and after test.
10	On Vehicle Dynamic Location Test	VLT devices will be mounted on any target vehicle connected with vehicle battery. Target vehicle with VLT devices will be run for 10 km on pre-defined track/route to verify dynamic location test. VLT device PVT data shall be within 12 meter for more than 90% of the fixed location data (as arrived using DGPS device on the same route). VLT device PVT data shall be super imposed on followed route map to check its correctness of followed route.

38. Page 23

In Table 6 B, for the Sl. No. 5 and entries thereof, substitute the following:

5	Battery Backup Test	Battery backup is the amount of time that the device battery can support sending the data without being connected to the power source. This test will be performed by disconnecting the input charging voltage to the device. On disconnecting the external supply, battery would use its charge capacity to send data through Cellular. Time duration between external power disconnect to the last data packet time denotes the battery backup time. **Acceptance Criteria:** Device shall be able to work in active mode for a period of 4 hours or more at the polling/ transmission rate of 60 sec

39. Page 19

Substitute the following Table 6 C for existing Table 6 C:

Table 6C:		
Device Level Environmental Test		
Sl. No	**Test**	**Test Procedure**
1	Dry Heat / High Temperature Test	The high temperature test is used to evaluate effects of high temperature conditions on safety, integrity, and performance of the device. The test shall be carried out in accordance with Indian Standard IS: 9000 (Part 3/Sec 5) the device shall be subjected to temperature of 70 ± 2°C for 16 h in high temperature. Test with device in working condition. The recovery period shall be 2 h. **Acceptance Criteria**: Device during and after the high temperature test the device shall be required to meet the provisions of Functional Test Number 1 as listed in Table 6A.

2	Cold Test	The test shall be carried out in accordance with IS 9000 (Part 2/Sec 4 – 1977). The device under test shall be subjected to temperature of –10 ± 2°C for 2 h with device in working condition. The recovery period shall be 2 h. **Acceptance Criteria**: Device during and after the cold test, the device shall be required to meet the provisions of Functional Test Number 1 as listed in Table 6A.
3	Damp Heat Test	The device under test shall be tested according to IS 9000 (Part 5/Sec 2 – 1981). The test is carried out at +25° to +55° C, Humidity 95%. Six cycles (each test cycle of 24 h) shall be run with device in off condition. Functional test shall be carried out with power in 'On condition' at start of 2^{nd}, 4^{th} and 6^{th} cycle. **Acceptance Criteria**: Device during and after the test the device shall be required to meet the provisions of Functional Test Number 1 as listed in Table 6A.
4	Temperature Shock	Temperature shock test is carried out to determine if the device can withstand sudden changes in the temperature of the surrounding atmosphere without experiencing physical damage or deterioration in performance. The device shall be tested as per IS 9000 (Part 14/Sec 2) – 1978. Exposure time at temperature extremes -10ºC and 70 ºC would be 3 hours/cycle and number of cycles would be two. **Acceptance Criteria**: Device after the test the device shall be required to meet the provisions of Functional Test Number 1 as listed in Table 6A.
5	Salt Spray Test	The salt spray test is conducted to check corrosion resistance of device. The device shall be tested according to Clause 4.8 of IS 10250 for 96 h. **Acceptance Criteria**: The device shall be required to meet the provisions of Functional Test Number 1 as listed in Table 6A.
6	High Voltage Test	The test is conducted to ensure service life requirements & functionality. The device under test shall be operated for 60 minutes at 18 V for 12 V systems & 36 V for 24 V systems. This test is as per ISO 16750-2:2010

		Acceptance Criteria: Device during and after the test the device shall be required to meet the provisions of Functional Test Number 1 as listed in Table 6A.

40. Page 27

In Table 6 D; for item Packet Type and Alert ID and entries thereof, substitute the following text for existing text :

Packet Type	Specify the packet type – NR = Normal EA = Emergency Alert TA = Tamper Alert **(Optional)** HP = Health Packet IN = Ignition On IF = Ignition Off BD = Vehicle Battery Disconnect BR = Vehicle Battery Reconnect BL = Internal Battery Low HB= Harsh Braking HA= Harsh Acceleration RT= Rash Turning
Alert ID	02 Character

41. Page 29

After Table 6 D; for paragraph (a), substitute the following text for existing text

a) The device shall support 40000 or more positional logs/packets. This is a functional test and the device will be simulated to be in non – Cellular coverage area and the logs will be maintained. The capacity of logging will be checked by monitoring the logs on the device.

42. Page 29

In Table 6 E; for Alert ID 2 and entries thereof, substitute the following text for existing text :

2.	Location Update (history)	Would be sent, if Cellular is not available at the time of sending the message

43. Page 30

Substitute the following Table 6 F for existing Table 6 F:

Table 6F:		
Message Format		
Start Character	$	1 byte
Packet Header	EPB, The unique identifier for all messages from VLT	Character, 3 bytes
Packet Type	Message Types supported. Emergency Message (EMR) or Stop Message (SEM)	Character, 3 bytes
IMEI Number	Unique ID of the Vehicle (IMEI Number)	Character,15 bytes
Packet Status	NM – Normal Packet, SP – Stored Packet	Character, 2 bytes
Date	Date and time of the location obtained from the location data in DDMMYYYY hhmmss format	Character,14 bytes
GPS Validity	A – Valid, V – Invalid	Character, 1 byte
Latitude	Latitude in decimal degrees - dd.mmmmmm format	Double, 12 bytes
Latitude Direction	N – North, S – South	Character, 1 byte
Longitude	Longitude in decimal degrees - dd.mmmmmm format	Double, 12 bytes
Longitude Direction	E – East W – West	Character, 1 byte
Altitude	Altitude in meters (above sea level)	Double, 12 bytes
Speed	Speed of Vehicle as Calculated by GPS module in VLT. (in km/hrs.)	Float, 6 bytes
Distance	Distance calculated from previous GPS data	Float, 6 bytes
Provider	G - Fine GPS N – Coarse GPS or data from the network	Character, 1 byte
Vehicle RegnNo	Registration Number of the Vehicle	Character, 16 bytes
Reply Number	The mobile number to which Test response need to be sent. (Emergency Mobile No. as specified by MHA/MoRTH/States.)	0
End Character	*	1 byte
Check sum	Ensure no error in transmission.	8 bytes

44. Page 31

In Clause no. 7 for first paragraph substitute the existing text with following text :

The VLT device would transmit data to the Backend Control Centre using Cellular wireless connectivity (with SMS fall back) as per the protocol provided in respective sections (Sub-section 6.3.4). The data from the devices would travel over the wireless telecom service provider network and finally get delivered at the Backend Control Centre. Since the permit holders/Device suppliers would require to have a valid communication plan on embedded SIM/UICC cards on the devices and would avail services from multiple telecom service providers, the data would be transmitted to the Backend Control Centre using the networks of multiple telecom service providers.

45. Page 31

In Clause no. 7 for second paragraph substitute the existing text with following text :

A suitable control mechanism would be established for the data transfer from VLT to Backend Control Centre, as only the authorized devices should be able to transfer data to the Backend Control Centre and a mechanism for authenticating the devices/ embedded SIM/UICC shall also be put into place.

46. Page 36

Delete Annexure C :

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THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA
P. B. NO. 832, PUNE 411 004
ON BEHALF OF

AUTOMOTIVE INDUSTRY STANDARDS COMMITTEE
UNDER

CENTRAL MOTOR VEHICLES RULES - TECHNICAL STANDING COMMITTEE
SET-UP BY

MINISTRY OF ROAD TRANSPORT & HIGHWAYS
(DEPARTMENT OF ROAD TRANSPORT & HIGHWAYS)
GOVERNMENT OF INDIA

11th December 2017

AUTOMOTIVE INDUSTRY STANDARD

Intelligent Transportation Systems (ITS) - Requirements for Public Transport Vehicle Operation

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October 2016

Status chart of the Standard to be used by the purchaser for updating the record

Sl. No.	Corrigenda	Amendment	Revision	Date	Remark	Misc.

General remarks:

INTRODUCTION

The Government of India felt the need for a permanent agency to expedite the publication of standards and development of test facilities in parallel when the work on the preparation of the standards is going on, as the development of improved safety critical parts can be undertaken only after the publication of the standard and commissioning of test facilities. To this end, the erstwhile Ministry of Surface Transport (MoST) has constituted a permanent Automotive Industry Standards Committee (AISC) vide order No. RT-11028/11/97-MVL dated September 15, 1997. The standards prepared by AISC will be approved by the permanent CMVR Technical Standing Committee (CTSC). After approval, the Automotive Research Association of India (ARAI), Pune, being the secretariat of the AIS Committee, will publish this standard.

Intelligent Transport Systems (ITS) are globally proven systems to optimize the utilization of existing transport infrastructure and improve transportation systems in terms of efficiency, quality, comfort and safety. Having realized the potential of ITS, Government bodies and other organizations in India are presently working towards implementing various components of ITS across the country.

The first step taken for creation and implementation of ITS was holding a National Workshop titled "User Requirements for Interactive ITS Architecture", which was conducted as a collaboration between SIAM and ASRTU on 26th & 27th February 2015. This was primarily focused on ITS in Public Bus Transportation. Nonetheless, the workshop helped to create the outline for "National Intelligent Transport System Architecture and Policy for Public Transport (Bus)", which was submitted by ASRTU and SIAM to the government

In the 44th & 45th CMVR-TSC, Chairman had directed - standardization activities to be initiated on Intelligent Transportation Systems (ITS) - Vehicle Location Tracking, Camera Surveillance System and Emergency Request Button. The committee intended to extend the above user requirements to all public transportation namely – buses, taxis, etc. The current document covers the requirements for Vehicle Location Tracking and Emergency Button. The other ITS components like PIS, CCTV system, Fare collection etc. are deliberated and would be addressed in later phase and could be added as separate parts to the current document..

Based on these directions, the AISC Panel on ITS has prepared this AIS-140 titled, "Intelligent Transportation Systems (ITS) - Requirements for Public Transport Vehicle Operation"

The panel has also deliberated and identified the necessary elements for an effective implementation of vehicle level ITS system.

This standard has been prepared by considering inputs received from all stake holders on ITS, mainly -

a. Directions of CMVR-TSC
b. Detailed Specification Document on Vehicle Tracking Devices (dated 4th March 2015, published by MoRTH)
c. Report of Department of Telecom (Telecom Engineering Centre) Automotive Working Group on M2M enablement in Intelligent Transport System (ITS)

This AIS on ITS, has been provisioned for device level approval; including construction and target vehicle level approval. Device level approval is needed to enable retro-fitment of ITS systems on in-use vehicles. This will ensure ITS Backend Control Centre infrastructure already presents with the STUs can be more fully utilized and make the investment in the Backend Control Centre infrastructure more viable.

As per the direction of CMVR-TSC which needed the Communication Protocol and Backend Control Centre requirement for tracking and handling the alerts to be detailed, the same has been addressed in Section 6 & 7, as detailed below.

- The devices would transmit data to the Backend Control Centre using 2G/3G/4G wireless connectivity (with SMS fall back) as per the protocol provided in respective sections (Section 6).
- The data from the devices would travel over the wireless telecom service provider network and finally get delivered at the Backend Control Centre. The detail about Device to Backend Communication Mechanism is mentioned in Section 7.

BIS and AIS both have panels which are formulating standards on ITS. It is our belief that taking the AIS route for the 1st implementation would give the faster time for adoption. Experts in the BIS panel and in DIMTS who are working on these subjects have been co-opted and invited to work in the AIS panel to make the AIS as robust as possible. Once implemented and all implementation problems in this emerging technology have been eliminated, BIS standard can be made with further inclusions if any resulting from consultations with the wider stakeholder community. Because of these reasons, we recommend the AIS route for regulation creation and first implementation.

One of the major concerns which has been raised during the panel meetings is on the issue of privacy encroachments by ITS systems. Some overseas member countries of the 1958 agreement have been continuously emphasizing in WP29 forums that the regulated ITS system must not encroach on privacy. Towards this, the panel has submitted a document titled ‘Data Privacy in Transportation ITS’ To help the system developers deal with these issues. Further, system developer can also take guidance from ‘IS/ISO/TR 12859: 2009 - Intelligent Transport Systems — System Architecture — Privacy Aspects in ITS Standards and Systems’ while developing their systems to meet the requirements of this standard. The Panel and the Automotive Industry Standards Committee (AISC) responsible for preparation of this standard are given in Annexure-D and Annexure -E respectively.

Intelligent Transportation Systems (ITS) - Requirements for Public Transport Vehicle Operation

1.0 SCOPE

1.A.0 This standard applies to both individual components as well as system environment intended to be used in Public transport vehicles.

1.A.1 INTELLIGENT TRANSPORTATION SYSTEMS-VLT WITH AN EMERGENCY SYSTEM

Requirements on ITS devices and functions - Vehicle Location Tracking and Emergency Button.

1.B.0 DEFINITIONS:

For the purpose of this standard, definitions are given below:

1.B.1 **"Acquisition sensitivity"** refers to the minimum signal level at which the device is able to successfully perform a cold start TTFF. The acquisition sensitivity test is a simulated signal test.

1.B.2 **"Assisted GPS (A-GPS)"** is a system allowing satellite receivers to obtain information from communication network resources to assist in acquiring satellite location. A-GPS system is especially useful when the receiver is in a location where it is difficult for the satellite signals to penetrate. In addition to providing better coverage, A-GPS also improves the start-up time, which is the time required by the satellites and the receivers to establish a reliable connection.

1.B.3 **"Circular Error Probability (CEP)"** is defined as the radius of a circle centered on the true value that contains 50% of the actual GPS measurements. So a receiver with 5 meter CEP accuracy will be within 5 meter of the true measurement 50% of the time. The other 50% of the time the measurement will be in error by more than one meter.

1.B.4 **"Dilution of Precision (DOP)"** is the degree of proximity of the location data to their mean value. The relative position of satellites affects the accuracy of location calculation by the locating module. Location coordinates computed when the satellites are clustered together suffer from dilution of precision (DOP), a factor that multiplies the associated errors. The DOP for an ideal satellites constellation arrangement equals close to 1, which does not magnify the underlying errors.

1.B.5 **"Distance Root Mean Square (DRMS also called RMS, 1Sigma)"**

This is computed as square root of the average of the squared horizontal position errors with 65% probability. The position expressed has the probability of being within a circle with radius with 65% probability. A locating module with 6 metre DRMS accuracy would be within 6 meters of its actual position 65% of the time.

1.B.6 **"Emergency Button"** A button provided in vehicle for passengers or crew members to send specialized data packet /SMS to Centralized regulatory server to indicate safety/panic situation caused by human or natural disaster or vehicle accident etc.

1.B.7 **"Global Positioning System (GPS)"** is a space-based radio navigation system. It provides positioning, navigation, and timing services to military and civilian users on a continuous basis.

1.B.8 **"Sensitivity"** refers to the minimum signal strength level at which locating module can successfully perform a location fix. A GNSS locating module has two different sensitivity levels – acquisition sensitivity and tracking sensitivity.

1.B.9 **"Time to First Fix (TTFF)"** describes the time required for a tracking device to acquire adequate satellite signals and related data (almanac and ephemeris data) to compute location.

1.B.10 **"Tracking Sensitivity"** refers to the minimum signal level at which the device is able to successfully maintain the location fix. The acquisition sensitivity test is a simulated signal test.

1.B.11 **"Vehicle Location Tracking (VLT)"** device uses satellite based location technology to determine and record the precise location of a vehicle at regular intervals. The location data so determined can be stored within the device, and/or can be transmitted to the Backend Control Centre using a wireless communication modem built in the device.

1.C REFERENCES:

The References are listed below.

1.C.1 National Level Vehicle Security and Tracking System – Detailed Specification Document on Vehicle Tracking Devices (GPS) (Published by MoRTH MoRTH).

1.C.2 APTA TCIP - American Public Transportation Association (APTA) Standard for Transit Communications Interface Profiles (TCIP)

1.C.3 EBSF - European Bus System of the Future

1.C.4 ISO 11898-1:2003 Road vehicles — Controller area network (CAN)

1.C.5 SAE J 1939 Recommended Practice for a Serial Control and Communications Vehicle Network.

1.C.6 Bus-FMS-Standard

1.C.7 SAE USCAR 18 / USCAR18-3 - FAKRA SMB RF CONNECTOR SUPPLEMENT

1.C.8 National ITS Architecture - U.S. Department of Transportation

1.C.9 ISO 17185-1:2014 - Intelligent transport systems — Public transport user information — Part 1: Standards framework for public information systems

1.C.10 Trans model Standard (CEN/TC 278 WG3/SG4, Reference Entity-Relationship Data Model for Public Transport) - European reference data model for Public Transport operations developed within several European Projects - EN 12896:2006

1.C.11 Specification for Entity-Relationship for describing the main fixed objects in Public transport CEN/TC 278, 2008 - EN 28701:2012

1.C.12 RTIG (Real Time Information Group Ltd) - Digital Air Interface Protocol

1.C.13 SIRI (Service Interface for Real Time Information) European Technical Specification (TS) - CEN/TS 15531

1.C.14 NeTEx-Network Exchange European Technical Specification (TS) CEN/TS 16614

1.C.15 NaPTAN (National Public Transport Access Node)

1.C.16 ISO 15638-15:2014 Intelligent transport systems – Framework for cooperative telematics applications for regulated vehicles (TARV) – Part 15: Vehicle location monitoring

1.C.17 ISO 15638-5:2013 Intelligent transport systems – Framework for collaborative Telematics Applications for Regulated commercial freight Vehicles (TARV) – Part 5: Generic vehicle information

1.C.18 NMEA-0183: The NMEA 0183 standard defines an electrical interface and data protocol for communications between marine instrumentation.

1.C.19 IS/ISO/TR 12859:2009 – Intelligent Transport System-System Architecture-Privacy Aspects in ITS standards and systems

1.C.20 Report of Department of Telecom (Telecom Engineering Centre) Automotive Working Group on M2M enablement in Intelligent Transport System (ITS)

1.C.21 URL: http://tec.gov.in/pdf/M2M/M2M%20Enablement%20in%20ITS.pdf

2.0 APPLICATION FOR CMVR TYPE APPROVAL

2.1 The application for CMVR device level approval shall be accompanied by information on the system specification as mentioned in Annexure A.

2.2 Type approval shall involve following steps:

2.2.1 **Device Approval**: Approval provided at Device level for compliance to this standard.

These approved devices can be fitted / retro-fitted by manufacturer/ dealer/ permit holder/system integrator in any vehicle model provided it shall meet installation requirements as mentioned in Clause No. 5 of this standard. For manufacturers seeking vehicle level approval with approved VLT with Emergency Buttons fitted shall only require installation approval as per the provisions of Clause 5 and Sub-Clause 6.1 of Clause 6.

2.3 **Modifications and Extension of Approval**

2.3.1 Every modification pertaining to the information, even if the changes are not technical in nature declared in accordance with clause 2.1, shall be intimated by the VLT with Emergency Button Manufacturer to the test agency.

2.3.1.1 If the changes are in parameters not related to the provisions, no further action need be taken.

2.3.1.2 If the changes are in parameters related to the provisions, the test agency, which has issued the certificate of compliance, may then consider, based on the justification provided by the VLT with Emergency Button Manufacturer and reviewed by the test agency, whether,

The model with the changed specifications still complies with provisions;

Or,

Any further verification is required to establish compliance.

2.3.2 In case of 2.3.1.2, tests for only those parameters which are affected by the modifications need be carried out based on Criteria for extension of type approval as per Annexure B.

2.3.3 In case of fulfilment of criterion of clause 2.3.1.1 or after results of further verification as per clause 2.3.1.2 are satisfactory, the approval of compliance shall be extended for the changes carried out.

3.0 ITS FUNCTIONS AND REQUIREMENTS

The list of ITS functions envisaged from this device type is set out below in Table 3A –

Table 3A: List of ITS Functions and Sub Functions

Function	Sub Functions
Safety and Security	Emergency Buttons
	Vehicle Location Tracking (VLT)

The above functions and their requirements shall be met by only single device that can be interfaced by external emergency buttons. The communications to Backend Control Server (Government authorized server) shall be done by device as per the protocol and functionalities defined below.

3.1 Vehicle Location Tracking (VLT) With Emergency Button

3.1.1 Functional Requirements for VLT

3.1.1.1 Device shall be capable of obtaining position information using Global Navigation Satellite System (GNSS). GNSS receiver specifications are as follows:

a. Device shall be capable for operating in L and/or S band and include support for NAVIC/IRNSS (Indian Regional Navigation Satellite System) for devices installed on or after 1st April, 2018.

b. The Device shall support GAGAN, the Indian SBAS (Satellite Based Augmentation System).

c. Device shall have a position accuracy of minimum 2.5 m CEP or 6 m 2DRMS.

d. Device shall have an acquisition sensitivity of minimum (-) 148 dBm.

e. Device shall have a tracking sensitivity of minimum (-) 165 dBm.

f. Device shall have an internal antenna; however if in case of Integrated systems with vehicle / aftermarket OEM approved kits if the fitment location prevents the internal antenna from functioning, then external antenna shall be provided.

3.1.1.2 Device shall support standard minimum I/Os as mentioned: 4 Digital, 2 Analogue and 1 Serial Communication (e.g. RS232) for interfacing external systems (E.g. Digital input for Emergency request button interfacing).

3.1.1.3 Device shall be capable of transmitting data to Backend Control Server (Government authorized server) via Wide Area (Mobile) Communications network (GSM/GPRS) as per Communication Protocol in Section 4.

3.1.1.4 Device shall be capable of transmitting Position, Velocity and Time (PVT data) along with heading (direction of travel) to a Backend Control Server (Government authorized server) at configurable frequency as per Communication Protocol of Section 4.

The fixed frequency shall be user configurable, minimum frequency shall be 5 sec during vehicle operation and not less than 10 minutes in sleep/IGN OFF) as per the protocol defined in Communication Protocol of Section 4.

3.1.1.5 Device shall be capable of transmitting data to minimum 2 different IP addresses (1 IP address for regulatory purpose (PVT data) and 1 IP address for Emergency response system other than the IP's required for Operational purpose.

3.1.1.6 On pressing of Emergency button, the system implementing VLT function shall send emergency Alert (Alert ID 10 as mentioned in Sub-section 4.2.1 of Communication Protocol Section 4) to the configured IP address(s) as per the Communication Protocol mentioned in Section 4. In the absence of GPRS network, the emergency alert shall be sent as SMS message along with vehicle location data to configured control center number(s). The SMS shall consist parameters as given in Sub-section 4.2.2.

3.1.1.7 Device shall have an internal back-up battery to support 4 hours of normal operations (to be tested for positional record transmission at a frequency of 60 sec).

3.1.1.8 Device shall be capable of transmitting alerts to the Backend Control Server (Government authorized server) directly. The applicable list of alerts is given in Section 4.2 (Alert ID 3 to 12) of Section 4.

3.1.1.9 Device shall support over the air software and configuration update.

3.1.1.10 Device shall support basic standard configuration (Mobile communications network settings, Backend Control Server (Government authorized server) details, data frequencies, alert thresholds etc.) as per configuration specification defined in Section 4.

3.1.1.11 Device shall support store and forward mechanism for all type of data (periodic data and alerts) meant for backend transmission. The system shall store data in internal memory during communication network un-availability and transmit the data when the connection resumes in last in first out (LIFO) manner. The live data shall be given higher priority for transmission than back log (stored data) at any point in time.

3.1.1.12 The Device shall have a unique identifier for identifying the VLT device and data. The unique ID shall be stored in a read only memory area so that it cannot be altered or overwritten by any person. The unique identifier may be Vehicle Identification number or IMEI (International Mobile Station Equipment Identity) Number.

3.1.1.13 Device shall store/write the registration number of the vehicle in the internal nonvolatile memory.

3.1.1.14 Device shall have an Embedded SIM.

3.1.1.15 Device shall be designed to operate between 8VDC and 32VDC using vehicle battery input voltage range 12 /24Volts.

3.1.1.16 Device shall have a sleep mode current $\leq$ 20 mA (If the function is implemented in a dedicated system/device).

3.1.1.17 Device shall support any operational GNSS system with 12 (minimum) acquisition channels.

3.1.1.18 The Device shall support:

- Location on GPRS/SMS
- Non-volatile memory to store min 40,000 positional log
- Configurable backup SMS facility in case of GPRS failure
- Capability to send serving and adjacent cell ID as well as network measurement report (NMR)

3.1.1.19 The Device GNSS module shall have:

- The capability of Hot start <5s
- The capability of Warm start : < 30s
- The capability of Cold start < 40 s

3.1.1.20 Device shall support Outputs as per NMEA 0183

3.1.1.21 The Device GPRS module shall have:

- Multi slot GPRS with In - built Quad-band GPRS module/Modem
- GPRS class 10 or above
- Support Embedded SIM to cater to the automotive operational requirement such as vibration, temperature and humidity and provide long life span with at least 10 years life and more than 1 million read/write cycles
- GPRS module & SIM shall support
  - SMS, Data (GPRS, TCP/IP) and
  - Support multiple network OTA switching (on-demand/automatic) capabilities.

3.1.1.22 Device shall be dust, temperature, vibration, water splash resistant, IP 65 rated or better, tamper proof as per Section 6.

3.1.1.23 Device shall be manufactured using processes as per quality management standard for automotive industries i.e. ISO/TS 16949 updated from time to time.

3.1.1.24 Device shall support A-GPS (Assisted GPS).

3.1.1.25 Device shall have provision of secured data transmission to the Backend Control Centre from the devices through secured channel (e.g. secured dedicated APN).

3.1.1.26 Device shall have 3 axis accelerometer and 3 axis gyroscope for getting the alerts on harsh breaking harsh acceleration, and rash turning.

3.1.2 **Functional Requirement for Emergency System**

3.1.2.1 Passengers or in-vehicle crew present in the vehicle shall be able to make an emergency request by pressing the emergency button provided.

3.1.2.2 The emergency request function shall not exist as standalone. The function shall be part of Vehicle Location Tracking (VLT) system. An alert shall be sent to the Backend Control Server (Government authorized server) when emergency request is raised. De-activation shall always be from authorized government server who receives alert message i.e. NERS system as mentioned in Sub-section 4.2.2.

3.1.2.3 The Emergency Buttons will be 'Normally Closed' (NC) type. The form factor of Emergency Buttons will be such that the button is easy to press in the case of an emergency, and simultaneously also minimizes the possibility of accidental or unintended press thereby causing a false alert.

3.1.2.4 On pressing of Emergency button, the system implementing VLT function shall send emergency Alert (Alert ID 10 as mentioned in Sub-section 4.2.1 of Communication Protocol Section 4) to the Backend Control Server (Government authorized server) as per the Communication Protocol mentioned in Section 4. In the absence of GPRS network, the alert shall be sent as SMS message along with vehicle location data to configured control center number. The SMS shall consist of parameters as given in Sub-section 4.2.2.

3.1.2.5 In absence of both GPRS and GSM networks and on pressing of Emergency Button, the system implementing VLT function shall store the emergency Alert (Alert ID 10 as mentioned in Sub-section 4.2.1 of Communication Protocol Section 4). Once the GPRS or GSM is available, this alert information shall be sent on high priority to the configured IP addresses as per the communication protocol mentioned in Section 4 or as SMS message along with vehicle location data to configured control center number. The SMS shall consist of parameters as given in Sub-section 4.2.2.

3.1.3 **Configuration of Device Parameters Over the Air (OTA)**

The device shall support at least the below parameters to be configurable over the air (through SMS and GPRS). The updation shall be allowed only over an 'authenticated' channel:

1. Setting/ Change of the Primary or Secondary IP and port number
2. Setting/ Change of the APN
3. Set configuration parameter like sleep time, overspeed limit, harsh braking, harsh acceleration, rash turning threshold limits etc.
4. Emergency control SMS Centre Number(s)
5. Configuring the vehicle registration number
6. Configuring the frequency of data transmission in normal / Ignition state / OFF state sleep mode/ Emergency state, etc.
7. Configuring the time duration for Emergency state
8. Capability to reset the device
9. Command to get the IMEI of the device

Configurable commands must involve the following features:

- SET: For setting the parameters.
- GET: For enquiring regarding the parameters such as mobile number, GSM strength, vehicle number and other important parameters.
- CLR: For clearing certain commands, alarms, alerts etc.

After each SET, GET, CLR command the device should send alert to

Backend Control Centre, as mentioned in Section 4 Alert 12, giving the details of Mode, mobile no/ IP of control center sending commands.

3.1.4 Tracking Device Health Monitoring Parameters

The device shall send status of health parameters at configurable interval and this threshold value shall also be configurable over the air. It shall be possible for health parameters to be fetched on demand via command as set out below in Table 3B.

Table 3B:
Health Monitoring Parameter

Sl. No.	Field	Description
1	Start Character	$
2	Header	The header of the packet/ identifier
3	Vendor ID	Vendor identification header
4	Firmware Version	Version details of the Firmware used in EX.1.0.0
5	IMEI	Identified of the sending unit. 15 digit standard unique IMEI no.
6	Battery percentage	Indicates the internal battery charge percentage
7	Low battery threshold value	Indicates value on which low battery alert generated in percentage
8	Memory percentage	Indicates flash memory percentage used
9	Data update rate when ignition ON	Indicates Packet frequency on ignition ON
10	Data update rate when ignition OFF	Indicates Packet frequency on ignition OFF
11	Digital I/o status	Inputs connected to the device.
12	Analog I/o status	Analog input status
13	End character	*

3.1.5 SMS Fall Back

In case of emergency state, (i.e. on pressing of Alert button), the device will shift to the SMS mode in case GPRS connectivity is not available. In such case, the device will send the Alert message and tracking data through SMS mode. Since SMS has the limitation of sending only 160 characters, so the tracking data to be sent in one SMS will have fields - IMEI, Latitude, Direction, Longitude, Direction, location fix, speed, Cell ID, LAC (Location Area Code), Date and Time as per emergency alert . The details is provided in Sub-section 4.2.2.

4.0 COMMUNICATION PROTOCOL

4.1 Data Frame Format

Table below (Table 4A) contains the listing of fields that the vehicle tracking devices would be required to send to the Backend Control Centre. The first 3 fields (Start character, Header for VLT with Emergency Buttons and Vendor ID, who has supplied the device) must be fixed in position as well as format (Header part of frame). Rest all other fields are required to be present in the location data sent by the devices to the backend, but can be in any sequence or with any separator between fields. The data value can be either in American Standard Code for Information Interchange (ASCII) or in HEX format. Device must transmit the Login message whenever it establishes (re-establishes after disconnection) its connectivity with Server with the specified fields. Login Message will carry following information:

- $DeviceName –Vehicle number on which the device is installed.
- $IMEI –15 Digit IMEI number.
- $Firmware – Version of the firmware used in the hardware.
- $Protocol -Version of the frame format protocol.
- $LastValidLocation – Last location info saved at the device.

Table 4A:
Data Message Format

Field	Description	Sample Data
Start Character	$	$
Header	The header of the packet/ identifier	
Vendor ID	Vendor identification header	
Firmware Version	Version details of the Firmware used in EX.1.0.0	1.0.0
Packet Type	Specify the packet type NR = Normal EA = Emergency Alert TA = Tamper Alert (Optional) HP = Health Packet IN = Ignition On IF = Ignition Off BD = Vehicle Battery Disconnect BR = Vehicle Battery	Depending upon the context, every frame from tracking device must carry a qualification code. This helps to determine the state in which vehicle is at that time.

	Reconnect BL = Internal Battery Low	
Packet Status	L=Live or H= History	L
IMEI	Identified of the sending unit. 15 digit standard unique IMEI no.	123456789012345
Vehicle Reg. No	Mapped vehicle registration number	DL1PC9821
GPS Fix	1 = GPS fix OR 0 = GPS invalid	1
Date	Date value as per GPS date time per GPS date time (DDMMYYYY)	220714
Time	Time value as per GPS date time in UTC format (hhmmss)	050656
Latitude	Latitude value in decimal degrees (not less than 6 places)	28.758963
Latitude Dir	Latitude Direction. Example N=North, S= South	N
Longitude	Longitude value in decimal degrees (not less than 6 places).	77.6277844
Longitude Dir	Longitude Direction. E=East, W= West	W
Speed	Speed of Vehicle as Calculated by GPS module in VLT. (in km/hrs.) (Upto One Decimal Value)	25.1
Heading	Course over ground in degrees	310.56
No of Satellites	Number of satellites available for fix	8
Altitude	Altitude of the device in meters	183.5
PDOP	Positional dilution of precision	
HDOP	Horizontal dilution of precision	
Network Operator	Name of Network	INA Airtel

Name	Operator	
Ignition	1= Ignition On , 0 = Ignition Off	1
Main Power Status	0 = Vehicle Battery disconnected 1= Vehicle Battery reconnected	1
Main Input Voltage	Indicator showing source voltage in Volts.(Upto One Decimal Value)	12.5
Internal Battery Voltage	Indicator for level of battery charge remaining. (Upto One Decimal Value)	4.2
Emergency Status	1= On , 0 = Off	0
Tamper Alert (Optional)	C = Cover Closed, O = Cover Open	C
GSM Signal Strength	Value Ranging from 0 – 31	25
MCC	Mobile Country Code	404
MNC	Mobile Network Code	10
LAC	Location Area Code	00D6
Cell ID	GSM Cell ID	CFBD
NMR (Network Measurement Report) Neighbouring Cell ID	Neighbouring 4 cell ID along with their LAC & signal strength	
Digital Input Status	4 external digital input status (Status of Input 1 to Input 3 (0=Off; 1=On))	0001
Digital Output Status	2 external digital output status (0=Off; 1=On)	01
Frame Number	Sequence Number of the messages (000001 to 999999)	000005
Checksum	Insures No error in transmission (optimal)	16
End Character	Indicated End of the frame	*

4.2 **Messages & Alerts from Devices**

4.2.1 Table below (Table 4B) contains the listing of alerts that need to come from the tracking devices. These alerts are applicable for both live packets as well as the history packets.

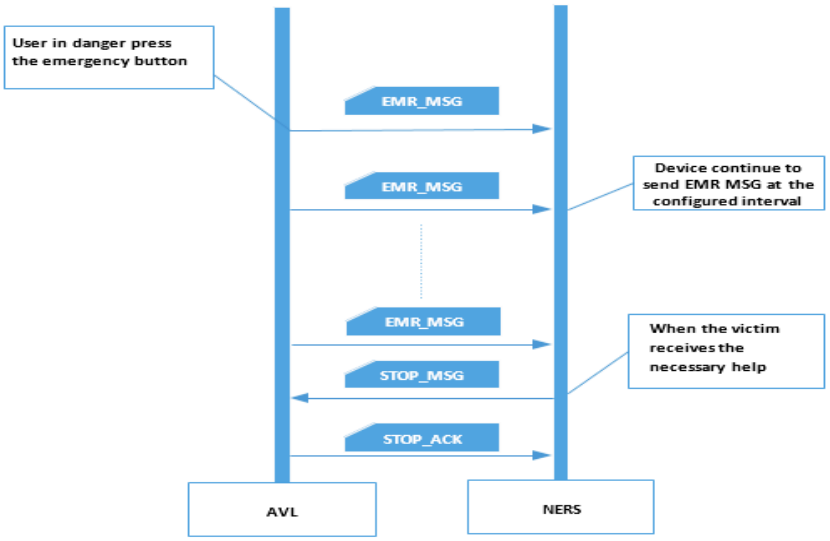
Table 4B:

Messages & Alerts Supported

Alert ID	Message & Alerts	Remarks
1.	Location Update	Default message coming from each device
2.	Location Update (history)	Would be sent, if GPRS is not available at the time of sending the message in protocol format Zero, BLANK, NIL, etc.
3.	Alert – Disconnect from main battery	If device is disconnected from vehicle battery and running on its internal battery
4.	Alert – Low battery	If device internal battery has fallen below a defined threshold
5.	Alert – Low battery removed	Indicates that device internal battery is charged again
6.	Alert – Connect back to main battery	Indicates that device is connected back to main battery
7.	Alert – Ignition ON	Indicates that Vehicle's Ignition is switched ON
8.	Alert – Ignition OFF	Indicates that Vehicle's Ignition is switched OFF
9.	Alert – GPS box opened (Optional)	Optional message would be generated indicating GPS box opened
10.	Alert – Emergency state ON*	When any of the emergency button is pressed
11.	Alert – emergency State OFF	When emergency state of vehicle is removed
12.	Alert Over the air parameter change	When any parameter is changed over the air. Shall include the name of parameter changed and source of command
13.	Harsh Braking	Alert indicating for harsh braking.
14.	Harsh Acceleration	Alert indicating for harsh acceleration.

15.	Rash Turning	Alert indicating for Rash turning.
16	Device Tempered	Alert Indicating Emergency button wire disconnect/ wire cut etc.

4.2.2 In case of emergency alert, the alert message shall be sent to 2 different IP addresses hence the device shall support minimum 2 IP addresses (1 IP address for regulatory purpose (PVT data) and 1 IP address for Emergency response system other than the IP's required for Operational purpose. The PVT data will send the emergency alert to the system. Primary alert will go to the emergency response Backend Control Centre (NERS/ MHA) as may be notified by the Government of India in the schema below:



Primary alert will go to the emergency response Backend Control Centre as notified by the Government of India in the indicative format below (Table 4C):

Table 4C:

Indicative Format for Alert to Emergency Response System

Attribute	Value / Description	Size
Packet Header	EPB, The unique identifier for all messages from VLT	Character, 3 bytes
Packet Header	EPB, The unique identifier for all messages from VLT	Character, 3 bytes
Message Type	Message Types supported. Emergency Message (EMR) or Stop Message (SEM)	Character, 2 bytes
Vehicle ID	Unique ID of the Vehicle (IMEI Number)	Character,15 bytes
Packet Type	NM – Normal Packet, SP – Stored Packet	Character, 2 bytes

Date	Date and time of location the location obtained from the data in DDMMYYYY hhmmss format	Character,14 bytes
GPS Validity	A – Valid, V – Invalid	Character, 1 byte
Latitude	Latitude in decimal degrees - dd.mmmmmm format	Double, 12 bytes
Latitude Direction	N – North, S – South	Character, 1 byte
Longitude	Longitude in decimal degrees - dd.mmmmmm format	Double, 12 bytes
Longitude Direction	E – East W – West	Character, 1 byte
Altitude	Altitude in meters (above sea level)	Double, 12 bytes
Speed	Speed of Vehicle as Calculated by GPS module in VLT. (in km/hr)	Float, 6 bytes
Distance	Distance calculated from previous GPS data	Float, 6 bytes
Provider	G - Fine GPS N - Coarse GPS or data from the network	Character, 1 byte
Vehicle RegnNo	Registration Number of the Vehicle	Character, 16 bytes
Reply Number	The mobile number to which Test response needs to be sent. (Emergency Mobile No. as specified by MHA/MoRTH/States.)	0
CRC	The 32 bit checksum of all the characters from the header up to the CRC field	8 bytes

*Above format is indicative only. These Format will be notified by the Government of India time to time.

4.3 Testing of Configuration of Device Parameters Over the Air (OTA)

The following testing will be done for

1. Setting/ Change of the Primary or Secondary IP and port number
2. Setting/ Change of the APN
3. Set configuration, parameter like sleep time for speed, harsh braking, rash turns, etc.

4. Emergency SMS Centre Number
5. Configuring the vehicle registration number
6. Configuring the frequency of data transmission in normal / Ignition state / OFF state sleep mode, Emergency state, etc.
7. Configuring the time duration for Emergency state
8. Capability to reset the device
9. Command to get the IMEI of the device

Configurable commands must involve the following features:

- SET: For setting the parameters.
- GET: For enquiring regarding the parameters such as mobile number, GSM strength, vehicle number and other important parameters.
- CLR: For clearing certain commands, alarms, alerts etc.

5.0 CONSTRUCTION AND INSTALLATION

(To be verified on component level and target vehicle level approval)

5.1 Requirements on vehicle interface for VLT with Emergency Button

Connector for Power

The requirements for interface shall be as below or as agreed between vehicle manufacturer and device manufacturer.

Standard connectors conforming to ISO 15170 shall be used at vehicle side. Connector requirements shall be as per Annexure – C, Clause 1.1 (Sl. No 1 - Low power systems 1)

However, Device/System side connector/s shall be pre-agreed with equipment manufacturer by

- Vehicle OEM in the case of OE fitment of the systems
- System supplier in case of retro fitment in aftermarket.

These requirements do not apply to integrated systems with vehicle where integration is done by vehicle manufacturer and /or System Integrator.

5.2 Requirement of Emergency System

Emergency button shall be one time press type. Separate release action from authorized server shall be required to bring back the emergency button to normal mode or clear emergency flag.

5.3 Physical Mounting

The VLT system shall be mounted in a suitable location such a way that it is not easily accessible /exposed to passengers.

This requirement shall not be applicable in case of combined systems VLT with HMI (Human Machine Interface) display in front of driver.

Test agency to verify this on vehicle level approval.

Emergency button(s) shall be fitted in such a way that every passenger including driver shall be able to access the Emergency button(s).

Passenger Car shall have 2 emergency buttons on each passenger row easily assessable by each of the passenger. There shall also be one dedicated emergency button for the driver.

Passenger Transport bus shall have emergency buttons at locations easily visible & assessable to all the passengers such as every 2 meters on both the sides on passenger seating area. For seats reserved for ladies there shall be a dedicated panic button for each row.

Test agency to verify this on vehicle level approval.

5.4 Power Supply

The vehicle tracking device will be installed on vehicles in which the power supply voltage from vehicle battery is widely varying (12V, 24V etc.) and also the power supply is not as stable as that in case of fixed locations, especially during engine start-up and braking when the voltage can fall to as low as 9V. Typically electronic devices are very sensitive to power surges and spikes, and equipment may fail if they do not receive stable power supply. The devices will need to have a resilient power supply unit that can withstand such fluctuations and the devices also need to have power backup so that they continue to function for some duration when the vehicle battery is not functional or is disconnected from the devices.

Vehicle power interface shall have

- One common ground linked to vehicle chassis
- One permanent power Supply (12/24V) connected to the vehicle battery
- One non-permanent power line (12/24V) connect to the battery after ignition

5.4.1 Electrical Wiring

The wiring harness used in the device shall be tested for flammability as per IS 2465.

6.0 FUNCTIONAL, PERFORMANCE, DURABILITY, ENVIRONMENTAL AND PROTOCOL TESTS

6.1 Vehicle Level Functional Tests

Following functionalities for each of the systems shall be demonstrated at the vehicle, in case system is provided by the vehicle OEM.

6.1.1 Vehicle Location Tracking With Emergency Button

6.1.1.1 Vehicle OEM shall only provide/ installed devices approved under component level testing.

6.1.1.2 System transmits PVT information to Backend Control Center (2 different IPs) at user configurable frequency (minimum 5 seconds) via GSM/GPRS.

6.1.1.3 System to communicate to control center on the occurrence of the alerts captured in Communication Protocol of Section 4.

6.1.2 **Emergency Request**

Emergency request function - When the emergency buttons (as applicable) placed anywhere in the vehicle is pressed by any passenger / crew, make sure that the emergency request message is send/received at the control center.

6.2 **Component Level Functional Tests**

Following functionalities for each of the systems shall be demonstrated. At the choice of the manufacturer, these functionalities can also be alternately demonstrated at the vehicle level and shall be deemed to be complied with at component level as well.

6.2.1 **Vehicle Location Tracking**

6.2.1.1 Standard connector provided for Power and other signals as per Annexure C.

6.2.1.2 Configuration of device as per the standard format mentioned in Section 4.

Local configuration upload shall be verified.

Configuration upload from control center shall be verified.

6.2.1.3 Vehicle Location data transmission to Backend Control Center.

6.2.1.4 Backend Control Centre shall be able to check the version of firmware loaded on the system.

6.2.1.5 Update the firmware of the system from Backend Control Centre

6.3 **Device Level Functional, Performance & Durability Tests**

The tests to be performed for device level approvals are as listed below. These functionality check will be performed after each test as acceptance criteria –

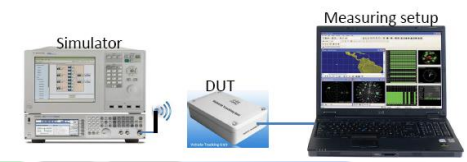
Tested systems shall satisfy general functional requirements at all the specified ranges during the test and after the test.

Following to be checked after testing:

i) Tracking functionality shall be checked via Backend Control Centre for the VLT system (Functional Test number 1 as per "Table 6A Functional Testing".

6.3.1 **Functional Testing**

Functional Testing as described in the Table 6A below shall be done with the acceptance criteria in Table 6A after completion of all the Performance & Durability Tests as listed in Table 6B.

Table 6A: Functional Testing		
Sl. No	**Test**	**Test Procedure**
1	Tracking Functionality Test	The test shall be conducted on VTL to determine the proper functioning of VLT with Emergency Button by testing its connectivity to Backend Control Centre (Government authorized server). Procedure: The VLT with Emergency Button shall be connected to vehicle battery to switch it on. The VLT with Emergency Button shall be tested for the connectivity to server and its capability to send two location messages
2	Location Accuracy Test	This test shall be conducted on VLT with Emergency Button.  The receiver is placed into a cold start state – usually by a command sent to the receiver through a test connection – and then a fairly strong navigation signal simulating in L and/or S band is sent. The time it takes for the receiver to determine its first good location fix is recorded. Test is done many times (>15 times) over many conditions and the results are averaged. **Acceptance Criteria**: 2.5 m CEP or 6 m 2DRMS
3	Acquisition Sensitivity Test	This test shall be conducted on VLT with Emergency Button. **Procedure:** Set the simulator to output navigation signal simulating L and/or S band to a particular location with a very level so that the tracking is not possible. Gradually increase the signal level that allows the receiver to successfully perform a cold start TTFF within a specified time frame. The minimum signal level that allows acquisition

		is referred as to the acquisition sensitivity. **Acceptance Criteria**: The acquisition sensitivity shall be minimum (-) 148 dBm.
4	Tracking Sensitivity Test	This test shall be conducted on VLT. **Procedure:** The device under this test is locked on to the simulator's output frequency (navigation signal simulating L and/or S band) and the simulator power output is lowered until the lock is lost. Multiple repetition of the test with different satellite geometries ensures that an accurate average measure is recorded. **Acceptance Criteria:** The tracking sensitivity shall be equal to or better than (-) 165 dBm.
5	Cold-Start Time to First Fix (TTFF) Test	The device in this test is placed into a cold start state. The time it takes for the device to determine its first good location fix is recorded. The cold start test is performed several times and the results are averaged. **Acceptance Criteria*:*** The cold start TTFF shall be less than 40 seconds at Open Sky condition or (-) 130 dBm.
6	Warm-Start Time to First Fix Test	In this test the device is started in warm start mode and time taken by device to determine the first valid location fix is recorded. This is done several times and results are averaged. **Acceptance Criteria:** The warm start TTFF shall be less than 30 seconds at Open Sky condition or (-) 130 dBm.
7	Hot-Start Time to First Fix Test	In this test the device is started in Hot start mode and time taken by device to determine the first valid location fix is recorded. This test is performed several times and results are averaged. **Acceptance Criteria:** The hot start TTFF shall be less than 5 seconds.
8	SIM Test	This test is to check the suitability of the SIM and communication module. The test shall be conducted to determine the effectiveness and operation of the GPRS module with OTA network switching capabilities on demand as well as automatically in real-time. The test consist of two type of testing as below:

		1. The device would be tested to perform as per the protocol using an embedded SIM. 2. The GPRS module & SIM, shall support: o SMS, Data (GPRS, TCP/IP) and o Support multiple network OTA switching capabilities (On Demand as well as Automatic Switching on real-time basis) **Acceptance Criteria:** In the testing, vendors has to demonstrate the embedded SIM based tracking and multiple network OTA switching capabilities (On Demand as well as Automatic Switching on real-time basis) for effective network management and transmission.
9	Interference Test	Interference testing is a type of test, in which Cold Start/Hot Start test are performed with device exposed to interfering signals and the performance as recorded. In this test, the GPS receiver is turned on and allowed to achieve a location fix. The jamming signal is then added to the GPS signal at a level that is detectable to the GPS receiver. The jamming signal power level is increased in 1 dB increments until the first degradation of the GPS receiver is noticed. This is typically a dropped satellite. The jamming signal power level is again slowly increased until the GPS receiver loses its 3D navigation fix. **Acceptance Criteria:** The Interference shall not result in any degradation of the Cold Start/Hot Start TTFF times. In addition, it shall not result in any degradation of the absolute location accuracy required and the same shall be 2.5 m CEP or 6 m 2DRMS.
10	Multipath Test	This test is a simulated frequency test conducted to determine the effect of multipath signals. The signal from a single satellite is simulated to arrive at the device via two or more paths. One path is typically a direct path, and other paths are typically a reflection of the same signal from building or structure. Multipath testing is a kind of a meta-test in that some of the above tests are done with the addition of multi-path simulation of one or more satellites by the GPS signal simulator.

		Acceptance Criteria: The multipath shall not result in any degradation of the Cold Start/Hot Start TTFF times. In addition, it should not result in any degradation of the absolute location accuracy required and the same shall be 2.5 m CEP or 6 m 2DRMS.

6.3.2 **Performance & Durability Test**

The Performance & Durability Test is listed in Table 6B.

Table 6B:
Performance & Durability Test

Sl. No	Test	Test Procedure
1	Shock Test	Shock test is performed to provide a degree of confidence that the device can physically and functionally withstand the relatively infrequent, non-repetitive shocks encountered in transportation environments. This test provides an assessment of the effect of the shocks on the performance of the device. The test shall be performed as per IS 9000-part 7 – 2006. Severity Level = 15g, Impact duration = 11ms, Impact Type = Half sine, Total number of impact = 9 (3 on each axis) **Acceptance Criteria:** Device after the shock test shall be required to meet the provisions of Functional Test Number 1 as listed in Table 6A.
2	Vibration Test	This test is performed to check that the device the device can physically and functionally withstand the vibration exposures in the life cycle typically encountered in a vehicular environment. The test shall be performed as per IS 9000-part 8 – 1981. The test specimen mounted on a suitable support shall be rigidly fixed on a suitable vibrating machine constructed to produce simple harmonic function (total amplitude of 1.5 mm) and shall be subjected to vibration through a frequency range of 10-55-10 Hz in a sweep period of 1 min with continuously varying frequencies. The vibration shall be applied for not less than 1 h in the directions of each of the 3 major axes of the light. **Acceptance Criteria:** During and after the test the device shall be required to meet the provisions of Functional Test Number 1 as listed in Table 6A.

3	Ingress Protection (IP)	The vehicle tracking devices must be able to work in dusty environment that are typically encountered by the public transport vehicles where these would be installed. IP rating (IS/ IEC 60529 - 2001) is used for specifying the environmental protection characteristics of the tracking device. The device will be tested for dust and water ingress according to IP 65 rating. **Acceptance Criteria:** The device shall be required to meet the provisions of Functional Test Number 1 as listed in Table 6A.
4	EMI /EMC	The Electromagnetic Interference (EMI) and Electromagnetic Compatibility (EMC) tests are performed to assess whether the device performs its intended functions in the electromagnetic environment to which it would be exposed. Further, the device shall not generate electromagnetic disturbances that may influence other equipment in the vicinity. **Acceptance Criteria:** The device shall meet the EMI/EMC requirements as per AIS 004 (Part 3).
5	Battery Backup Test	Battery backup is the amount of time that the device battery can support sending the data without being connected to the power source. This test will be performed by disconnecting the input charging voltage to the device. On disconnecting the external supply, battery would use its charge capacity to send data through GPRS. Time duration between external power disconnect to the last data packet time denotes the battery backup time. **Acceptance Criteria:** Device shall be able to work in active mode for a period of 4 hours or more at the polling/ transmission rate of 60 sec
6	Reverse Polarity Protection without Fuse	The device to be tested shall be connected to a reversed voltage of 14 V for 12 V systems and 27 V for 24 V systems for 2 min after connecting the system to the suitable circuit. **Acceptance Criteria**: After test; the device shall be required to meet the provisions of Functional Test Number 1 as listed in Table 6A.

<table>
<tr><td>7</td><td>Wiring Harness - Flammability Test</td><td>Flammability Test: The wiring harness used in the device shall be tested for flammability as per IS 2465.</td></tr>
<tr><td>8</td><td>Wiring Harness - Electrical Properties</td><td>As per AIS 028
or DIN72551 or ISO 6722</td></tr>
<tr><td>9</td><td>Free Fall</td><td>IS 9000 (Part VII/Sec 4) Free fall at 500 mm.
Acceptance Criteria: After test the device shall be required to meet the provisions of Functional Test Number 1 as listed in Table A</td></tr>
<tr><td>10</td><td>Performance Parametric Test
(Nine points, tri temperature/tri voltage)</td><td>During testing, VLT with Emergency button shall be kept inside test chamber in power ON condition.
(System shall be stabilized for minimum 5 min at each condition.
At each test point the system will be powered on and shut down 5 times with a duration of 1 min ON and 1 min OFF time)
Following are the various voltages & temperatures
<table>
<tr><td>24V System</td><td>12V System</td></tr>
<tr><td>18V, -25°C</td><td>9V, -25°C</td></tr>
<tr><td>18V, +80°C</td><td>9V, +80°C</td></tr>
<tr><td>18V, Room Temperature</td><td>9V, Room Temperature</td></tr>
<tr><td>27V, -25°C</td><td>13.5V, -25°C</td></tr>
<tr><td>27V, +80°C</td><td>13.5V, +80°C</td></tr>
<tr><td>27V, Room Temperature</td><td>13.5 V, Room Temperature</td></tr>
<tr><td>32V, -25°C</td><td>16V, -25°C</td></tr>
<tr><td>32V, +80°C</td><td>16V, +80°C</td></tr>
<tr><td>32V, Room Temperature</td><td>16V, Room Temperature</td></tr>
</table>
Acceptance Criteria: The device shall be required to meet the provisions of Functional Test Number 1 as listed in Table A for each value of the temperature and voltage.</td></tr>
</table>

11	Insulation Resistance Test	Test shall be conducted as per ISO 16750-2:2010 after damp heat test mentioned in point 3 of the Section 6.4. System/components shall remain 0.5 h at RT after the damp heat test. Test shall be conducted With a voltage of 500 V DC. Acceptance Criteria: Insulation Resistance shall be > 1 MΩ. No arcing or puncturing of insulation allowed shall be observed
12	Load Dump Test Pulse 5a	VLT shall be tested for this. For 12 V System: A Voltage spike of 65V, 4 Ohms 200ms pulse-5a as per standard ISO 7637-2: 2004 For 24 V System: A Voltage spike of 123V, 8 Ohms 200ms pulse-5a as per standard ISO 7637-2: 2004. **Acceptance Criteria**: Device shall meet functional class A as per ISO 7637-2: 2004. After test, the device shall be required to meet the provisions of Functional Test Number 1 as listed in Table 6A.

6.3.3 **Device Level Environmental Tests**

The environmental tests to be performed for device level approvals are as listed in Table 6C.

Following to be checked after testing:

i) Tracking functionality shall be checked via Backend Control Centre for the VLT with Emergency Button.

Table 6C:

Device Level Environmental Test

Sl. No	Test	Test Procedure
1	Dry Heat / High Temperature Test	The high temperature test is used to evaluate effects of high temperature conditions on safety, integrity, and performance of the device. The test shall be carried out in accordance with Indian Standard IS: 9000 (Part 3/Sec 5) the device shall be subjected to temperature of 70 ± 2°C for 16 h in high temperature. Test with device in working condition. The recovery period shall be 2 h.

		Acceptance Criteria: Device during and after the high temperature test the device shall be required to meet the provisions of Functional Test Number 1 as listed in Table 6A.
2	Cold Test	The test shall be carried out in accordance with IS 9000 (Part 2/Sec 4 - 1977). The device under test shall be subjected to temperature of –10 ± 2°C for 2 h with device in working condition. The recovery period shall be 2 h. **Acceptance Criteria**: Device during and after the cold test, the device shall be required to meet the provisions of Functional Test Number 1 as listed in Table 6A.
3	Damp Heat Test	The device under test shall be tested according to IS 9000 (Part 5/Sec 2 - 1981). The test is carried out at +25° to +55° C, Humidity 95%. Six cycles (each test cycle of 24 h) shall be run with device in off condition. Functional test shall be carried out with power in 'On condition' at start of 2nd, 4th and 6th cycle. **Acceptance Criteria**: Device during and after the test the device shall be required to meet the provisions of Functional Test Number 1 as listed in Table 6A.
4	Temperature Shock	Temperature shock test is carried out to determine if the device can withstand sudden changes in the temperature of the surrounding atmosphere without experiencing physical damage or deterioration in performance. The device shall be tested as per IS 9000 (Part 14/Sec 2) – 1978. Exposure time would be 3 hours/cycle and number of cycles would be two. **Acceptance Criteria**: Device after the test the device shall be required to meet the provisions of Functional Test Number 1 as listed in Table 6A.
5	High Temperature Test	The high temperature test is used to evaluate effects of high temperature conditions on safety, integrity, and performance of the device. The test shall be carried out in accordance with Indian Standard IS: 9000 (Part 3/Sec 5) the device shall be subjected to temperature of 70 ± 2°C for 16 h in high temperature. Test with device in working condition. The recovery period shall be 2 h. **Acceptance Criteria**: Device during and after the high temperature test the device shall be required to meet the provisions of Functional Test Number 1 as listed in Table 6A.

6	Salt Spray Test	The salt spray test is conducted to check corrosion resistance of device. The device shall be tested according to Clause 4.8 of IS 10250 for 96 h. **Acceptance Criteria**: The device shall be required to meet the provisions of Functional Test Number 1 as listed in Table 6A.
7	High Voltage Test	The test is conducted to ensure service life requirements & functionality. The device under test shall be operated for 60 minutes at 18 V for 12 V systems & 36 V for 24 V systems. This test is as per ISO 16750-2:2010 **Acceptance Criteria**: Device during and after the test the device shall be required to meet the provisions of Functional Test Number 1 as listed in Table 6A.

6.3.4 **Protocol Testing**

This set of testing needs to be done for all cases namely vehicle level testing and component (Device) level testing.

Protocol is a set of rules to be followed by the device while sending data to the Backend Control Centre. The protocol comprises data update rate, number of fields, start character, end character, alert type etc. Protocol testing involves checking the compliance of data sets received by the Backend Control Centre against the protocol both with respect to the data fields as well the format. It is expected that the data coming to a central server shall be exactly as required under the protocol. Table below (Table 6D) mentions the validation process for the protocol communication.

Table 6D:

Protocol Testing Parameters

Field Description Validation Process	
Field	**Description**
Start Character	$
Header	The header of the packet/ identifier
Vendor ID	Vendor identification header
Firmware Version	Version details of the Firmware used in EX.1.0.0
Packet Type	Specify the packet type – NR = Normal EA = Emergency Alert TA = Tamper Alert

	HP = Health Packet IN = Ignition On IF = Ignition Off BD = Vehicle Battery Disconnect BR = Vehicle Battery Reconnect BL = Internal Battery Low
Packet Status	L=Live or H= History
IMEI	Identified of the sending unit. 15 digit standard unique IMEI no.
Vehicle Reg. No	Mapped vehicle registration number
GPS Fix	1 = GPS fix OR 0 = GPS invalid
Date	Date value as per GPS date time (DDMMYYYY)
Time	Time value as per GPS date time in UTC format (hhmmss)
Latitude	Latitude value in decimal degrees (with minimum 6 decimal places)
Latitude Dir.	Latitude Direction. Example N=North, S= South
Longitude	Longitude value in decimal degrees (with minimum 6 decimal places)
Longitude Dir.	Longitude Direction. Example E=East, W= West
Speed	Speed of Vehicle as Calculated by GPS module in VLT.(in km/hr)
Heading	Course over ground in degrees
No. of Satellites	Number of satellites available for fix
Altitude	Altitude of the device in meters
PDOP	Positional dilution of precision
HDOP	Horizontal dilution of precision
Network Operator Name	Name of Network Operator.
Ignition	1= Ign On , 0 = Ign Off
Main Power Status	0 = Vehicle Battery Disconnected 1= Vehicle Battery Reconnected
Main Input Voltage	Indicator showing source voltage in Volts.
Internal Battery	Indicator for Level of battery charge remaining

Voltage	
Emergency Status	1= On , 0 = Off
Tamper Alert (Optional)	C = Cover Closed , O = Cover Open
GSM Signal Strength	Value Ranging from 0 – 31
MCC	Mobile Country Code
MNC	Mobile Network Code
LAC	Location Area Code
Cell ID	GSM Cell ID
NMR (neighbouring Cell ID)	Neighbouring 4 cell ID along with their LAC and signal strength
Digital Input Status	4 external digital input status (Status of Input 1 to Input 3 (0=Off; 1=On))
Digital Output Status	2 external digital output status (0=Off; 1=On)
Frame Number	Sequence Number of the messages (000001 to 999999)
Checksum	Insures No error in transmission (optional)
End Character	Indicated End of the frame
The following test would be performed along with the protocol testing of the device:	

a) Memory Storage

The device shall support 40000 or more positional logs/packets. This is a functional test and the device will be simulated to be in non – GPRS coverage area and the logs will be maintained. The capacity of logging will be checked by monitoring the logs on the device.

b) Messages & Alerts from Devices

Table below (Table 6E) contains the listing of alerts that need to come from the tracking devices. These alerts are applicable for both live packets as well as the history packets.

Table 6E: Messages & Alerts

Alert ID	Message & Alerts	Remarks
1.	Location Update	Default message coming from each device
2.	Location Update (history)	Would be sent, if GPRS is not available at the time of sending the message
3.	Alert – Disconnect from main battery	If device is disconnected from vehicle battery and running on its internal battery

4.	Alert – Low battery	If device internal battery has fallen below a defined threshold
5.	Alert – Low battery removed	Indicates that device internal battery is charged again
6.	Alert – Connect back to main battery	Indicates that device is connected back to main battery
7.	Alert – Ignition ON	Indicates that Vehicle's Ignition is switched ON
8.	Alert – Ignition OFF	Indicates that Vehicle's Ignition is switched OFF
9.	Alert – GPS box opened (Optional)	Message would be generated indicating GPS box opened
10.	Alert – Emergency state ON*	When any of the emergency button is pressed
11.	Alert – emergency State OFF	Emergency state of switch will be cancelled by backend server, when emergency state of vehicle is removed
12.	Alert Over the air parameter change	When any parameter is changed over the air. Shall include the name of parameter changed and source of command
13.	Harsh Braking	Alert indicating for harsh braking.
14.	Harsh Acceleration	Alert indicating for harsh acceleration.
15.	Rash Turning	Alert indicating for Rash turning.

* In case of Emergency Alert ON system, the alert message should go in the below format as set out in Table 6F. This emergency alert message shall be sent to 2 different IPs; i.e. the device shall support minimum 2 IPs simultaneously.

Table 6F:

Message Format

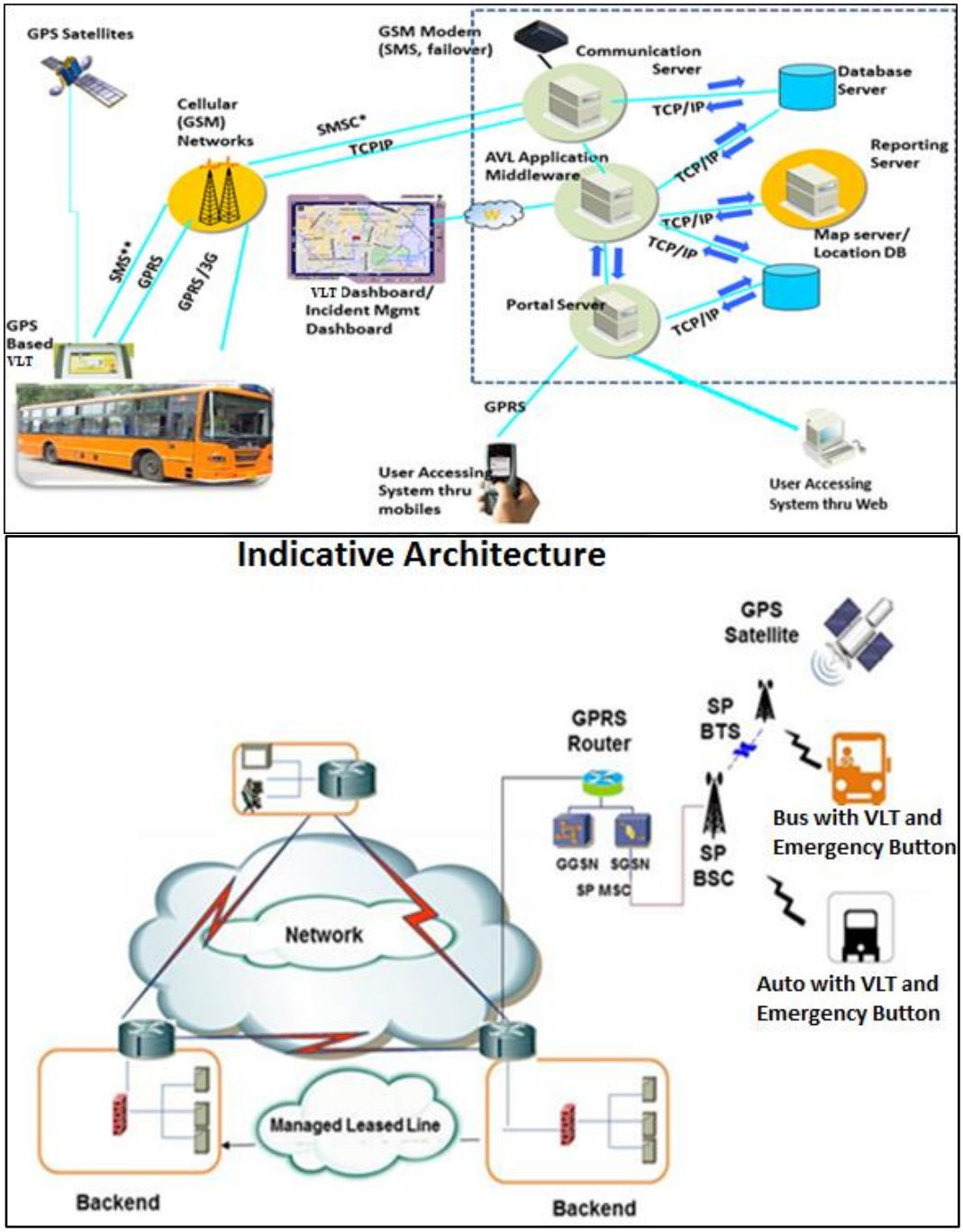
Attribute	Value / Description	Size
Packet Header	EPB, The unique identifier for all messages from VLT	Character, 3 bytes
Message Type	Message Types supported. Emergency Message (EMR) or Stop Message (SEM)	Character, 2 bytes

Device ID Vehicle ID	Unique ID of the Vehicle (IMEI Number)	Character,15 bytes
Packet Type	NM – Normal Packet, SP – Stored Packet	Character, 2 bytes
Date	Date and time of the location obtained from the location data in DDMMYYYY hhmmss format	Character,14 bytes
GPS Validity	A – Valid, V – Invalid	Character, 1 byte
Latitude	Latitude in decimal degrees - dd.mmmmmm format	Double, 12 bytes
Latitude Direction	N – North, S – South	Character, 1 byte
Longitude	Longitude in decimal degrees - dd.mmmmmm format	Double, 12 bytes
Longitude Direction	E – East W – West	Character, 1 byte
Altitude	Altitude in meters (above sea level)	Double, 12 bytes
Speed	Speed of Vehicle as Calculated by GPS module in VLT. (in km/hrs.)	Float, 6 bytes
Distance	Distance calculated from previous GPS data	Float, 6 bytes
Provider	G - Fine GPS N – Coarse GPS or data from the network	Character, 1 byte
Vehicle RegnNo	Registration Number of the Vehicle	Character, 16 bytes
Reply Number	The mobile number to which Test response need to be sent. (Emergency Mobile No. as specified by MHA/MoRTH/States.)	0
CRC	The 32 bit checksum of all the characters from the header up to the CRC field	8 bytes

7.0 DEVICE TO BACKEND COMMUNICATION MECHANISM

The VLT device would transmit data to the Backend Control Centre using GPRS wireless connectivity (with SMS fall back) as per the protocol provided in respective sections (Sub-section 6.3.4). The data from the devices would travel over the wireless telecom service provider network and finally get delivered at the Backend Control Centre. Since the permit holders/Device suppliers would require to have

a valid communication plan on SIM cards on the devices and would avail services from multiple telecom service providers, the data would be transmitted to the Backend Control Centre using the networks of multiple telecom service providers.



A suitable control mechanism would be established for the data transfer from VLT to Backend Control Centre, as only the authorized devices should be able to transfer data to the Backend Control Centre and a mechanism for authenticating the devices/SIMs shall also be put into place.

The following mandatory provisions will have to be made in the Backend Control Centre:

1. Registration and activation of the device(s) fitted on the vehicle, including the details of vehicle registration number, engine number, chassis number, vehicle make and model, device make and model, and telecom service provider's name.

2. Re-registration/re-activation of the device(s) fitted on the vehicle in case of any change in device or telecom service provider, etc.

3. Regular health check of the device(s) fitted on the vehicle, as per the parameters and frequency defined in Sub-section 3.1.4.

4. Administration/configuration of devices for any changes in the parameters as decided by the respective state from time to time.

5. Notification of alerts in case of press of an Alert Button fitted on the vehicle, in the protocol defined in Section 4.

6. Notification of alerts in case of defined deviations by vehicle such as over-speeding, deviation from defined route/geographic area, time of operation, etc.

7. Location tracking of the vehicle including real-time as well as history tracking for up to last 90 days.

8. Notification to the permit-holder through SMS in case any device(s) stops functioning/sending data to the Backend Control Centre.

9. Reports of the vehicles with devices not working/sending data beyond defined number of days (1 day, 3 days, 7 days and 30 days).

10. Ensure that the security and privacy of the data is maintained in accordance with applicable laws/guidelines of various government authorities.

In addition to the above mandatory provisions, the Backend Control Centre can provide any other optional features.

The mechanism to set up the Backend Control Centre shall be decided by the respective states. The states can chose any of the following options for setting up the Backend Control Centre:

1. States can set up their own dedicated Backend Control Centre, meeting the above listed mandatory provisions and any other optional features as they may decide.

2. States can allow telecom service providers to offer Backend Control Centre as a Value Added Service (VAS) to the permit holders, meeting the above listed mandatory provisions and any other optional features as they may decide. In this case, the telecom service providers shall provide access to the Backend Control Centre to government officials, as decided by the respective state.

ANNEXURE A:

INFORMATION TO BE SUBMITTED FOR TYPE APPROVAL

1.0 VLT SYSTEM DETAILS

a. Make

b. Type

c. Model No.

d. Part No.

e. Installation layout: Attach drawing showing location in vehicle.

2.0 VEHICLE LOCATION TRACKING AND EMERGENCY BUTTONS

a. Make

b. Model No.

c. Part No.

d. Connector used

e. Connector used for antennas

e.1. main GSM antenna

e.2. GPS antenna

e.3. WLAN antenna

3.0 SYSTEM SOFTWARE

a. Make

b. Version

c. Operating System Details with Version

4.0 COMMUNICATION PROTOCOL USED

a. Vehicle to Center

- VLT to Control Center
- Command Set for Configurations

5.0 DESCRIPTION OF DEVICE

6.0 DRAWINGS

6.1 Device/System Drawing.

6.2 Vehicle installation Drawing.

7.0 INSTRUCTIONS MANUAL

ANNEXURE B:

CRITERIA FOR EXTENSION OF TYPE APPROVAL

B1.0 In case of following changes, Functional, Performance, Durability and Environmental Tests which are necessary for establishing compliance are listed below

	Changes in System	Tests to be conducted
B1.1	Change in Make, Model, Type, accompanied with or without a Part No of Vehicle Location Tracking (VLT) and Vehicle Health Monitoring.	Applicable tests as per Section 6 and Functional verification at system integration level or component level as applicable.
B1.2	Change in onboard layout of ITS component or complete system	Verification at system integration level along with target vehicle
B1.3	Change in software of ITS System	Functional verification at system integration level.
B.1.4	Change in wiring harness and connectors	Connector requirements specified in this standard.

ANNEXURE C:

PHYSICAL INTERFACES (CONNECTORS) FOR POWER AND I/Os

The below section is for new vehicles and not for the retro-fitment of ITS systems on in-use vehicles.

Device/System side connector/s shall be as per the equipment manufacturer by in case of retro fitment in aftermarket.

Provisions for Power connectors and Power supply to be made by Manufacturers in case of OE fitment & Dealer / Permit holder in case of retro fitment of systems outside vehicle manufacturer facility.

These requirements do not apply to integrated systems with vehicle where integration is done by vehicle manufacturer and /or System Integrator.

1.0 Vehicle Side Connectors

The vehicles shall be equipped with connectors with appropriate fuse protection for interfacing systems implements the functions

Power for physical systems are supplied by vehicle battery which supplies power to all electrical system in the vehicle.

When the engine is running, the vehicle battery is in charge and the systems shall consume normal power needs. But when the engine is turned off, the power consumption by systems shall be limited by means of sleep modes or auto shut off.

Considering the power requirements for equipment packages, the systems are grouped as

ITS System Classification	Max Power	Typical Systems / Packages
Low Power Systems	Up to 120 W	VLT with Emergency Button

The power interface shall have

- One common GROUND linked to vehicle chassis - GND
- One permanent power line (12/24V) linked to the battery after Manual Switch – B+
- One non-permanent power line (12/24V) linked to the battery after Main Switch – SW+

1.1 Minimum Connector Requirements

The minimum connector requirements are formulated as following.

Sl. No.	Recommended Electrical Provisions	Max Power	Applicable ITS Systems	Minimum Requirement	Recommended Connector
1.	Low Power System 1 (Mandatory Provision)	Up to 120 W	Telematics Device/VLT System with Emergency Button	B+, SW+, GND	OEM to protect ISO 15170-B1-3.1-Sn/K1 Socket (Female) Connector

The OEM may provide optional auxiliary connectors of their choice for meeting other functional requirements.

1.2 Connector labeling in Wiring Harness:

Vehicle side wiring shall have the following labeling for the connectors

Recommended Electrical Provisions	Labeling Requirement
Low Power System 1 **(Mandatory Provision)**	ITS 120 W
Low Power System 2 **(Mandatory Provision)**	ITS 120 W
High Power System 1 **(Mandatory Provision)**	ITS 360 W
CAN Interface (OBDII CAN) **(Mandatory Provision)**	ITS CAN

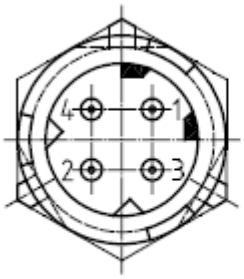
1.3 Connector Cavity/PIN Assignment

Power Connector: ISO 15170-B1-3.1-Sn/K1, ISO 15170-B2-3.1-Sn/K1

Pin 1	B+
Pin 2	SW+
Pin 3	GND

CAN Connector: ISO 15170-B1-4.1-Sn/K1

Pin 1	CAN High
Pin 2	CAN Low
Pin 3	Option CAN Ground
Pin 4	Not used



a) Code 1 — Colour: black (BK)

b) Code 2 — Colour: grey (GY)

2.0 Device/System connectors

Device/System side connector/s shall be pre-agreed with equipment manufacturer by

1. Vehicle OEM in the case of OE fitment of the systems
2. Permit holder or Dealer in case of retro fitment of systems outside vehicle manufacturer facility

ANNEXURE D:

(See Introduction)

COMPOSITION OF AISC PANEL *

Name	Organization
Convener	
Mr. Rakesh Jain	Delhi Integrated Multi-Modal Transit System Ltd. (DIMTS)
Members	**Representing**
Mr. Prashant Tiwari /Shri Alok Sethi	Delhi Integrated Multi-Modal Transit System Ltd. (DIMTS)
Mr. A. A. Deshpande/ Mr. M. M. Desai / Mr. K. B. Patil	The Automotive Research Association of India (ARAI)
Director / Mr. Samir Sattigeri /Shri M. M. Pathak	Central Institute of Road Transport (CIRT)
Mr. G. R. M. Rao	Vehicle Research & Dev. Estt. (VRDE)
Dr. Madhusudan Joshi	International Centre for Automotive Technology (ICAT)
Mr. K. K. Gandhi	SIAM
Mr. S. Ravishankar/ Mr. D. Balakrishnan/Ms. Suchismita Chatterjee	Ashok Leyland Technical Centre (SIAM)
Mr. Girish Kodolikar	Force Motors Ltd. (SIAM)
Mr. Sanjay Tank	Mahindra and Mahindra Ltd. (SIAM)
Mr. Shrikant V. Joshi / Mr. P S Gowrishankar, / Mr. Sharad S. Bhole	Tata Motors Ltd. (SIAM)
Mr. Suchindran M	Toyota Kirloskar Motor Pvt. Ltd. (SIAM)
Mr. Jitendra Malhotra/ Mr. Sumit Sharma/ Mr. Raj Kumar Diwedi	Maruti Suzuki India Ltd.(SIAM)
Mr. RajendraKhile/Mr Karuppasamy	Renault Nissan Technology and Business Centre (SIAM)
Mr. S Ramiah	TVS Motor Company Ltd. (SIAM)
Mr. Arun Sivasubrahmaniyan	Hero Motocorp Ltd. (SIAM)
Mr. R. Narasimhan	Bajaj Auto Ltd. (SIAM)
Mr. Uday Harite	ACMA
Mr. Raju Agarwal / Mr. Rahul Jain	Castmaster Mobitec India Pvt Ltd.
Mr. Vishwajit Joshi	KPIT Cummins Infosystems Ltd

* At the time of approval of this Automotive Industry Standard (AIS)

ANNEXURE E

(See Introduction)

COMMITTEE COMPOSITION *
Automotive Industry Standards Committee

Chairperson	
Mrs. Rashmi Urdhwareshe	Director The Automotive Research Association of India, Pune
Members	**Representing**
Shri Priyank Bharti	Ministry of Road Transport and Highways (Dept. of Road Transport and Highways), New Delhi
Representative from	Ministry of Heavy Industries and Public Enterprises (Department of Heavy Industry), New Delhi
Shri S. M. Ahuja	Office of the Development Commissioner, MSME, Ministry of Micro, Small and Medium Enterprises, New Delhi
Shri Shrikant R. Marathe	Former Chairman, AISC
Shri R.R. Singh	Bureau of Indian Standards, New Delhi
Director	Central Institute of Road Transport, Pune
Director	Indian Institute of Petroleum, Dehra Dun
Director	Vehicles Research and Development Establishment, Ahmednagar
Director	International Centre for Automotive Technology
Director	Global Automotive Research Centre
Director	Indian Rubber Manufacturers Research Association
Representatives from	Society of Indian Automobile Manufacturers
Shri T. R. Kesavan	Tractor Manufacturers Association, New Delhi
Shri Uday Harite	Automotive Components Manufacturers Association of India, New Delhi

Member Secretary

Shri Vikram Tandon

Dy. General Manager

The Automotive Research Association of India, Pune

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