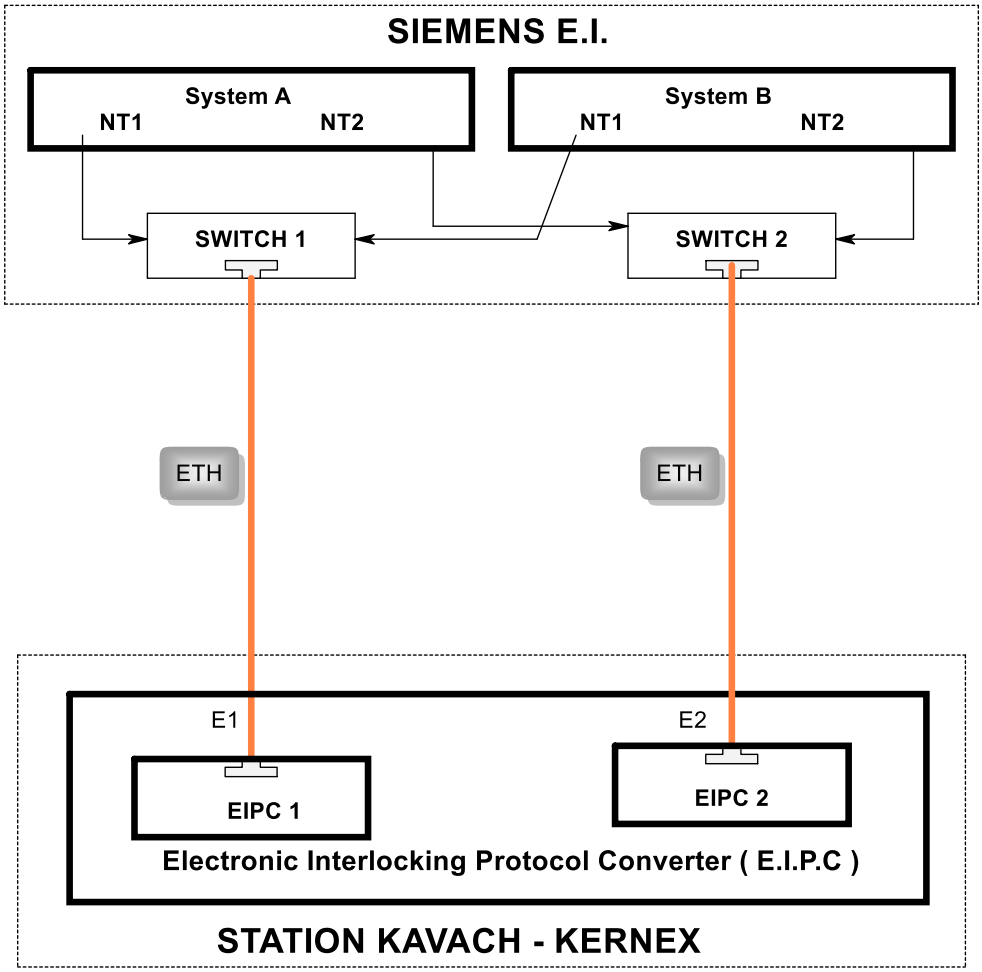
Test Format for EI – KAVACH Interface based on OEM proprietary protocols.

1. The part list interfacing is as under

#	Electronic Interlocking	KAVACH
Make	SIEMENS	KERNEX
Model no		
Interface type	Ethernet	Ethernet
Power Supply		5V
Other modules		

2. Connection diagram:



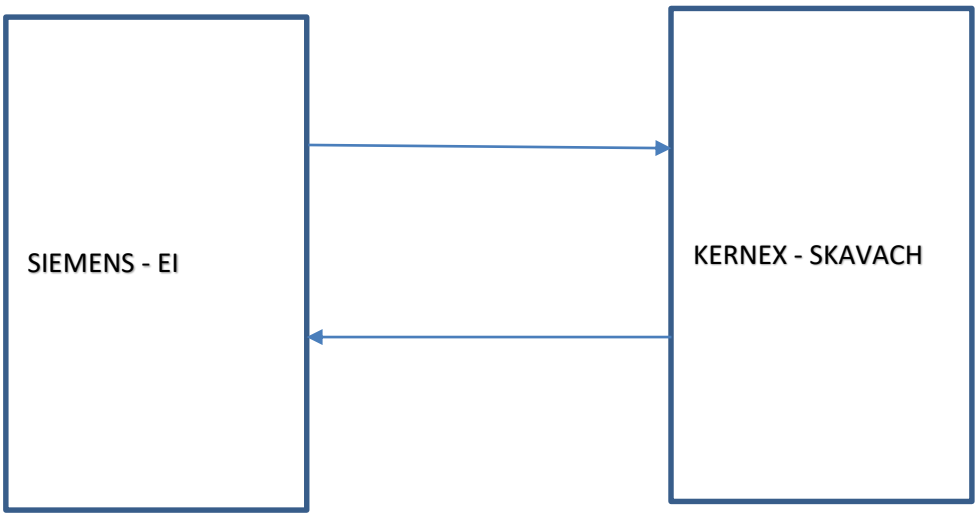
a) Is the power supply duplicated? **YES**

b) Is the communication duplicated? **YES**

c) Whether the communication is point to point? **YES**

d) Whether the communication is Peer to Peer OR Master - Slave? **PEER to PEER**

3. Protocol Sequencing:



a) Is periodic health check available? **YES**
b) Is time synchronization available? **NO**

c) Entire Request – Response procedure is to be written down below: -

1. **SIEMENS-EI Sends a WNC+ protocol based message to SKAVACH which includes VITAL DATA (Application Data), TX & RX time stamp message's and other fields as below table.**

DST	DA	SST	SA	PDV	CI	DP	SP	RxTS	TxTS	AppData	CRC

2. **SKAVACH Sends the reply packet which includes TX and RX time stamp message's as below table.**

DST	DA	SST	SA	PDV	CI	DP	SP	RxTS	TxTS	CRC

4. Periodicity and Timeout:

(i) Whether the communication is periodic? : **YES**

(ii) What is the maximum rate of transfer of data? : **10Mbps**

(iii) How many maximum number of data bits can be exchanged between EI and KAVACH? : **3584 Bits / 448Bytes**

(iv) The maximum round trip delay after which communication is said to be lost is : **1 Second**

(v) The KAVACH (Receiver) cycle time is : **20 milli seconds**

(vi) The Electronic Interlocking (Transmitter) cycle time is: **300 milli seconds**

(vii) The boot up time of Electronic Interlocking is : **Average: 180 Seconds**
(Depends on the station Yard)
(Is it Station – specific?) : **YES**

(viii) The boot up time of Stationary KAVACH is :**20 Seconds**
(Is it Station – specific?) :**NO**

5. Handling of duplicate messages:

How duplicate messages are detected?

By EI: **Using TX and RX Time stamp messages.**

By SKAVACH: **Using TX and RX Time stamp messages.**

a) How duplicate messages are not processed?

By EI:

if the same time stamp message is received from the SKAVACH for the three cycle's SIEMENS-EI is not updating the RELAY Statuses.

By SKAVACH:

SKAVACH will check for Rx time stamp is updating or not, if it is not updating For the three cycles, the SKAVACH will make it as communication failure.

b) Are duplicate messages stored in event logger?

By EI: **NO**

By SKAVACH: **NO**

6. Handling of out of sequences messages :

a) How out of sequence messages are detected?
By EI:

By SKAVACH: **The TX Timestamp sent by the SKAVACH shall be received to the SKAVACH in the next Messages sent by the SIEMENS-EI the RX time stamp will be checked.**

b) How out of sequence messages are not handled?
By EI:

By SKAVACH: **The TX Timestamp sent by the SKAVACH shall be received to the SKAVACH in the next Messages sent by the SIEMENS-EI the RX time stamp will be checked, If the Rx time stamp is not matching with the last 3 messages sent by the SKAVACH, those messages will be ignored.**

c) Are out-of-sequence messages stored in event logger?

By EI: **NO**

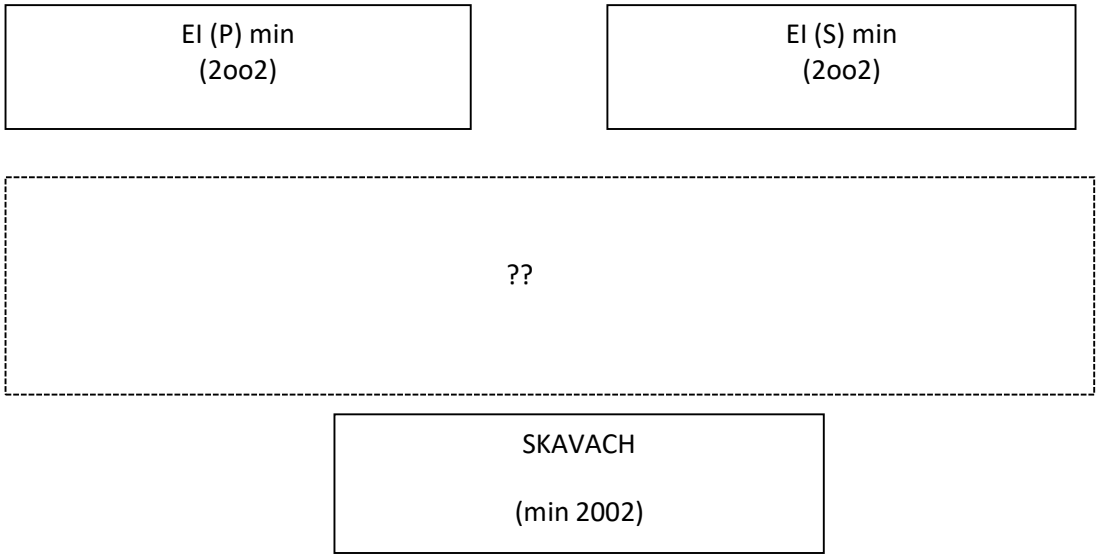
By SKAVACH: **NO**

7. Communication Redundancy:

a) KAVACH is standalone system with: **2oo2.**

b) Is the Electronic Interlocking System Hot Standby or Warm Standby: "**HOT STANDBY"** Electronic Interlocking system has "Single hardware architecture with diverse software" or 2oo2 hardware architecture: **"2oo2 hardware architecture"**

c) Schematic showing the communication arrangements without having impact original architecture of EI and SKAVACH is shown below: -



d) The entire message flow explaining communication redundancy is as under :-

i) SKAVACH request to both EIs in hot/warm standby: **Hot Standby**

ii) Both EIs respond and reply: **Only one system will reply but due 2oo2 Architecture SKAVACH will receive the messages from both the channels**

iii) SKAVACH Validates: **SKAVACH will validate the messages received if both are same then the message will be processed.**

e) Is the connection between EI and KAVACH direct? **YES**

f) If it is not direct, i.e., through a channel which is connected to other devices then the precautions taken to mitigate vulnerability and Interference shall be listed below:-

#	Mitigation Measures	Phase of mitigation	Responsibility (EI/Kavach/Railways)
(i)			
(ii)			
(iii)			

g) (i) Is Tx sequence number available from EI side? **NO (Time Stamp is used)**

(ii) Is Tx sequence number generated by EI unique? **NO (Time Stamp is used)**

(iii)

(iv) How is it unique? **Not Applicable**

(v) How S-KAVACH validated this? **The timestamp shall be incremented with configured range else the message will be discarded.**

h) i) Is Tx sequence number available from SKAVACH side? **NO (Time Stamp is used)**

ii) Is Tx Sequence number generated by SKAVACH unique? **NO (Time Stamp is used)**

iii) How is it Unique? **Not Applicable**

iv) How S-KAVACH validated this? **The timestamp shall be incremented with configured range else the message will be discarded.**

8. Time Stamp :-

a) Time stamping process of EI: **Through railway data logger SEIMENS – EI pc's will get sync of time and date.**

b) Time stamping process of S-KAVACH: **Through GPS**

c) Is time stamping process of EI and S-KAVACH same? **NO**

d) If time stamping is not same, the following are the steps taken to resolve the issue: **It will not impact the communication between EI-SKAVACH.**

e) How leap year is handled?

f) It time Zone having impact on design? IST/GMT: **NO**

9. IP address:

a) KAVACH system must ensure that the IP address provided by EI is only used for it's system/PC which is connected to EI.

b) KAVACH system shall inform EI OEM about IP address which they use at their systems (This is to avoid any network conflict between both systems):

IP Address needs to be provided by EI for SKAVACH.

10. CRC:

a) What is the length of CRC of the Interface Protocol?
16-Bit

b) If it is less than 27 – bit, what techniques the OEM is following to meet the required level of THR for SIL-4? **In SIEMENS-EI WNC protocol CRC is of 16-bit length for a True representation, Now the entire message of True representation excluding CRC will be complimented and CRC will be calculated and sent.**

11. Version Control:

a) How version control of executive logic is managed in EI?

b) How version control of executive logic is managed in S-KAVACH?
Executive logic files are maintained in a third party application called CLM (collaborative lifecycle management).

c) How version control of application logic is managed when bits required to be sent are modified in EI?

i) Does the CRC of application logic changes? **YES**

ii) If yes, how safety validation of application logic is ensured?

If Product data version mismatches with the Configured value, application data will not be processed.

iii) What measures the Firm is planning to make it independent of Executive logic CRC?
EI Can maintain separate CRC for relays exchanged with KAVACH.

iv) How version control of data being sent through the EI-KAVACH Interface is ensured?
If Product data version mismatches with the Configured value, application data will not be processed.

v) If version control of data sent is not ensured what validation measures are taken by EI OEM to ensure safety?

d) How version control of application logic is managed when bits required to be received are modified is S-KAVACH?

Executive logic files are maintained in a third party application called CLM (collaborative lifecycle management).

i) Does the CRC of KAVACH TOC application logic change? **YES**

ii) If yes, how safety Validation of KAVACH TOC application logic is ensured?

Application Logic shall be re-verified by a FAT with the independent V&V team.

iii) What measures the firm is planning to make it independent of KAVACH TOC application logic CRC?

SKAVACH application logic depends on the relays statuses, presently no plans to make it independent.

iv) How version control of data being received through the Kavach – EI interface is ensured?

Application CRC's of EI and SKAVACH shall be maintained.

v) If version control of data sent is not ensured, what validation measures are taken by KAVACH OEM to ensure safety?

Application CRC's of EI and SKAVACH shall be maintained.

12. Grouping of Relays / Acquiring relay information: -

a) EI shall indicate the total number of axle counters/ track circuits, points, lamp providing relays, other relays in a message. The message bytes shall be standardized and submitted to RDSO by KAVACH OEMs.

Presently the Bit list is submitted to respective railway board.

b) EI shall keep on sending all the relays status every cycle on the KAVACH Interface port.

YES, the Relay statuses are received at every message cycle.

c) This shall be a default activity in all new EI installations.
d) The existing installations are also to be gradually migrated.
e) The bit chest shall be provided to Railways by EI OEM.
f) KAVACH OEM shall use this bit-chart and fetch the required relay information.

The test details shall be as under: -

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g) The logs showing the status of relays between the Data logger output and port of KAVACH shall be compared for 30 days and SD shall be less than 10^{-8} in an hour. Report to be enclosed.