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Agenda item 8

Transmitted by CITA

Study on the inclusion of eCall in the periodic roadworthiness testing of motor vehicles

EU PROJECT: MOVE/C2/SER/2017-282-SI2.772101

https://publications.europa.eu/en/publication-detail/-/publication/c6524bd7-2b54-11e9-8d04-01aa75ed71a1

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Project partners

CITA – www.citainsp.org
FSD – www.fsd-web.de
VIAS Institute – www.vias.be

Subcontractor

IERC – www.ierc.de

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Motivation

REGULATION (EU) 2015/758 Recital 18

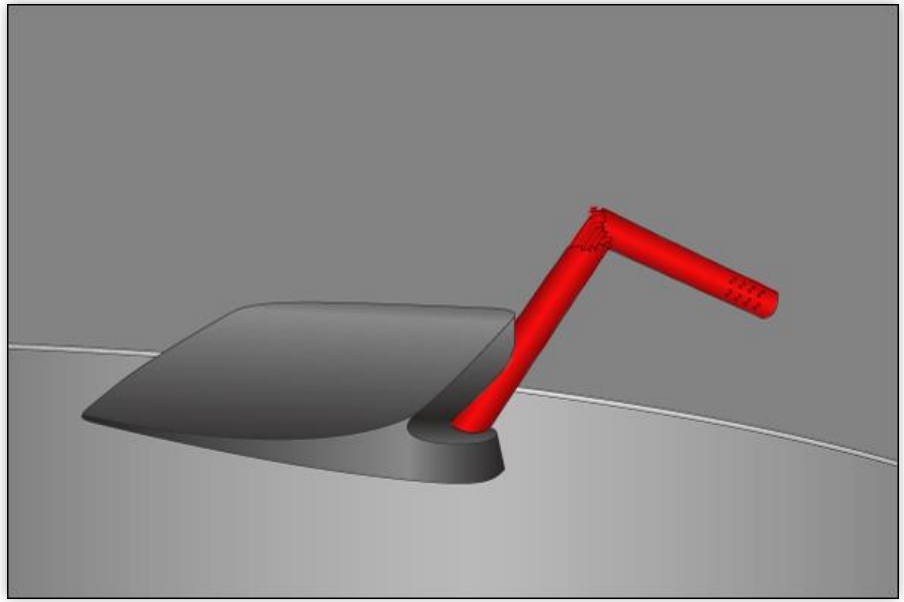
"the 112-based eCall in-vehicle system, as an emergency system, requires the highest possible level of reliability. The accuracy of the minimum set of data and of the voice transmission, and quality, should be ensured, and a uniform testing regime should be developed to ensure the longevity and durability of the 112-based eCall in-vehicle system. Periodic roadworthiness tests should therefore be carried out regularly in accordance with Directive 2014/45/EU of the European Parliament and of the Council."

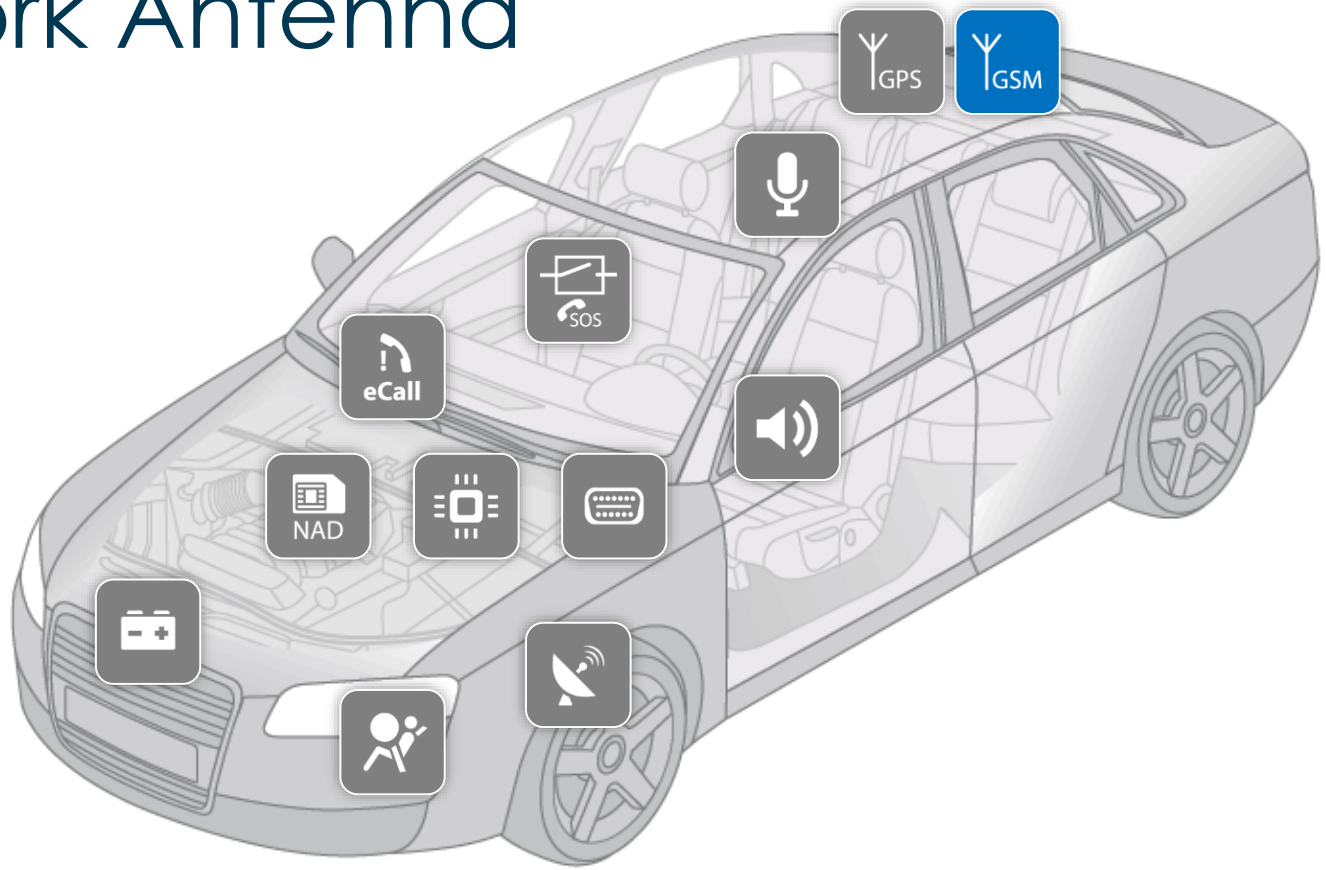
Reasons for defects

- external damage of components
- degradation of components
- incorrect maintenance
- manipulation

External Damage Of Components

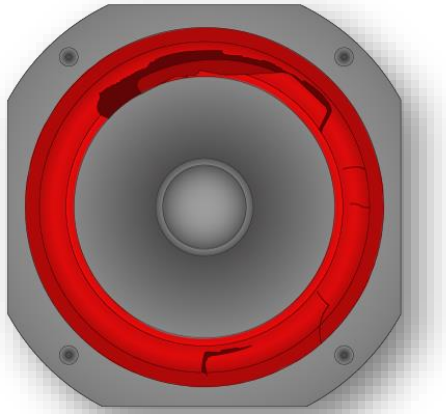
Example: Mobile Network Antenna





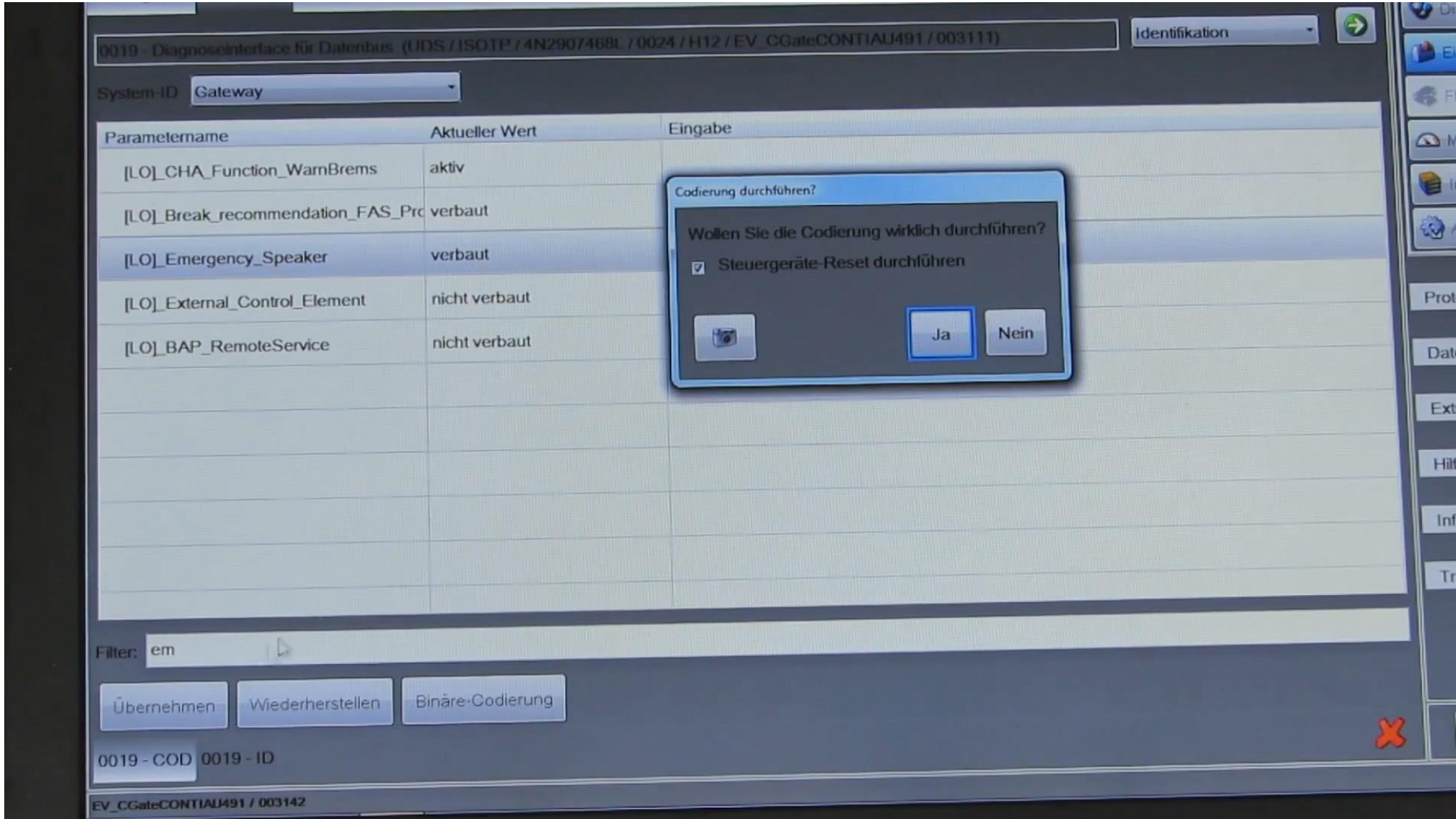
Degradation of components

Example: Loudspeakers



Manipulation

Example: Electronic Control Unit



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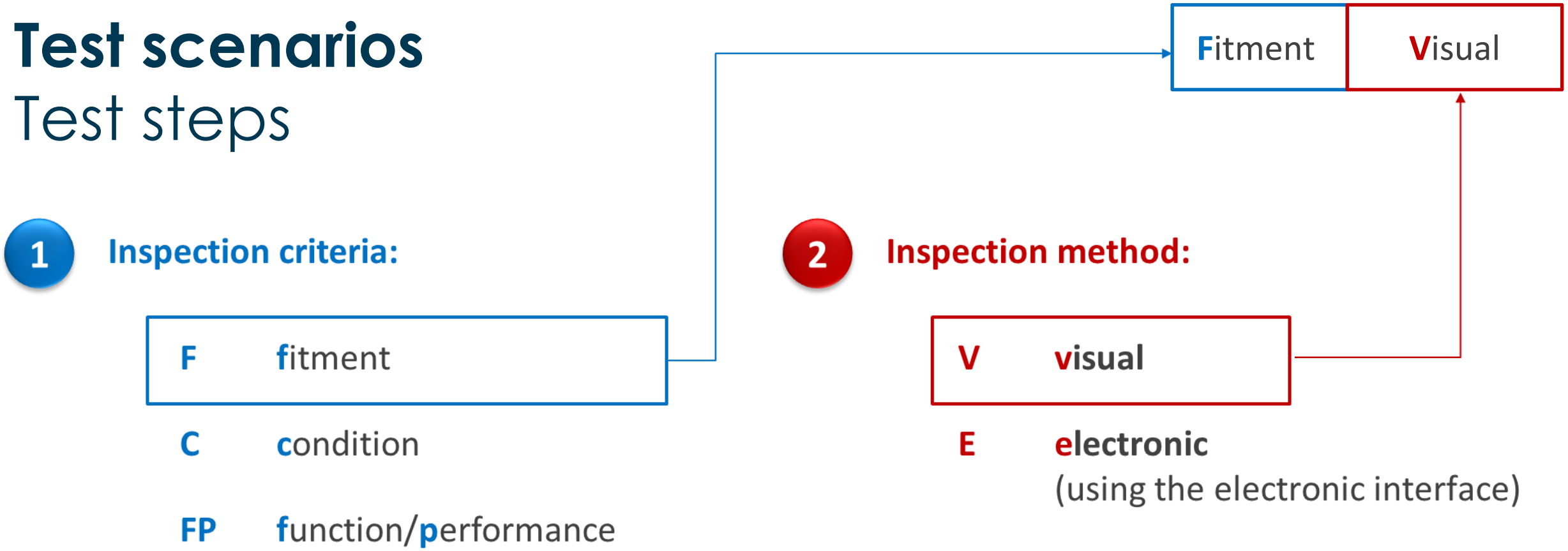
- ✓ Risk analysis methodology
- ✓ Workshop with stakeholders in 06/2018
- ✓ Final Report 01/2019, EU MVWG 06/2019
- ✓ 5 scenarios (detection rate & execution time):
  - (0) No inspection / base case
  - (1) MIL check
  - (2) ePTI Level 2
  - (3) ePTI Level 3
  - (4) Test call

Test scenarios
Test steps



Example

Scenario 1 – Testing via warning and indicator lamp

Code	Test step	Method	Time [s]
F1/V	System identification	visual	2
F1/E	System identification	electronic	2
F2/E	Configuration testing	electronic	0
C1/V	Condition testing on the basis of visual components	visual	4
C2/V	Condition testing on the basis of warning & control units	visual	3
C2/E	Condition testing on the basis of warning and control units	electronic	0
C3/E	Condition testing on the basis of stored trouble codes	electronic	1,4
FP1/E	Checking the minimum set of data	electronic	1,4
FP2/E	Testing the voice quality	electronic	4,7
FP3/E	Testing the mobile communications components	electronic	0
FP4/E	Execution of a remote test call	electronic	55,7
		sum	9

Example

Scenario 1 – Testing via warning and indicator lamp

Development test scenarios

Scenario 3 – Testing via electronic vehicle interface – level 3

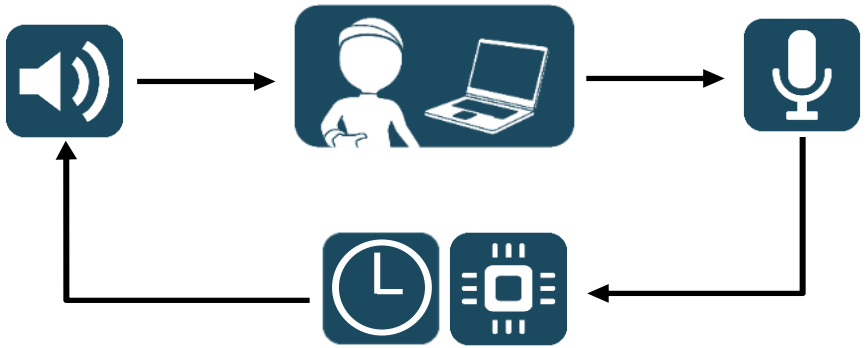
Code	Test step	Method	Execution time [s]
F1/V	System identification	visual	2
F1/E	System identification	electronic	2
F2/E	Configuration testing	electronic	0
C1/V	Condition testing on the basis of visual components	visual	4
C2/V	Condition testing on the basis of warning & control units	visual	3
C2/E	Condition testing on the basis of warning and control units	electronic	0
C3/E	Condition testing on the basis of stored trouble codes	electronic	1,4
FP1/E	Checking the minimum set of data	electronic	1,4
FP2/E	Testing the voice quality	electronic	4,7
FP3/E	Testing the mobile communications components	electronic	0
FP4/E	Execution of a remote test call	electronic	55,7
		sum	13,5

Highlights

Example ePTI Level 3 – Voice functionality

testing the microphone and emergency speaker by

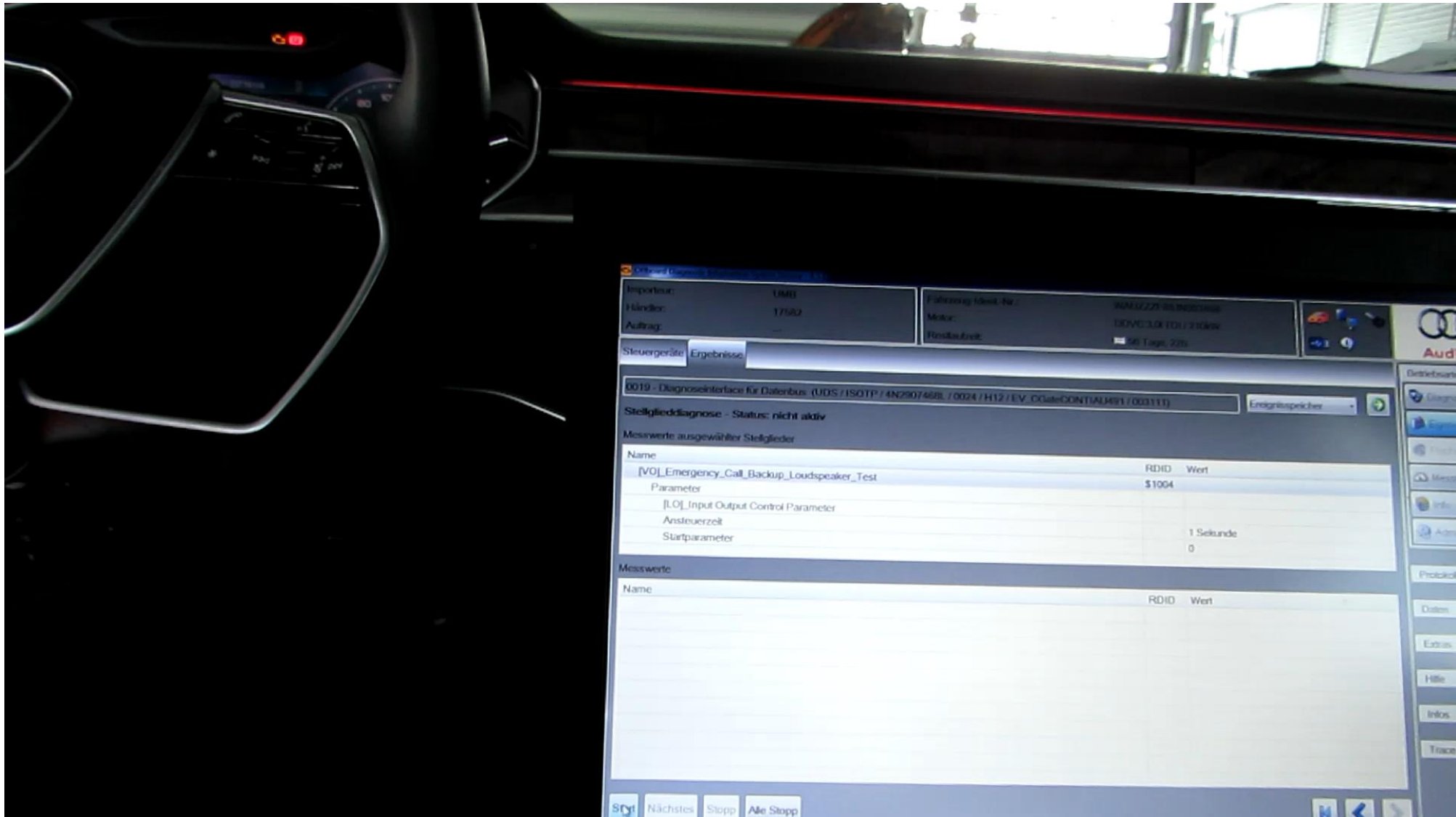
- **echo-test or**
- **triggering the loudspeakers and reading the signal level of the microphone**



Highlights

Function / Performance | Electronic

Example ePTI Level 3 – Voice functionality



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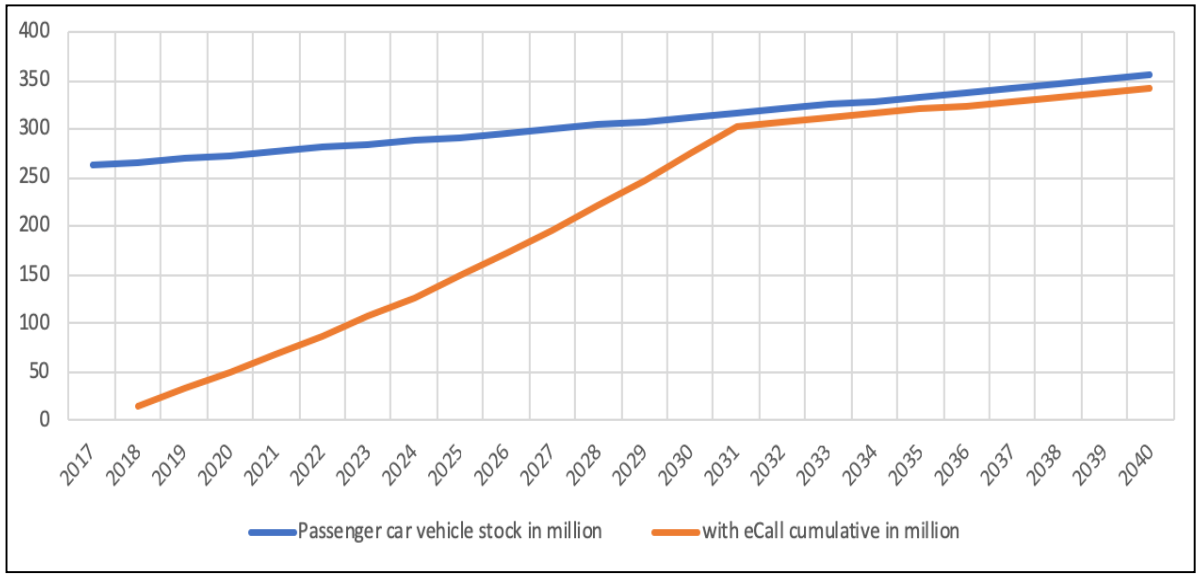
Introductory Information to Cost-Benefit-Analysis

Starting point: vehicle-fleet



Results: Benefit-cost ratios (BCR)

BCR = 1:	weak
BCR between 1 and 3:	acceptable
BCR > 3:	excellent
BCR < 1:	not acceptable.

Benefits of PTI for eCall:

- Economic benefit through the improvement of road safety.
- Economic benefit through the improvement of traffic efficiency.

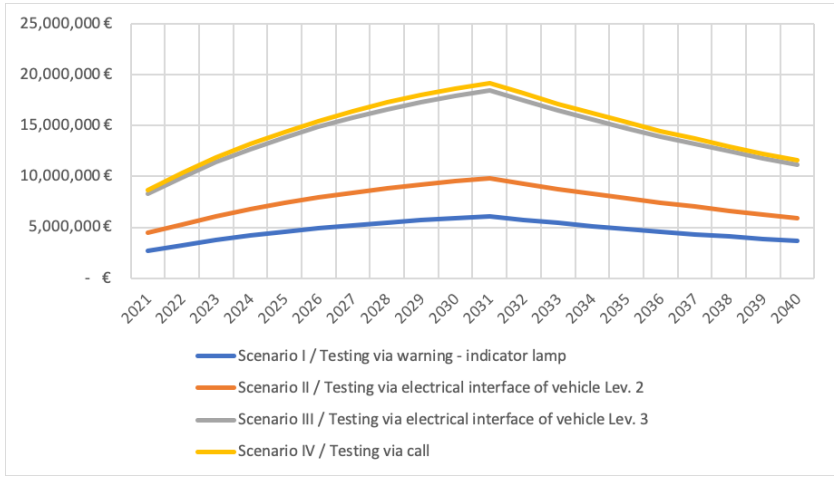
Uncertainties & Limitations:

- the possible failure rates and detection rates are not based on actual values because actual values can only be gained after the introduction of PTI for eCall.
- FSD made best guesses for these variables, based on their empirical experiences in this area.

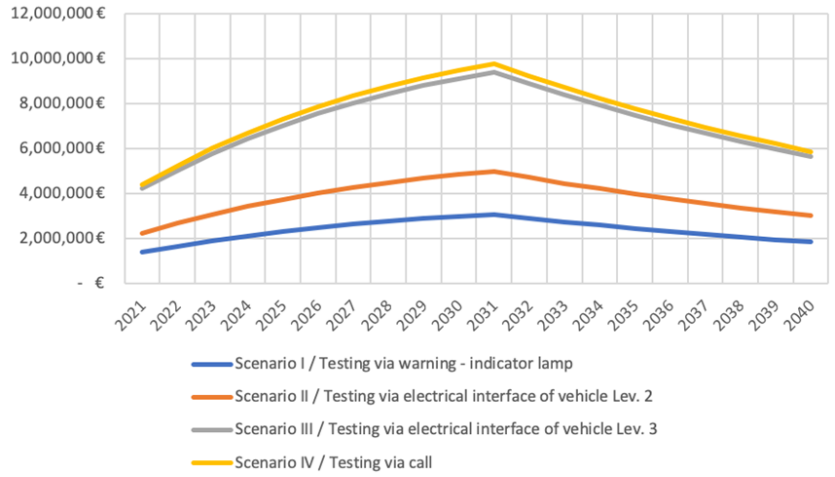
Detection of defects

Detection rate

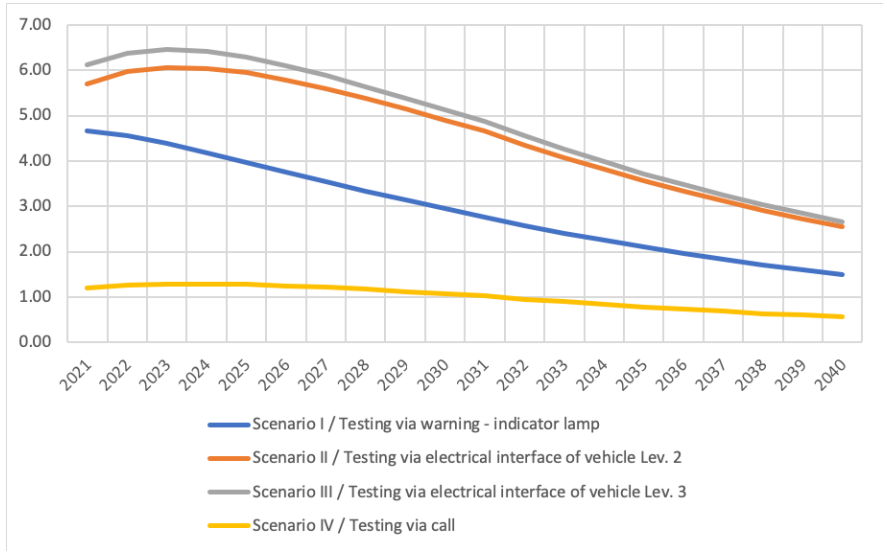
		Detection rate				
Scenario		0	1	2	3	4
eCall Components		**Without-Case**	**Testing via warning and indicator lamp**	**Testing via el. vehicle interface – Level 2**	**Testing via el. vehicle interface – Level 3**	**Testing via call**
GNSS receiver	1	○	●●	●●	●● ●●	●● ●●
GNSS antenna	2	○	●	●	●● ●●	●● ●●
Network access device (NAD)	3	○	●●	●●	●● ●	●● ●●
NAD antenna	4	○	●	●	●● ●	●● ●●
Electronic control unit	5	○	●	●● ●●	●● ●●	●● ●●
Microphone	6	○	●	●	●● ●●	●● ●●
Loudspeaker/ Emergency speaker	7	○	●	●	●● ●●	●● ●●
Manual pushbutton	8	○	●●	●●	●●	●●
Battery & electrical power supply	9	○	●● ●	●● ●	●● ●●	●● ●●
Warning and indicator device	10	○	●	●● ●●	●● ●●	●● ●●



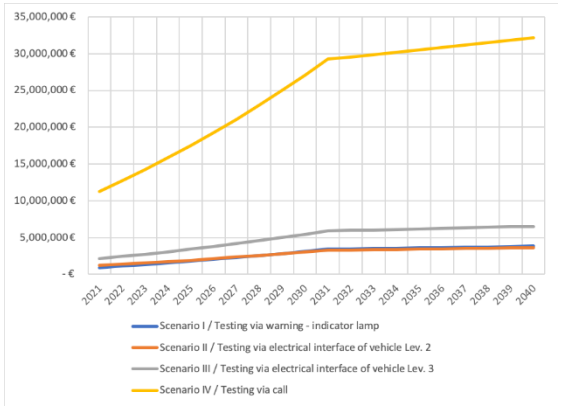
Benefits of avoided fatalities



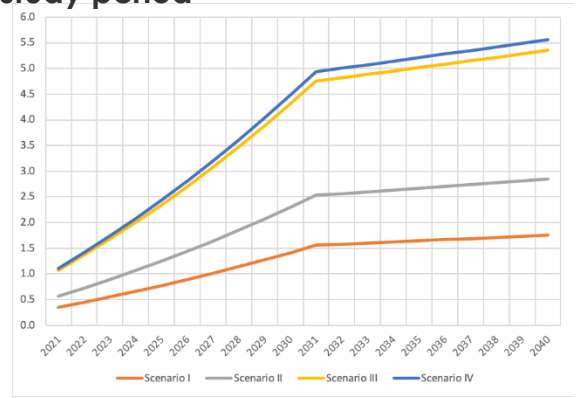
Benefits of avoided severe injuries



Avoided number of vehicles with defects in million cumulative



Development of total costs over the study period



Results

Scenario	benefit / cost
0 – No test	Base case
1 – MIL	2,96
2 – Electronic interface level 2	4,58
3 – Electronic interface level 3	4,82
4 – Test via eCall	0,99

Note: the analysis does not consider the cost of non emergency calls

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Conclusions

- ✓ A rational approach on the possible issues of eCall not detectable with self-diagnosis only
- ✓ The proposal only includes equipment already defined in Directive 2014/45/EU
- ✓ Benefit = 4,82 x Cost with Performance testing

Recommendation

Directive 2014/45/EU Annex I

Item	Method	Reason for failure	Assessment of deficiencies		
			Minor	Major	Dangerous
7.13 eCall					
7.13.1 Fitment and configuration	Visual inspection and using electronic interface by reading out the software version and the configuration of the system	(a) System or any component missing		X	
		(b) Software version incorrect		X	
		(c) System coding incorrect		X	
		(d) Software tampered		X	
7.13.2 Condition	Visual inspection and using electronic interface by reading out all failure information	(a) System or components damaged		X	
		(b) eCall MIL indicates any kind of failure of the system		X	
		(c) eCall electronic control unit failure		X	
		(d) Mobile network communication device failure		X	
		(e) GPS signal failure		X	
		(f) Audio components not connected		X	
		(g) Power source not connected or insufficient charge		X	
		(h) System indicates failure via the electronic vehicle interface		X	
7.13.3 Performance	Visual inspection and use of electronic interface by reading out the minimum set of data and testing the audio components (e.g. echo-test)	(a) Minimum set of data (MSD) incorrect		X	
		(b) Audio components not working in order		X	
		(c) Mobile communication jammed		X	

Thank you for your attention!!!