

System Version (SV) Management and Trackside – On Board Compatibility

Annex C

to the ERTMS Deployment overview of RFC North Sea – Rhine – Mediterranean

Understanding the system versions and backward compatibility was recognized a few years ago as an essential point for the exchange with RUs and vehicle owners to be able to adequately assess the requirements for vehicle equipment and authorisation, as ETCS is a system that is constantly being further developed. In particular, mandatory error corrections may have to be considered in the period between the publication of the TSIs. As part of change control management, ERA is obliged to analyse all error corrections to determine whether there is an obligation to implement them and to publish the results. This task was last defined in TSI 2023 [(EU)2023/1695, chapter 7.2.10.1].

The WG ERTMS Expert Group of the RFC NSRM relies on documents from the EUG and ERA when preparing Annex C. The baseline compatibility assessment for the TSI 2023 is not yet available at the time of the closing date of this ERTMS Deployment Overview, so that information can currently only be provided to a limited extent based on documents from the EUG.

The following presentation represents a compilation taken from a document prepared by the ERTMS Users Group.

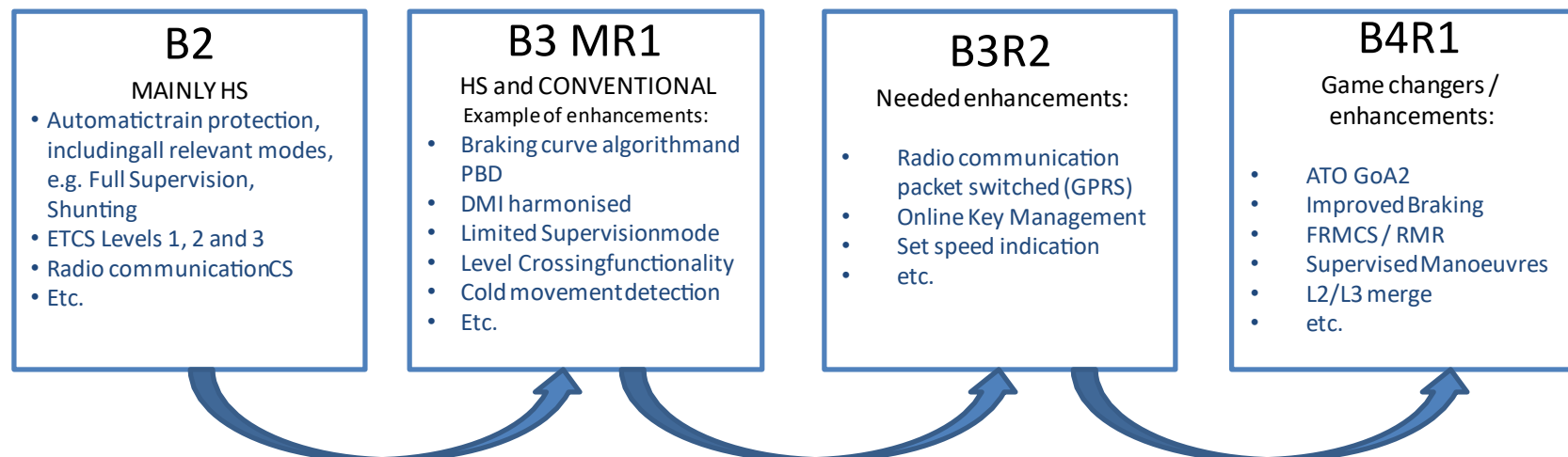
Baseline

A baseline...

...is defined by a stable kernel in terms of system functionality, performance and other non-functional characteristics.

New baseline implies significant changes to the kernel by:

- adding new functionalities
- changing substantially existing ones



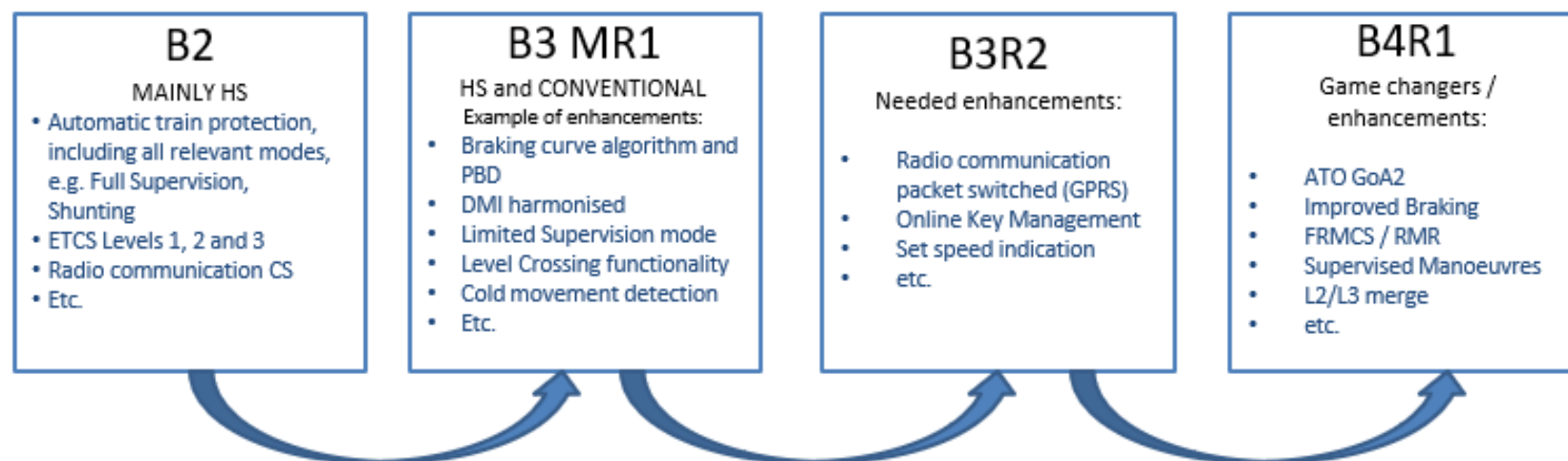
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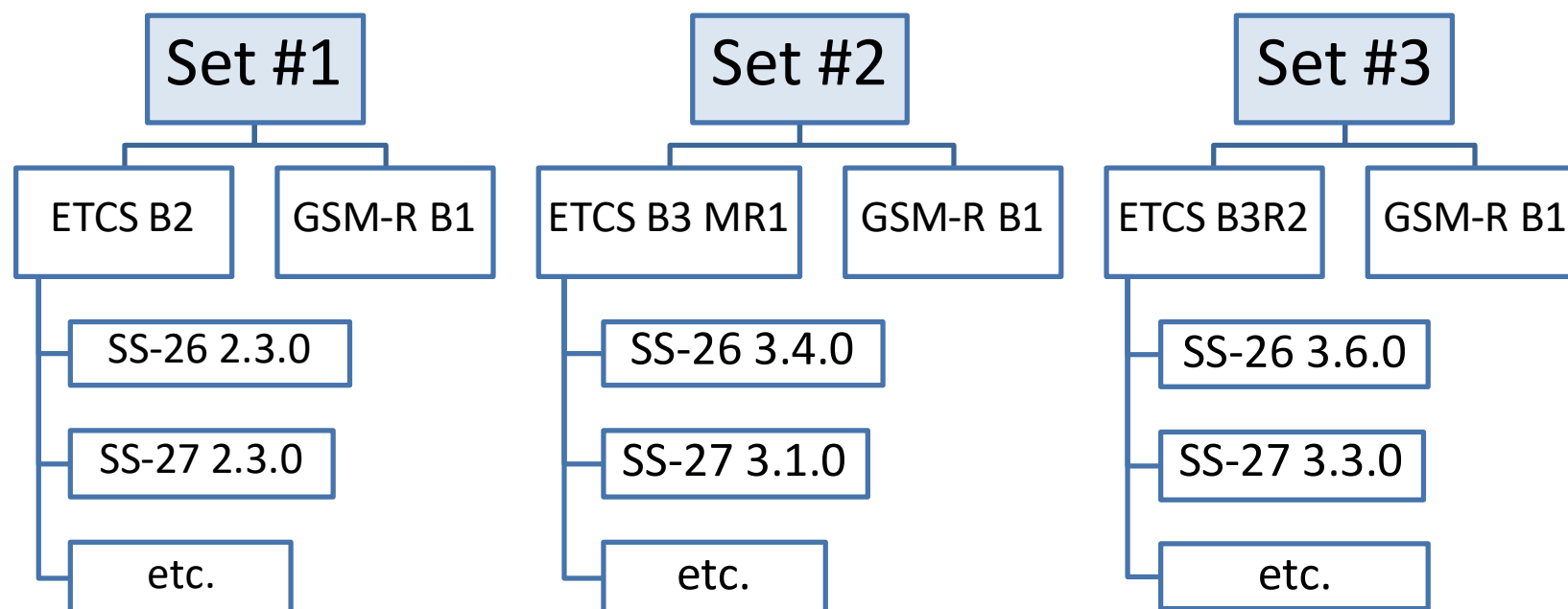
Set of specifications

(up to TSI CCS 2016/2019)

A set of specifications ...

... lists all mandatory specification documents with their version.

Pre-B4, the TSI contained 3 sets of which one had to be applied.



System Version

A System version (SV)...

... defines unambiguously the ETCS mandatory functions that ensure [technical interoperability](#) between ERTMS/ETCS [on-board and trackside](#) subsystems

Why do we need a System version (SV)?

- To prevent situations leading to an unacceptable reduction of safety or performance, due to changes in the ERTMS/ETCS specifications (and hence behaviour)

A System version (SV) [is NOT](#):

- To be assimilated to a certain Baseline or Baseline Release
- Defined by a single document (e.g. SRS)
- A version of the ETCS language
- A suppliers' product version !

System Version X.Y

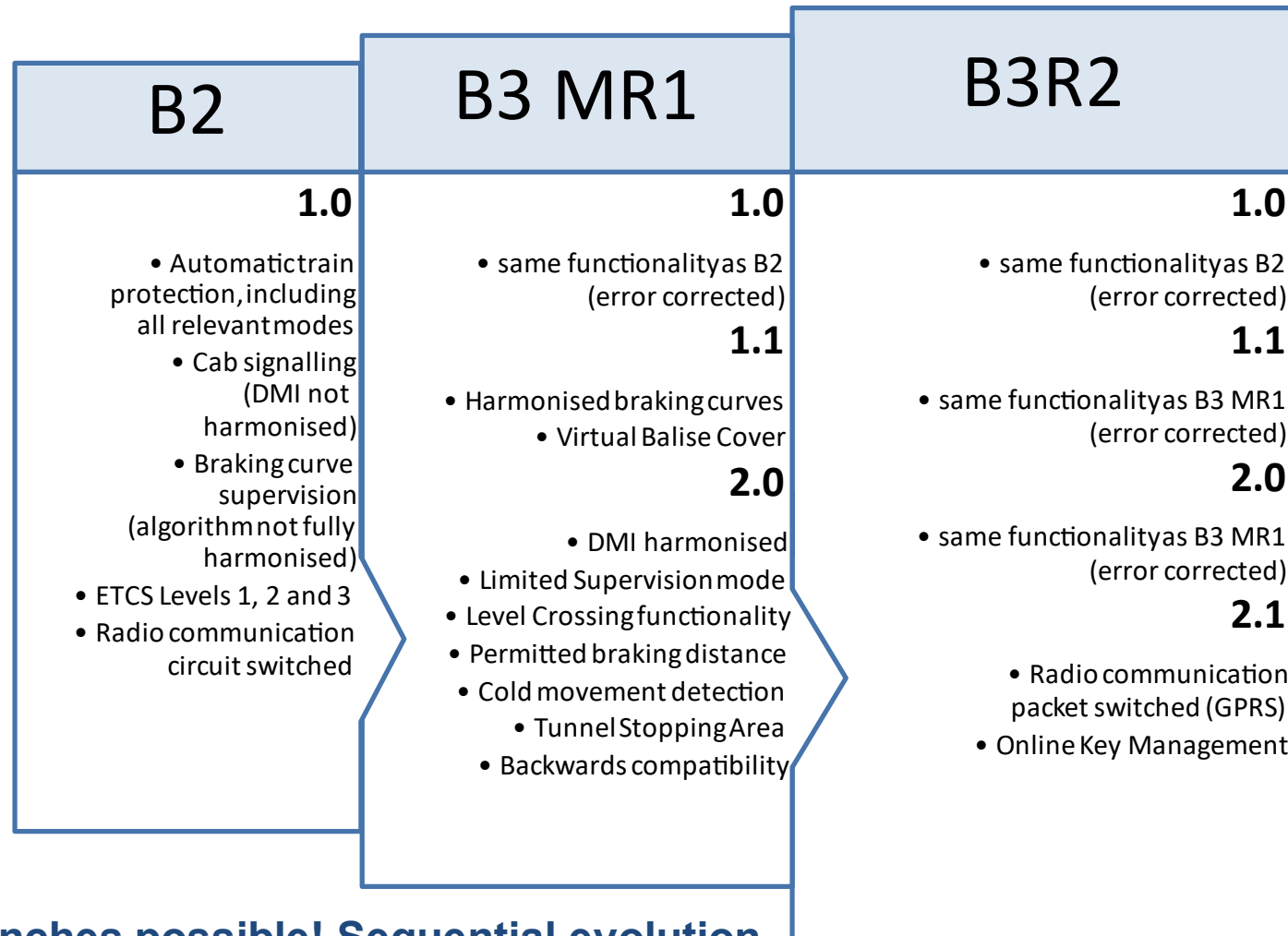
System Version: X.Y

X: non-compatible versions

Y: compatible versions within a version X

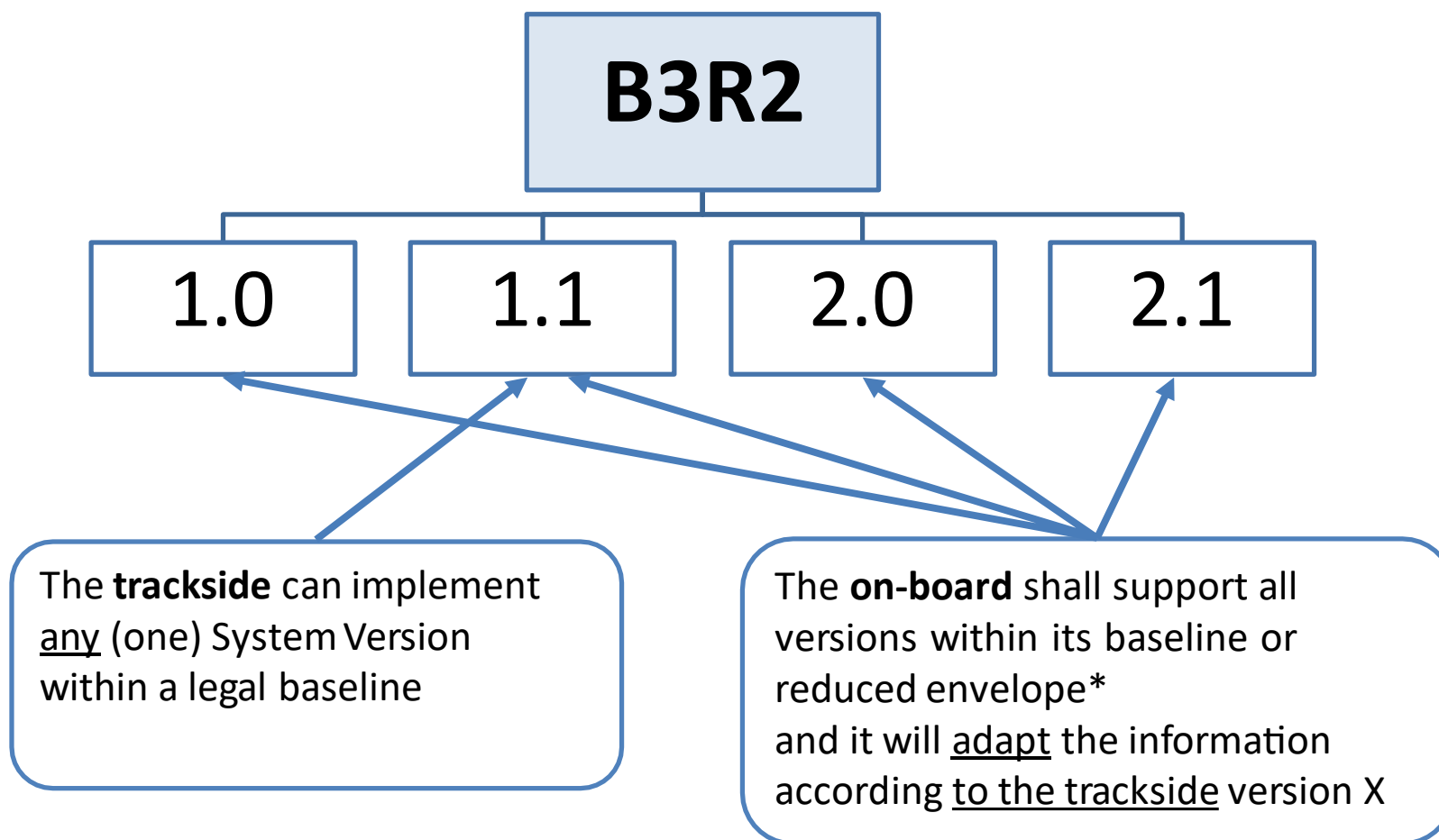
Baselines and System Versions

(up to TSI CCS 2016/2019)



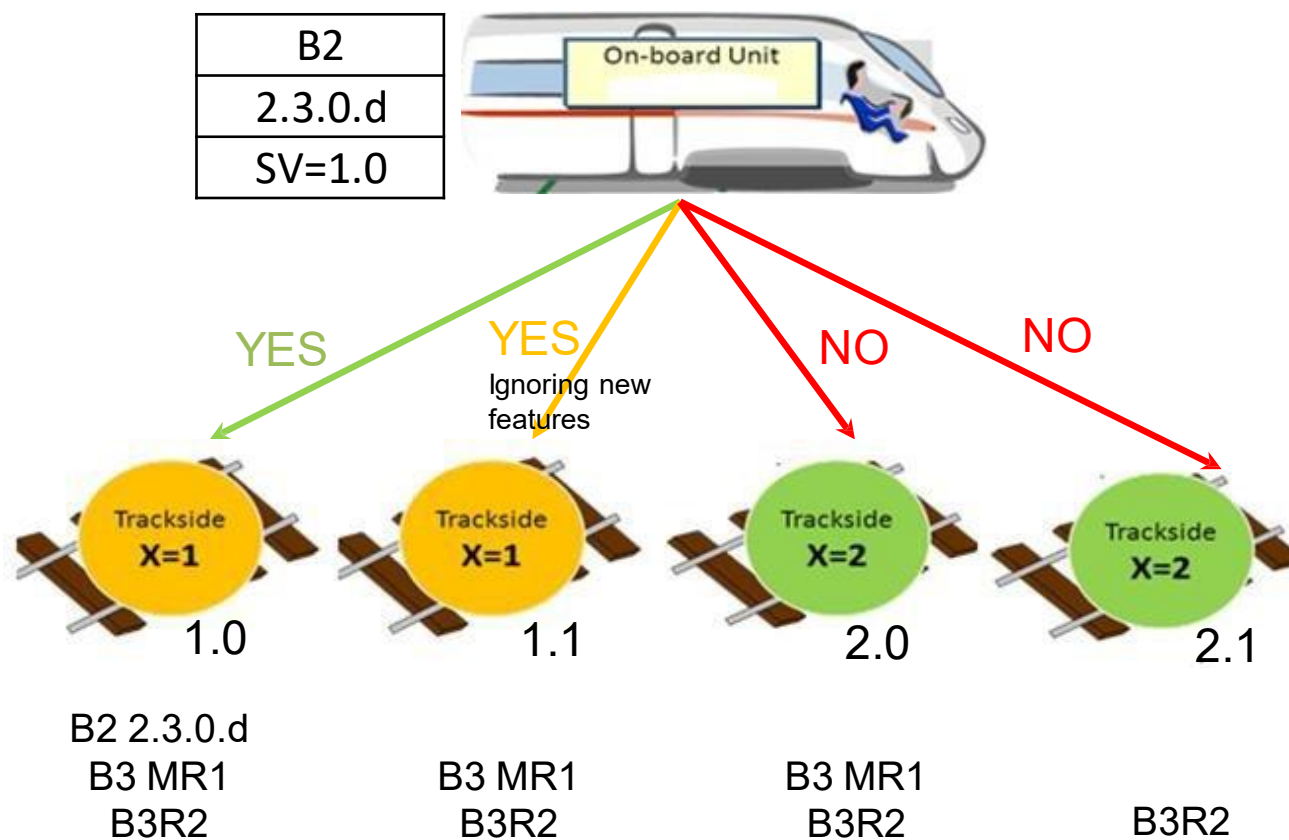
No branches possible! Sequential evolution

SV for on-board and trackside

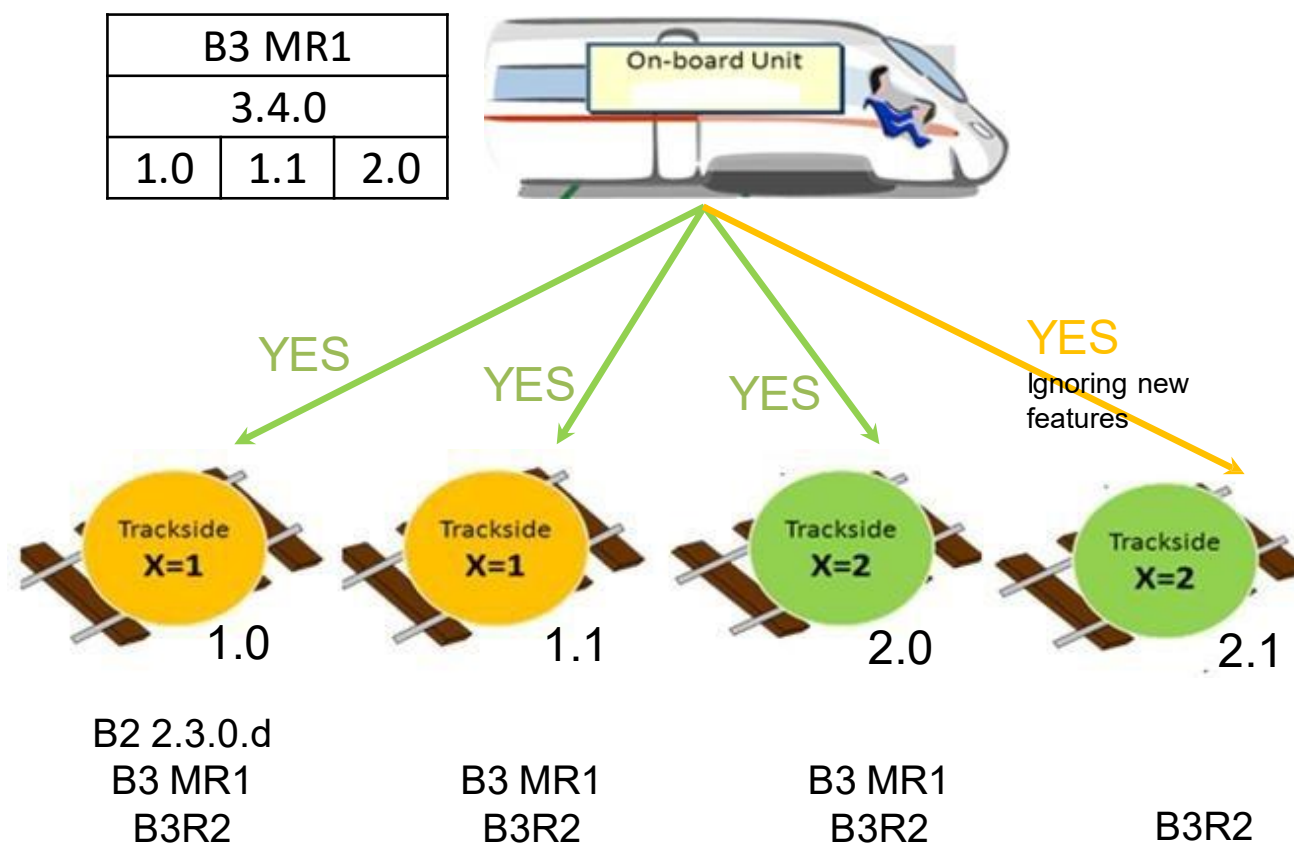


*) The reduced envelope will be specified in new SS153

The B2 on-boards

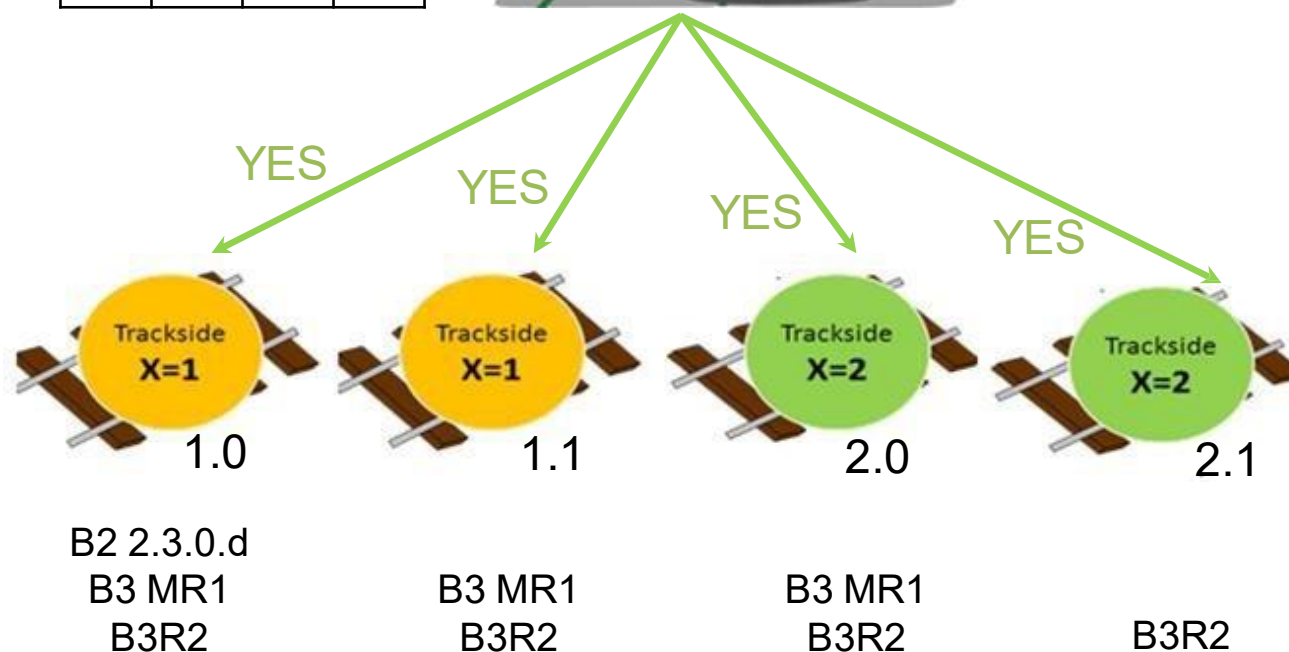


The B3 MR1 on-boards



The B3R2 on-boards

B3R2			
3.6.0			
1.0	1.1	2.0	2.1



Summary Compatibility

(up to B3R2)

Quality, Functionality "Evolution" ↑

Quality, Functionality "Evolution" ←

		B3R2 OBU		
		B3MR1 OBU		
		B2 OBU		
One Installed SV trackside	System Version	Highest SV supported by on-board		
		1.0	2.0	2.1
	B2	1.0	Yes	Yes
	B3MR1	1.1	Yes*	Yes
	B3R2	1.	No	Yes
		2.	No	Yes*

* without X.1 functionality

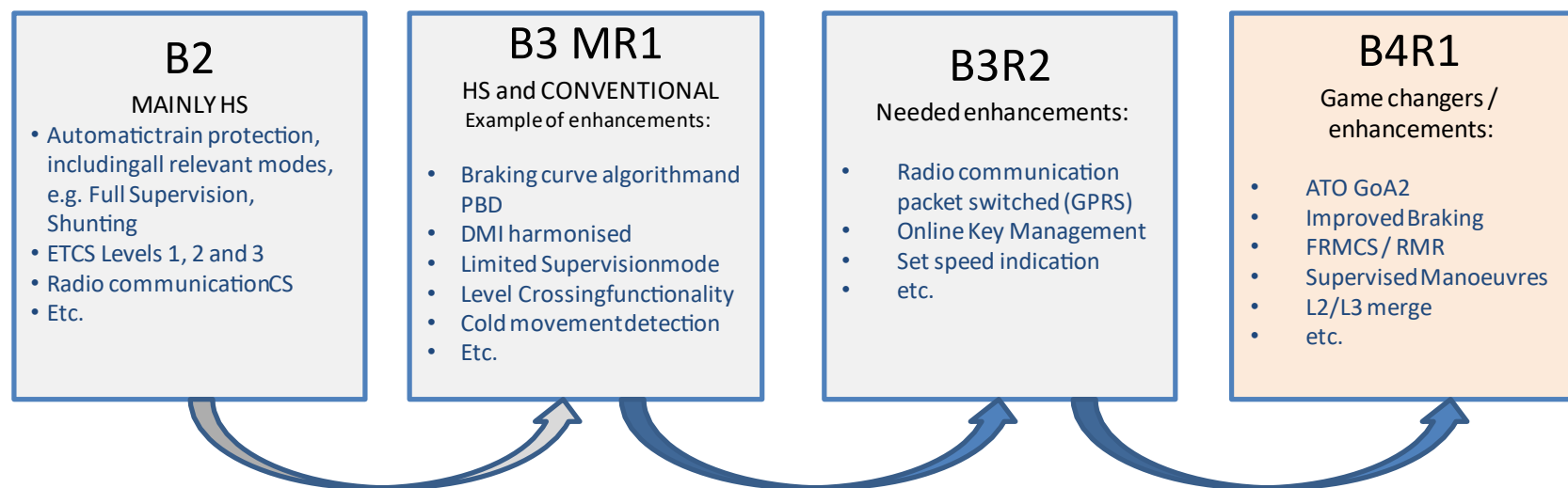
B2 trackside for B3 trains

Backward Compatibility Assessment (BCA) considerations

- By construction, a **B3 enabled train shall be able to operate on a B2 trackside**, without any change.
- However, due to the fact **B3 corrects** a series of inconsistencies or errors in **the B2 specifications**, including some minor changes in the air-gap interface, some modifications to B2 lines could be necessary **to ensure the proper operation of a full-TSI B3 train**.
- The **Baseline Compatibility Assessment (BCA)** should be used to anticipate the potential gaps or incompatibilities between B3 (MR1 or R2) onboards and system version 1.0 trackside developed following (older) B2 specifications. These BCAs provide **the mitigation measures**. EUG provides an **Engineering guideline (#79)** with engineering rules.



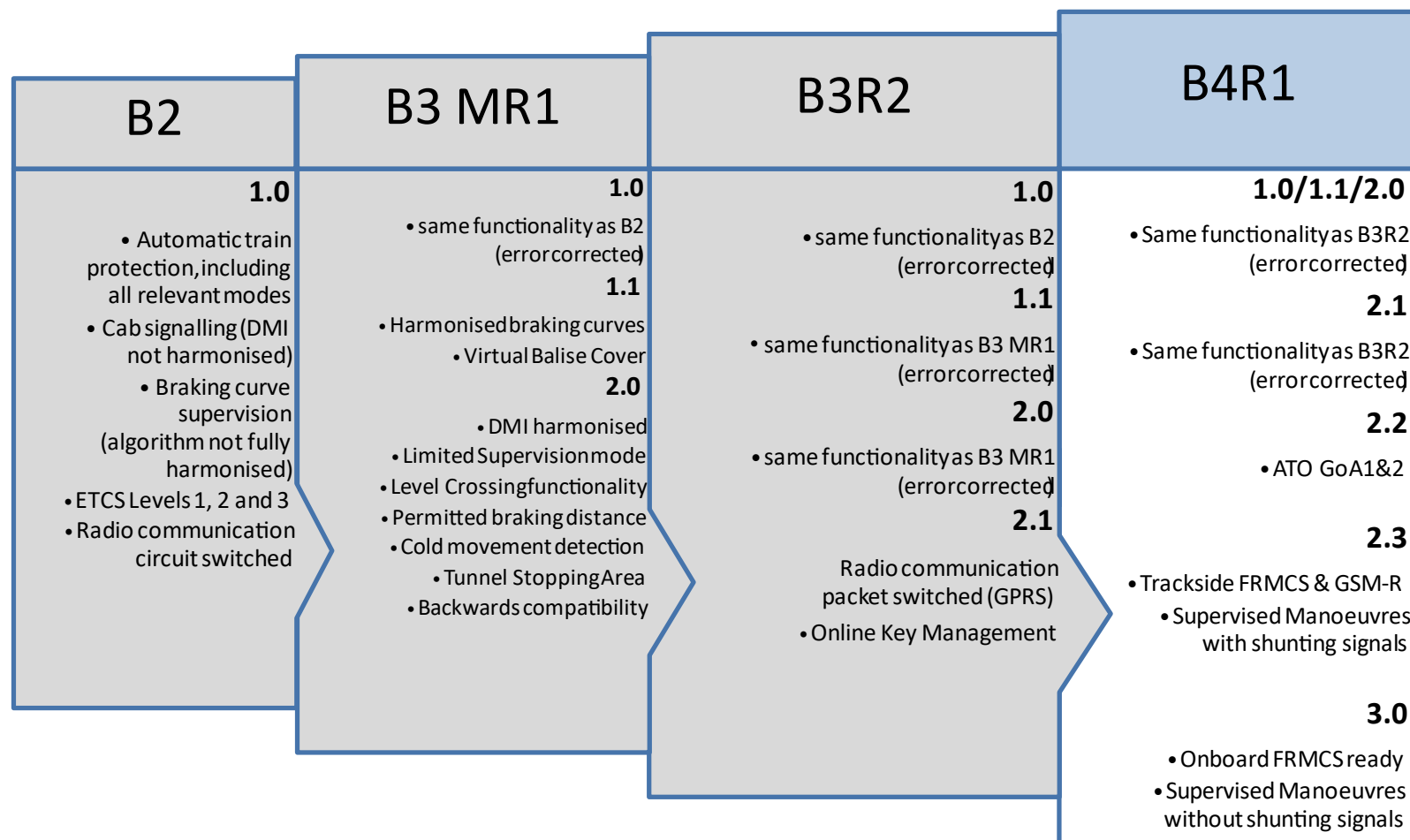
Baseline 4 Release 1



Situation as per September 2023:

- B2/B3 specifications (Sets #1-#3) are not allowed to be used for new to start projects; however still to be used during a so-called 'transition regime', described in Annex B
- For all new developments B4R1 must be used; reduced envelopes (SV2.1 – SV2.2) of full B4R1 (up to SV3.0) for onboards possible
- The BCA of the new B4 functions is still to be performed

Some new System Versions !

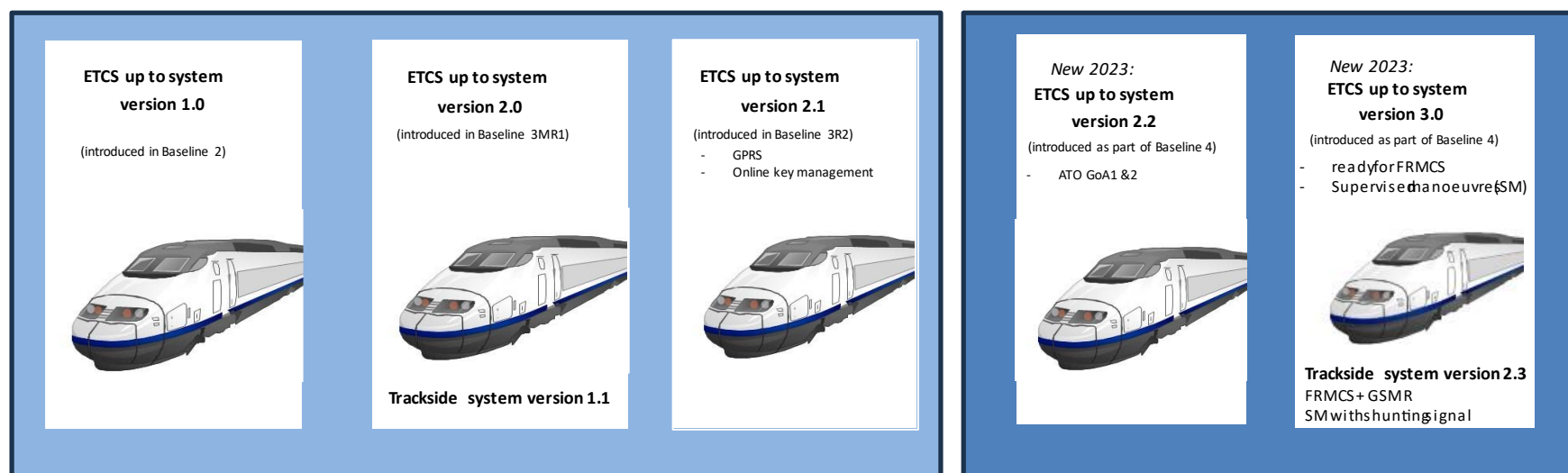


New SV3.0 (X=3) creates incompatibility

→ SV3.0 Trackside only to be deployed after 2027....

(it is expected that with TSI CCS 2027 full FRMCS specifications will become available)

Changes justifying the introduction of new ETCS System Versions in TSI CCS 2023



Justifications:

- **New compatible functions** (backwards and forwards) introduced as part of ETCS system version 2.2 (**ATO GoA1/2**).
- **New incompatible functions** (backwards compatible, but not forwards compatible) introduced as part of ETCS system version 3.0 (**Supervised Manoeuvres / FRMCS**).
- **New Trackside version 2.3** allows the deployment of 3.0 functionalities in a compatible way (**RMR: FRMCS + GSM-R**, supervised manoeuvres with shunting signals)

New framework for maintaining ERTMS specifications



Ongoing (B3) projects raised 2 relevant issues/concerns:

1. How to **include and maintain specifications in an efficient way**?
 - Not keeping specifications with known errors in the legal framework
2. How to have a structured approach for:
 - **partial fulfilment** of system versions ?
 - and different implementation frameworks for **fast error corrections** ?
 - and gradual **implementation of needed innovations**?

The solution: Introduction of the **Single Set of Specifications** with one harmonised regime:

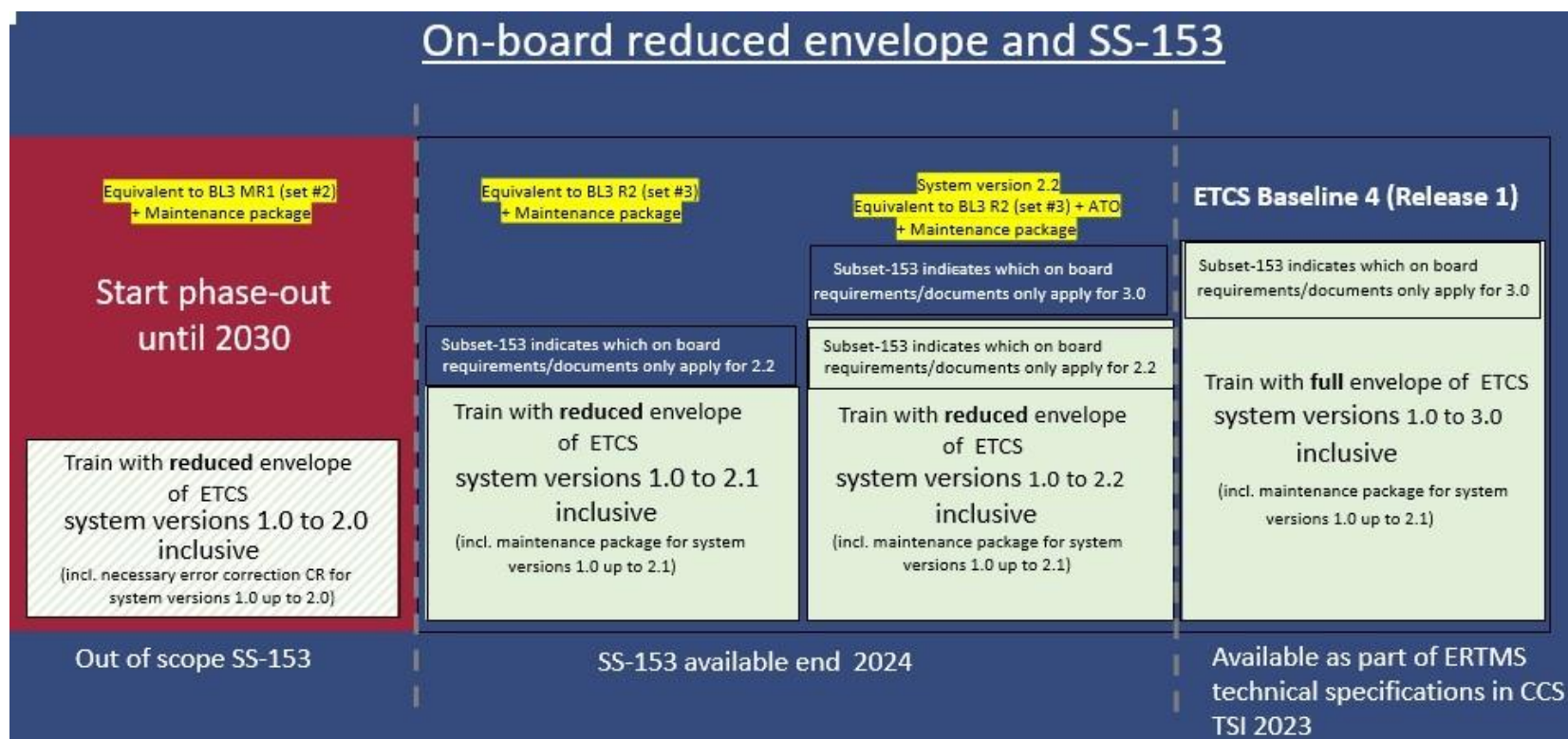
- **Former sets #1, #2 and #3 are removed** from Appendix A*
- Onboards can implement new, full Baseline 4 functionality (SV3.0) or have **reduced envelope**** functionality according to system version (2.1-2.2)! ***
- **Tracksides** can be deployed by choosing one of the system versions **1.0, 1.1, 2.0, 2.1, 2.2, 2.3, or 3.0.**

*) Applicability of former set of specifications for trackside; CCS TSI 2023/1695 conditions are defined for set 1-3. see (7.4.1.2)

**) The reduced envelope will be specified in new SS153

***) The on-board requirements are defined in 7.4.2 with 7.4.2.4 defining the system version implementation rules

On-board reduced envelope and SS-153



Maintenance Packages:

As older Sets of Specifications #1, #2 (SV1.0-2.0) are not “error corrected”, they will require to introduce the maintenance package according to the new “error correction process”

Summary Compatibility

Quality, Functionality "Evolution"		System Version		Highest SV supported by on-board				
				1.0	2.0	2.1**	2.2**	3.0
One Installed SV trackside	B2	1.0		Yes	Yes	Yes	Yes	Yes
		1.1		Yes*	Yes	Yes	Yes	Yes
	B3MR1	2.0		No	Yes	Yes	Yes	Yes
		2.1		No	Yes*	Yes	Yes	Yes
	B3R2	2.2		No	Yes*	Yes*	Yes	Yes
		2.3		No	Yes*	Yes*	Yes*	Yes
	B4R1	3.0		No	No	No	No	Yes

* With reduced functionality

** In TSI 2023 (B4R1), SV2.1 and 2.2 exist as reduced envelopes for new OBU

What about FRMCS ?

TSI 2023

- First versions of FRMCS specifications as legal anchor (V1 , BL0)
- Concept of ETCS/ATO readiness for FRMCS
- Modularity (open interfaces between on-board ICs/products)

TO (2024-2025)

- FRMCS V2
- Complete set of specs for test and validation (EU Trial on FRMCS)
- Suitable for tendering pilots.

Amendment to TSI (2026-2027)

- FRMCS V3, BL1 (end 2026)
- Validated specifications after EU Trial and pilots
- CCS TSI subsequent update (June 2027)
- Suitable to start tendering real applications and start counter for GSM-R decommissioning.

TO: Technical Opinion of ERA
preparing for future legal
requirements. Suitable for
tendering pilots

Summary

- Till TSI CCS 2023: **A baseline** can contain **several system versions, a baseline release** (defining a set of specifications) defines which SVs are available.
- From TSI CCS 2023: A baseline and subsequent releases **contain and manage all SVs ≥ 2.1** in **one set of specifications. SVs ≤ 2.0 are frozen.**
- **Technical compatibility** is checked between (implemented) trackside and (available) on-board system versions, NOT between baselines or SRS versions
- Trains can be **backwards and forwards compatible** to a trackside (however, some BCA^{*)} mitigation measures should be obeyed).

^{*)} BCA: Baseline Compatibility Assessment
The BCA B4 to B3 still needs to be performed