STM-DK Subrack

Installation manual

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Change log

Issue / Date	Affected pages	Description	References
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1.01 / 19-02-2013	All	Updated after meeting with Alstom, DSB and BDK.	
1.02/ 21-02-2013	All	Updated according to Review-01.	
1.03/14-11-2013	All	New scope: To be used for any train type without the need for a specific installation guide.	
1.04/16-12-2013	13 and 21	Information on vehicles with one antenna added	
1.05/10-01-2014	All	Some application rules specified	
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1.08/09-06-2016	Chapter 1, 2, 3, 5.4, 6 Chapter 2 is inserted with Decommissioning	References to dedicated application rules are removed. A general reference to Application rule document is inserted. Antenna tuning is rewritten, Decommissioning inserted	
1.09/14.08.2017	Chapter 3.1 new Chapter 4.2.6 Chapter 4.2.8 Chapter 4.4 Chapter 4.7.5 Chapter 5.2	Generel rules for installation Circuit breaker update Circuit breaker update text in drawing Havarilog included Requirement to external power included Requirement to verification of Litra code and ATP train	
1.10/02.11.2020	Chapter 5.5	The interval for tuning temperature is changed to -10°C and +40°C	
1.11/02.02.2022	All	Drawing name changed to STM-DK Subrack, installation manual. Document updated for VE6. All sections of the document is updated.	

Table of Contents:

1 Introduction

1.1 Scope

The purpose of the STM-DK Subrack installation manual is to provide the requirements and the necessary information for installation of the STM-DK Subrack as an add-on system to an ETCS Onboard system.

System related subjects, like operational SW interface between the ETCS Onboard system and the STM-DK Subrack are not within the scope of this manual. These subjects are covered by the generic approval of the STM-DK or in /8/.

This STM-DK Subrack Installation manual is written for technical personnel, who shall design the installation of the STM-DK Subrack.

The STM-DK Subrack is only for use with the Danish ATC-infrastructure.

It is the task of the system integrator to ensure that cables and components used for connection to the STM-DK Subrack and the antenna(s), comply with the train installation requirements and the relevant standards.

For cable installation it is advised to follow good practice and separate power cables and other “noise” contributing equipment from signal cables, to avoid unwanted interference to the signal cables.

If no revision for standards is mentioned in this document the latest issue applies.

1.2 Definitions

BDK	Banedanmark
STM-DK	ETCS STM developed for the current/legacy Danish train protection system (ZUB123)
DMI	Driver Machine Interface (of ETCS Onboard)
EB	Emergency Brake
ETCS	European Train Control System
RU	Railway undertaking

Operational states of DK-STM

NP	No power
PO	Power on (performing self test)
CO	Configuration (initial communication with ETCS)
DE	Data entry (communication with ETCS to get train data)
CS	Cold stand by (ETCS has control). STM-DK antennas are passive
HS	Hot Stand by (ETCS has control). STM-DK antennas are active
DA	Data Available (STM-DK has control)
FA	Failure (ETCS has control)

1.3 References

If version is not part of document identification it is always the latest valid version that are referred to.

Document title	**References**	**Document identification**
Antenna ZUB123 *(Valid for S25441-M1-A3)*	/1/	G81050-J2118-A004-D
Connection box	/2/	G81050-J2118-A005-B
Indbygningsforskrift ZUB123 Einbauanleitung *(Valid for S25441-M1-A3)*	/3/	G81050-J2118-A006-A
Samlingstegning for befæstigelsesbolt til punktantenne	/4/	G81050-J2118-A018-A
Indbygningsforskrift ZUB123 Einbauanleitung NF-ZKS S25441-M2-A3-*	/5/	G81050-J2118-A021-A
Indbygningsforskrift ZUB123 Einbauanleitung NF-ZKS S25441-M2-A4-*	/6/	G81050-J2118-A022-A
ZUB123 Beschreibung der ATC-Diagnose-Schnittstelle	/7/	G81001-E3117-U001-C
DK-STM Systembeskrivelse	/8/	KN 655.00 Q2959 (BDK)
DK-STM Application Rules	/9/	G81001-X3107-L005-10 Baseline 5.0, 2022-01-27
DK-STM Dokumenteret Slutafprøvning	/10/	AN 656.00 Q4446 V 1.14

Table 1 References

2 STM-DK Subrack general

This section describes the STM-DK Subrack in general

2.1 Interface for the STM-DK Subrack

The context for the STM-DK Subrack is shown in Figure 1.

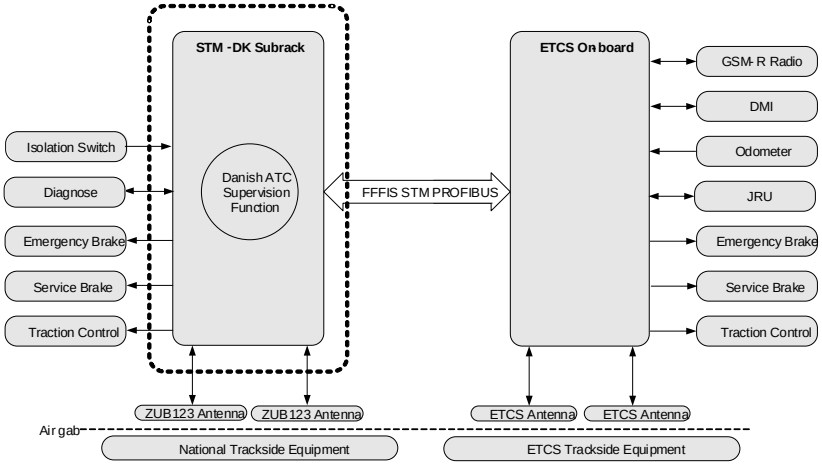


Figure 1 Interfaces of the STM-DK subrack

The STM-DK Subrack is a part of the overall ETCS Onboard system. The interface to STM-DK Subrack is defined at the front connectors of the different boards in the 19" Subrack.

STM-DK Subrack provides interfaces for

- Emergency brake
- Service brake
- Traction cut off
- ZUB123 antenna(s)
- ETCS Onboard unit (Profibus)
- Power supply
- Diagnose

The STM-DK Subrack is connected to the ETCS On-Board via a PROFIBUS connection.

Brake commands and Traction Cut-off commands are sent to the ETCS by the Profibus-connection.

Error data, balise data, train data etc. are sent to the JRU by the Profibus-connection.

The STM-DK Subrack is operated by the DMI of the ETCS Onboard system.

The STM-DK Subrack gets odometerdata from ETCS

2.2 The HW of the STM-DK Subrack

The overall STM-DK Subrack structure is seen in Figure 2.

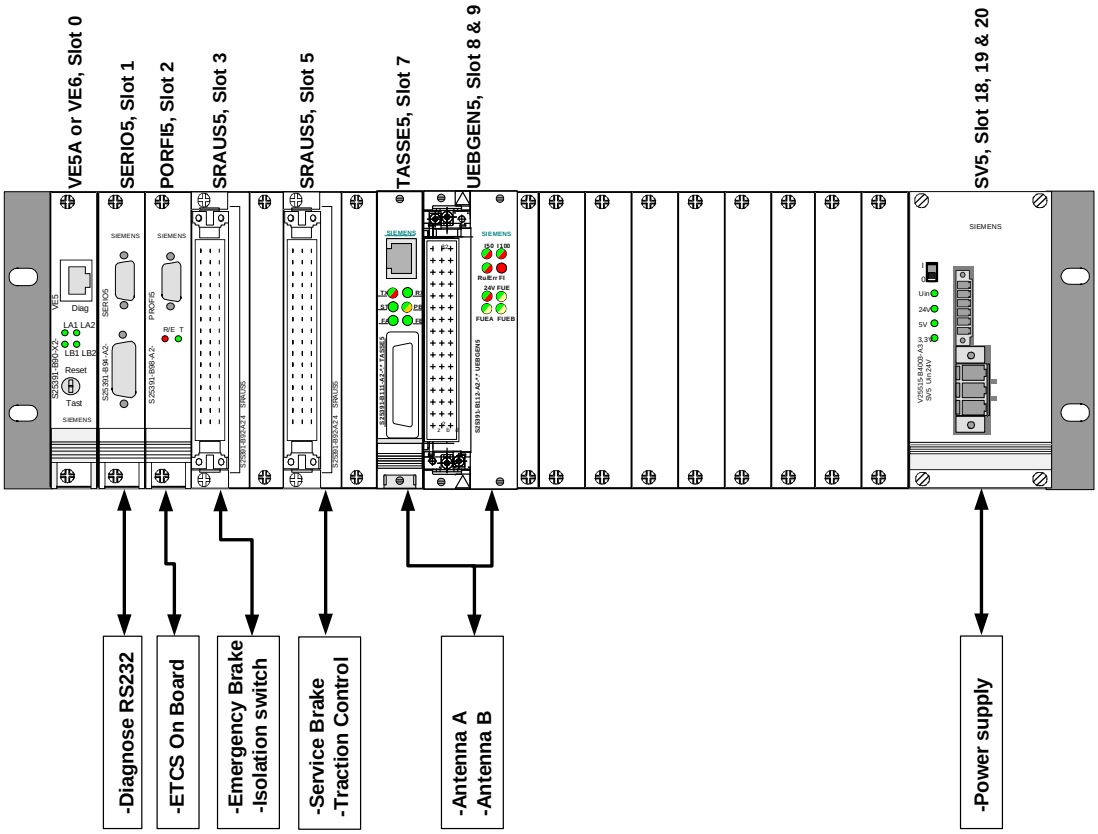


Figure 2 Overall STM-DK Subrack structure

All interfaces are at the front connectors on the boards. The specific properties of the interfaces are described in following sections of this document.

The total hazard rate for the STM-DK Subrack is $2x10^{-9}$/Hour.

The STM-DK Subrack complies with EN 45545-2:2013+A1:2015 HL3.

The STM-DK Subrack is delivered in two different HW versions:

- for 24 V DC battery voltage
- for 110 V DC battery voltage (Also used for 72 V DC battery supply with modifications, see note below)

Order number for STM-DK Subrack:

- For 24 V DC battery voltage, G81002-E3135-H024-*
- For 110 V DC battery voltage, G81002-E3135-H110-*

STM-DK Subrack boards:

Slot.	Board	Function
0	SIMIS TCC VE5/VE6, CPU	STM-DK Subrack CPU
1	SIMIS TCC SERIO5	Diagnose interface
2	SIMIS TCC PROFI5	Communication with ETCS-Onboard
3	SIMIS TCC SRAUS5	Relay interface for emergency brake
5	SIMIS TCC SRAUS5	Relay interface for service brake and traction cut-off
7	SIMIS TCC TASSE5	Antenna telegram receiver board
8 & 9	SIMIS TCC ÜBGEN5	50 and 100 kHz interface for antennas
18,19 & 20	SIMIS TCC SV5	Power supply

Table 2 STM-DK Subrack boards

The choice of battery voltage applies to the feeding of the power supply unit SV5 and to the energising of the isolation switch function of the SRAUS5 board in slot 3. Beware that the SRAUS5 board of the 110 V rack does not comply with requirements for 72 V systems. An SRAUS5 board for 72 Volt does not exist for the STM-DK Subrack.

If the STM-DK Subrack is to be used with other power supply sources than the train battery voltage of 24 V DC, 72 V DC or 110 V DC and for instance a DC-DC converter is used, then see section 9.5 for supply voltage requirements.

The contacts of the SRAUS5 board relays (emergency brake contact, service brake contact, traction cut off contact) may be used by a voltage different from the supply voltage. However, the permissible load current depends on the voltage.

See section 9.5 for further information.

Note: the voltage interval for the 110 V DC power supply is much wider than the voltage interval for the 110 V DC SRAUS5 cut off relays, but the cut off relays need not to be used; there are other ways to bypass the STM-DK Subrack emergency brake output.

3 Requirements for installation

For installation the following are required:

- Installation and maintenance personnel shall be qualified for their work.
- The installation of the STM-DK Subrack shall comply with the application rules for the STM-DK Subrack ref. /9/ and with instructions as described in this document.
    - Some of the applications rules from ref. /9/ are further elaborated in this document for clarification.
    - Text in cursive is copied text from ref. /9/.

3.1 STM-DK Subrack conditions of use

3.1.1 Storage and transport

Regarding storage and transport (as a component) of the STM-DK Subrack, conditions as defined in EN60721-3-2 class 2M2 and 2K2 shall not be exceeded.

Ref. /9/ AppRule_74

3.1.2 Protection class

The STM-DK Subrack shall be installed inside a cabinet with minimum IP54 rating according to EN60529.

Ref. /9/ AppRule_49

3.1.3 EMC

The conditions as described in EN61000-6-2 / EN61000-6-4 and EN50121-3-2 shall not be exceeded for STM-DK Subrack.

An external filter at the power input is needed. (i.e SIFI-B).

The power to the STM-DK Subrack shall be supplied through a Schaffner FN2060-10/6 or equivalent filter and through a suitable circuit breaker.

It is required that the STM-DK Subrack is only accessed by maintenance staff.

Ref. /9/ AppRule_10, AppRule_11, AppRule_12

3.1.4 Mechanical requirements

The mechanical conditions as described EN 50155, class 1B(EN 61373) and IEC60571-1 shall not be exceeded for the STM-DK Subrack.

Ref. /9/ AppRule_35

3.1.5 Climatic requirements

Allowed temperature range: - 40 °C to + 70 °C inside the cabinet for the STM-DK Subrack (EN 50155 class TX)

If external ventilation of the TCC cabinet is used, special attention may be needed. (It may be necessary to monitor the ventilation unit for functionality to ensure the right temperature conditions for the STM-DK Subrack.)

Ref. /9/ AppRule_2

3.1.6 Insulation and Dielectric strength

The STM-DK Subrack shall be installed in an enclosure and environment, that ensures the pollution degree does not exceed PD2 of EN50124-1 and causes no higher demand on the STM-DK than OV2 of EN50124-1 and EN60664-1.

Maximum permissible altitude: 4000 m.

Ref. /9/ AppRule_1

3.1.7 STM-DK Subrack Installation in general

1. The STM-DK Subrack shall be installed in a locked cabinet preventing unauthorised access to the STM-DK Subrack.

   Ref. /9/ AppRule_48

2. All cables connected to the front connectors of the STM-DK Subrack shall be shielded.

   - The shield of cables connected to the STM-DK Subrack shall be attached to a ground plane (ground bar), close to the STM-DK Subrack.

   - The shields of the cables connected to the STM-DK Subrack front connectors for TASSE5, UEBGEN5, SRAUS5, PROFI5 shall be electrically connected to the front connector of the STM-DK Subrack. (i.e. The shield shall be connected to the cable connector housing.)

NB: The connector housings for the SV5 is made of plastic and the cable shield and the cable shield for the power cable shall not be grounded at the SV5 board.

- Before cables connected to the STM-DK Subrack is leaving the cabinet where it is built in, the cables shields shall be terminated to a ground plane (ground bar).

Ref. /9/ AppRule_13.

See section 4 for further details for cable shields and grounding.

3. No other connections than specified in this manual are allowed.

   See ref. /9/ AppRule_14, AppRule_25, AppRule_41, AppRule_42, AppRule_56.

4. Unless explicitly stated differently in this manual including the referenced standards it shall be assured that no higher voltages than 60V can be applied to the hardware interfaces of STM-DK Subrack even in case of failure of the connected equipment.

   Ref. /9/ AppRule_110

5. Before removing/connecting any connections to the STM-DK Subrack, the power shall be turned off for the STM-DK Subrack, by using the switch on the SV5 or the MCB for the power supply.

   Ref. /9/ AppRule_38

6. After power on, the STM-DK Subrack shall return to state NP within 48 hours to enable a new self-test. If this limit is exceeded, the STM-DK Subrack will enter FA mode and by itself cause an emergency braking.

7. The connection to the emergency brake contacts shall be proven safe against short circuits inside the front connector, the connecting cable, and the cabling in the vehicle.

   See also section 9 for further details

8. The data processing module, VE5A/VE6, has a diagnosis "UNILINK" interface on the front. External components must not be connected to the UNILINK interface while the ZUB123-STM carries responsibility for the safety of the train.

   Only authorised staff may use the UNILINK interface for the provided online diagnostic facilities.

   Ref. /9/ AppRule_54, AppRule_55 and AppRule_62

   Note: Ref. /9/ AppRule_54, AppRule_55 and AppRule_62 is also valid for VE5A.

9. The STM-DK Subrack can be started in 2 ways:

    a) By applying power to the front to the unsupplied SV5 power supply
    b) By the switch on the front of the CPU (VE5A or VE6). Power supply must be supplied.

    Ref. /9/ AppRule_187

    Note: Ref. /9/ AppRule_187 is also valid for VE5A.

10. The STM-DK Subrack is turned off by switching off the power supplied to the SV5 power supply

    Ref. /9/ AppRule_188

3.1.8 STM-DK Subrack installation after start-up

1. After the installation of the STM-DK Subrack the integration test on the vehicle shall verify that the STM-DK Subrack does not disturb other profibus participants.

    Hint: Noise, wrong or missing termination, address conflict, faulty connections or wrong connections etc. might be the cause of the disturbance of other Profibus participants.

    Ref. /9/ AppRule_97

2. After the first start-up and configuration it shall be verified that the STM-DK Subrack starts up correctly.

    Hint: It shall be possible to enter DA-state (Data available) for the STM-DK Subrack.

    Ref. /9/ AppRule_37

    See section 11 for further details.

4 Grounding and mechanical mounting

This section describes the grounding concept and the mechanical mounting for the STM-DK Subrack.

4.1 Grounding Concept

This section describes the grounding concepts to be applied for the installation of STM-DK Subrack. The concept applies to all train types. Cables, applied to connect the STM-DK Subrack to other equipment, must be shielded. In general, all cables shields must be grounded in both ends. The cables to the front connectors shall have their shield connected to a ground bar close to the connector.

Grounding straps (including grounding straps for the antennas) must be as short as possible and not longer than 0.8 m and shall have a cross section of at least 10 mm^2.

> NOTE: As a rule of thumb grounding straps can be selected with a length-to-width ratio of 5:1 to ensure a low-impedance and low-inductance grounding connection.

Signal cables of the STM-DK Subrack shall be routed away from power cables or equipment/cables which could cause interference in the signal cables.

The STM-DK Subrack cassette shall be grounded to the grounded mounting frame or with a grounding strap to a grounding point. The STM-DK Subrack cassette is coated and toothed contact washers shall be applied, when mounting the STM-DK Subrack in the mounting frame, to cut through the coating to ensure a good electrical grounding connection.

A suitable grounding concept is shown in Figure 3 for a STM-DK Subrack mounted in a closed cabinet.

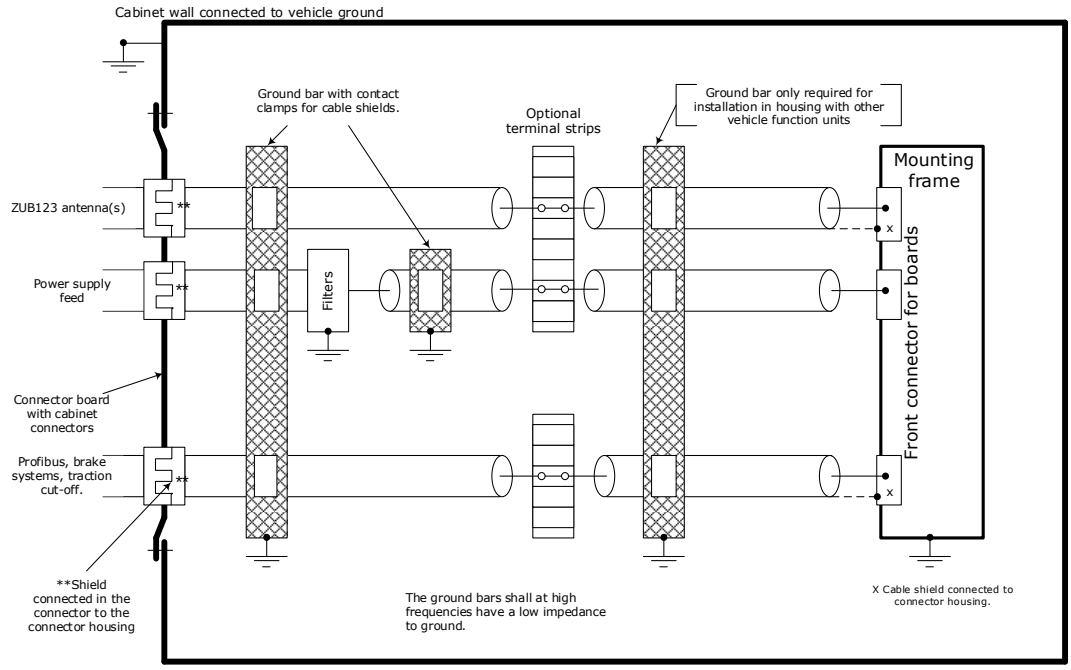


Figure 3 Grounding concept

4.2 STM-DK Subrack and installation

This section describes the dimensions and the mounting of the STM-DK Subrack.

4.2.1 STM-DK Subrack dimensions

19 inch rack of 3 height units:

Length = 483 mm
Depth = 225 mm
Height = 132 mm

Weight = 6 kg.

4.2.2 STM-DK Subrack mounting and grounding

The STM-DK Subrack shall be mounted via the 4 mounting holes with M6 bolts and 6 mm toothed contact washers. See Figure 4.

The tightening torque, bolt type, cutting washer and grounding solution must be decided by the system integrator.

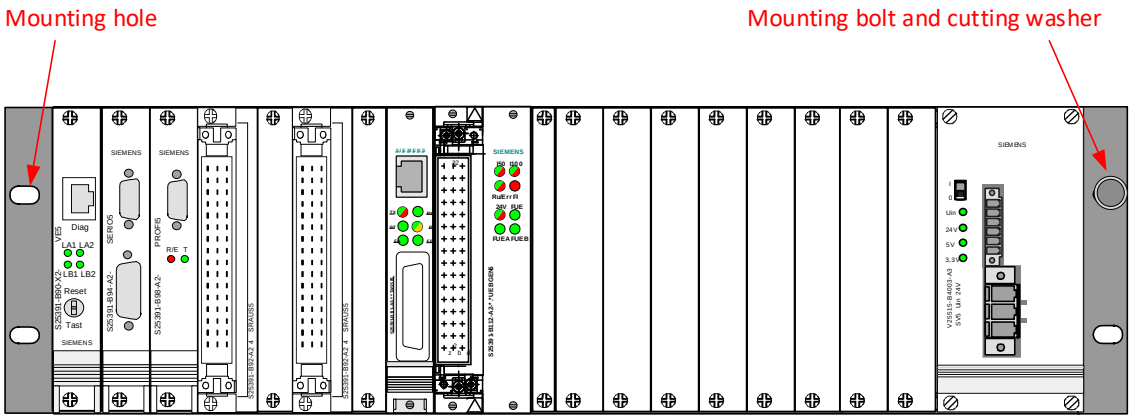


Figure 4 STM-DK Subrack mounting

5 Antennas and antenna cabling

This section applies to installation of antenna(s) and antenna cabling, choice of cables and components and in general how to connect from the ZUB123 antenna to the STM-DK Subrack.

5.1 Application rules

The following application rules shall be followed.

Ref. /9/ AppRule_26, AppRule_41, AppRule_42.

In the following, relevant information from applications rules is part of the guidance for installation and use of UEBGEN5 and TASSE5.

5.2 Allowed antennas

The STM-DK Subrack shall use one of the following types of antennas:

- S25441-M1-A3 (Cable entry opposite driving direction)
- S25441-M1-A4 (Cable entry in driving direction)
- S25441-M2-A3 (low profile - Cable entry opposite driving direction)
- S25441-M2-A4 (low profile - Cable entry in driving direction)

The ambient operating and storing temperature range for the antennas is -30 °C to + 55 °C.

Note: The antennas are destroyed if the storage or operating temperature for the antennas is below -30 °C.

The above antennas complies with EN 45545-2:2013+A1:2015 HL3.

5.3 Antenna installation height

Antenna type	Max speed	Distance between S.O (rail top plane) and surface of antenna.	
		Max	Min
S25441-M1-A3 S25441-M1-A4	180 km/h	180 mm	130 mm
S25441-M2-A3 S25441-M2-A4	160 km/h	177 mm	108 mm

Table 3 Antenna installation height

5.4 Antenna placement, fastening and metal free room

The antenna types S25441-M1-A3 and S25441-M1-A4 shall be installed according to ref. /1/, /3/ and /4/.

The antenna type S25441-M2-A3 and S25441-M2-A4 shall be installed according to ref. /5/ and /6/.

For requirements concerning the metal free space around the antennas see ref. /3/, /5/ and /6/.

The antenna centerline shall be placed no more than 4 m behind the centerline of the first axle and no more than 10 m behind the front puffer of the vehicle.

On vehicles with boogies, the antenna shall be installed on the boogie.

It shall be possible to adjust the installed antennas vertical position to adjust for decrease of wheel diameter due to wear or wheel re-profiling.

5.5 Antenna cabling and connection

Cable types for connection from antenna to STM-DK Subrack connection point:

- Habia 43739-010-09. (Complies with EN 45545-2:2020 R15 HL2)
- Huber + Suhner (Siemens Number) V25132-Z5-A38.

The above cables are proven in use. If another cable is selected, the properties of the selected cable, incl. shieldings shall at least correspond to the properties of one of the above cables.

If the antenna cable needs to pass two waggons, an interconnection cable must be used. Note the requirements in section 5.12.2 for the connection of the cable shield in one end or in both ends depending on the possible potential difference between the waggons.

It is not for this manual to describe or decide how the cable shield shall be terminated for the inter coach connection. This is for the system integrator to decide, based on the train type.

It is for the system integrator to ensure that the cables comply with requirements (mechanical, fire etc.) for cable installation on the specific loco or train. If the above cables are selected for inter coach connection cables for the antenna connection, it is the system integrator that shall ensure that the cables comply with the requirements (mechanical, fire, bending etc.) for inter coach connection cables.

Maximum cable length from the STM-DK Subrack connection point to the ATC-antennas or connection box is 60 meters. A connection cable from connection box to antenna of max 3 meters can be allowed beyond the 60 meters.

At the connection points it shall be ensured that re-enforced insulation to other potentials is sufficient according to EN50124-1.

The values for the antenna isolation between housing and internal electronics can be considered the same as for the cable mentioned and for the mentioned antennas in section 5.2.

The wiring for the 2 antennas (antenna A and antenna B) shall be galvanically separated. The cabling used for antenna connections and UEBGEN5 connections shall at the minimum comply with:

- Nominal voltage of 60 VAC (60 V_{eff})
  - A nominal voltage of at least 300 VAC is recommended.
- Surge voltage resistance (test voltage) of 1032 V_p

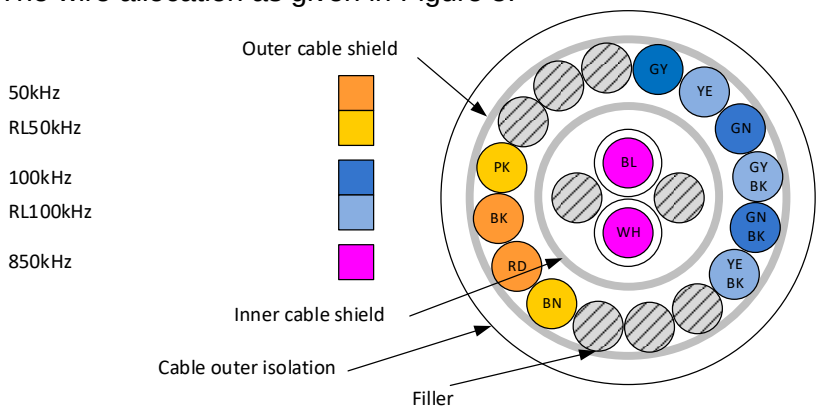
If the vehicle has only one antenna, it shall be connected as antenna A.

6-pol Multi connector for connection to the antenna: Siemens V25132-A204-X

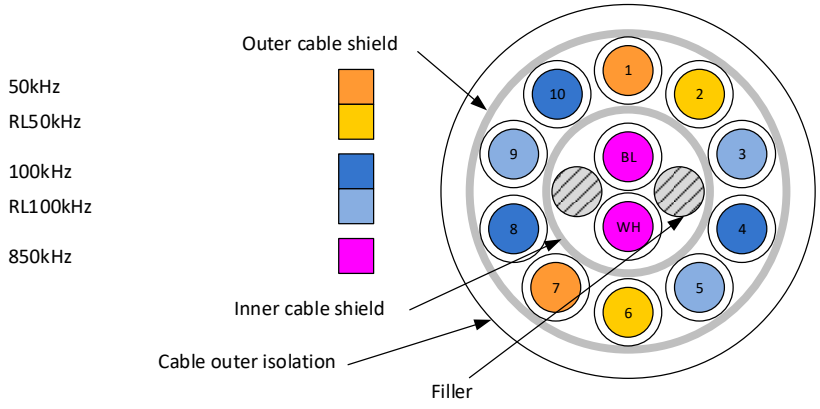
5.5.1 Recommendations for antenna cable wire allocation

All wires in the antenna cable shall be used for signals

The wire allocation as given in Figure 5.



Habia 43739-010-09



Huber + suhner (siemens number V25132-Z5-A38)

Figure 5 Antenna cable wire allocation

Note: In case of a connector box is placed close to the antenna, the connecting cable from the connector box to the antenna shall be max 3 m. In this connection

cable, only one wire per connection is needed for the 50 kHz circuit and only two wires per connection are needed for the 100 kHz circuit.

See Figure 8 and Figure 9 for cable connections.

5.6 Electrical connection to Antenna A and Antenna B

For system logic reasons, it shall be assured that for both the EVC and the STM-DK Subrack the same end of the vehicle is defined as “A” respectively “B”.

- UEBGEN5, for controlling 50 kHz and 100 kHz circuits.
- TASSE5, for receiving telegrams on the 850 kHz circuit.

The layout of the interface is seen at Figure 6 **Fejl! Henvisningskilde ikke fundet.**and Figure 7.

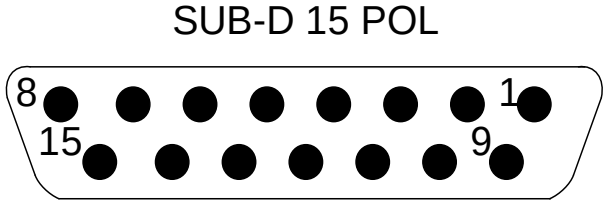


Figure 6 Layout and numbering of the 15 pole SUB D Female Connector for TASSE5 board

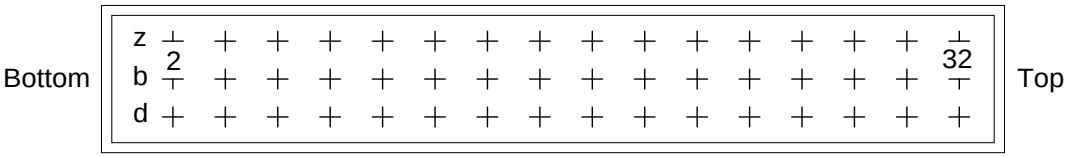


Figure 7 Layout and Counting of the 48 pole Interface Male Connector for UEBGEN5 board

Pin Assignment for Antenna A and B

For pin assignment for UEBGEN5 connector, see Table 4. Pins not shown, are not assigned.

Front connector UEBGEN5				
X2	**z**	**B**	**d**	**Description**
32	100A	100A	100A	Forward conductor 100 kHz Antenna A
30	RL100A	RL100A	RL100A	Return conductor 100 kHz Antenna A
26	100B	100B	100B	Forward conductor 100 kHz Antenna B
24	RL100B	RL100B	RL100B	Return conductor 100 kHz Antenna B
16	50A	50A	50A	Forward conductor 50 kHz Antenna A
14	RL50A	RL50A	RL50A	Return conductor 50 kHz Antenna A
10	50B	50B	50B	Forward conductor 50 kHz Antenna B
8	RL50B	RL50B	RL50B	Return conductor 50 kHz Antenna B
4				Do not use signal.
2				Do not use signal.

Table 4 Pin Assignment for UEBGEN5 Connector

For pin assignment for TASSE 5 connector, see Table 5. Pins not shown, are not assigned.

Pin no	Function	Specification
1	ST5_1 for Antenna A	Connection for 850 kHz circuit for Antenna A
2	ST5_2 for Antenna B	Connection for 850 kHz circuit for Antenna B
3	ST6_1 for Antenna A	Connection for 850 kHz circuit for Antenna A
4	ST6_2 for Antenna B	Connection for 850 kHz circuit for Antenna B
11		Do not use signal.
12		Do not use signal.
13		Do not use signal.
14		Do not use signal.
15		
Shield		Shield of connecting cable to be terminated in connector housing.

Table 5 Pin Assignment for TASSE5 Connector

5.7 Pre-fabricated cables

Although not mandatory, pre-fabricated cables can be used to connect the front connectors of UEBGEN5 / TASSE5 to the connection point (multi connectors or terminal rows) for the external antenna cable.

Do not cut, shorten or in any way change the pre-fabricated cables. The cables are tested before delivery.

5.7.1 Cable for TASSE5

Length: 2 m. Supplier: Siemens. Order no: V25132-M1372-A20

Connector pinout:

The Table 6 shows the 15 pins of the connector. The number inside the table shows the identification number of the wire in the cable.

The 2 columns “Signal name” and “comment” are put in the table for easy identification of signals and which wires to connect in a standard installation when using the pre-fabricated cable.

Pin no	Wire ID	Signal name	Comment
1	1	ST5_1 for Antenna A	Connect to connection point
2	3	ST5_2 for Antenna B	Connect to connection point
3	2	ST6_1 for Antenna A	Connect to connection point
4	4	ST6_2 for Antenna B	Connect to connection point
5			No wire
6			No wire
7			No wire
8			No wire
9			No wire
10			No wire
11			No wire
12			No wire
13	5		Do not use signal. Terminate in unused connection point or isolate wires separately.
14	7		Do not use signal. Terminate in unused connection point or isolate wires separately.
15	6		Do not use signal. Terminate in unused connection point or isolate wires separately.

Table 6 Wire allocation for TASSE5 cable

5.7.2 Cable for UEBGEN5

Length: 2 m. Supplier: Siemens. Order no: V25132-M1371-A20

Connector pinout:

The Table 7 shows the 48 pins of the connector.

The 2 columns “Signal name” and “comment” are put in the table for easy identification of signals and which wires to connect in a standard installation when using the pre-fabricated cable.

Row no	Column d	Column b	Column z	Signal name	Comment
2		Wire no. 12	Wire no. 11		Do not use signal. Terminate in unused connection point or isolate wires separately.
4		Wire no. 10	Wire no. 9		Do not use signal. Terminate in unused connection point or isolate wires separately.
6					No Wire
8			Wire no. 8	RL50B	Connect to connection point
10			Wire no. 7	50B	Connect to connection point
12					No wire
14			Wire no. 6	RL50A	Connect to connection point
16			Wire no. 5	50A	Connect to connection point
18					No wire
20					No wire
22					No wire
24			Wire no. 4	RL100B	Connect to connection point
26			Wire no. 3	100B	Connect to connection point
28					No wire
30			Wire no. 2	RL100A	Connect to connection point
32			Wire no. 1	100A	Connect to connection point

Table 7 Wire allocation for UEBGEN5 cable

5.8 Components for connection to TASSE5 and UEBGEN5

Components from Table 8 can be used for connection to TASSE5 and UEBGEN5, if pre-fabricated cables suggested in section are not used for the installation.

Necessary components for connecting to UEBGEN5, 48 pole DIN 41612 connector			
Component	**Number of items**	**Supplier**	**Order no.**
Metal house	1	Intermas EL	409 118 572
Cable strain relief	1	Intermas EL	409 118 571
Coding socket	1	Intermas EL	409 034 725
DIN-Power FO48FC-B	1	Harting	09 06 248 3201
Crimp contact	24	Harting	09 06 000 7472 *)
Cable 6 x 2 x 0,5 mm²	Max 2 m.	SIEMENS	V25132-Z5-A92
Necessary components for connecting to TASSE5, 15 pole SUB-D			
Component	**Number of items**	**Supplier**	**Order no.**
D SUB MA CRIMP 15 POLE	1	Harting	09 67 015 5601
Crimp contacts	4	Harting	09 67 000 8176 *)
Metal hood	1	Harting	09 67 015 0343
Cable 4 x 2 x 0,56 mm²	Max 2 m.	SIEMENS	V25139-Z1-A30

Table 8 Components for connection to TASSE5 and UEBGEN5

5.9 Antenna cabling

The intend of the drawing (Figure 8) is to provide an illustrative input for cable lengths and connection using pre-fabricated cables.

Be aware that it is the system integrator that shall ensure that the cables comply with the installation requirements.

For the inter coach connection cables for the antenna connection, it is the system integrator that shall ensure that the cables comply with the requirements (mechanical, fire, bending etc.) for inter coach connection cables.

NB: If no connection box is used, the max 60 m from connection point is to the antenna connection.

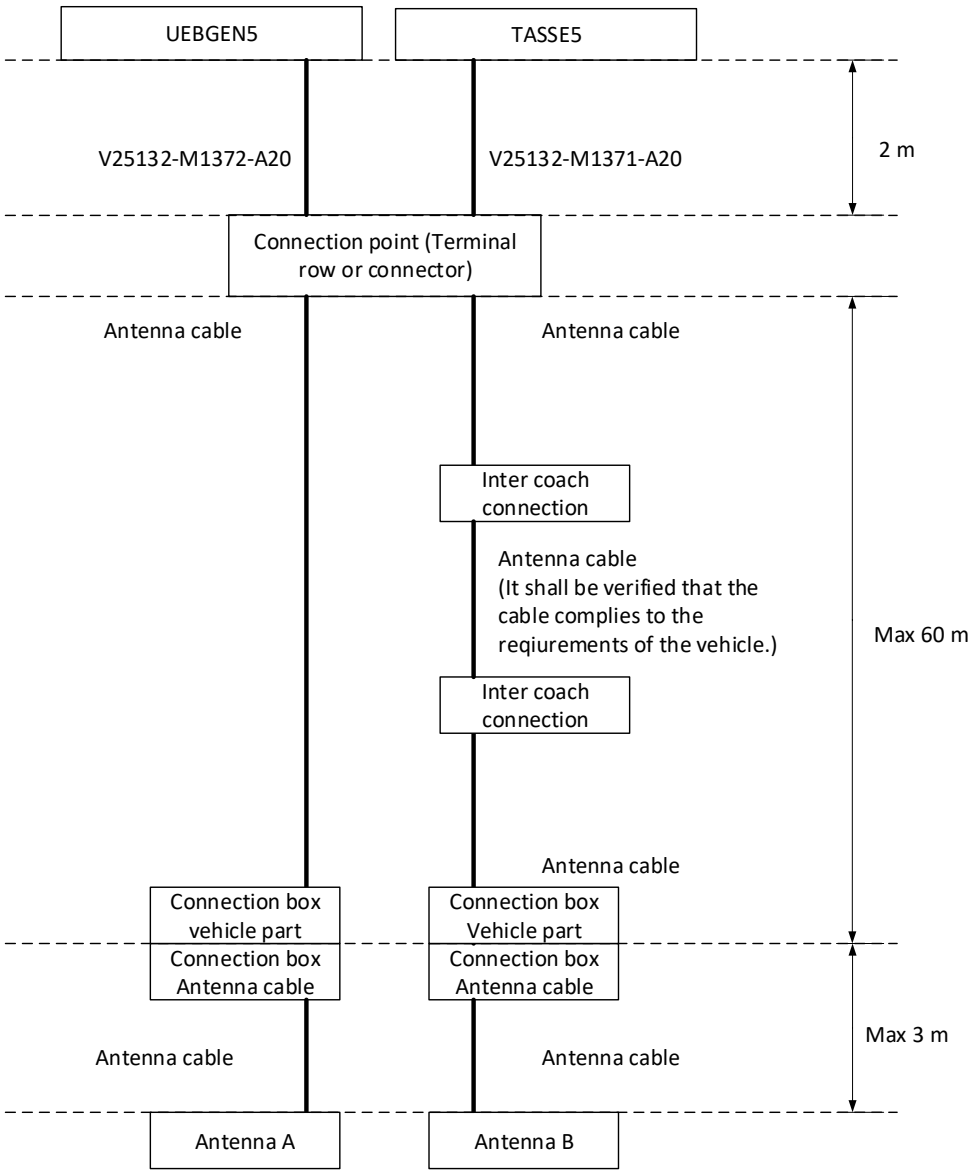


Figure 8 ZUB123 antenna cable connection

5.10 Siemens antenna connection concept

This description is simple concept for how to connect the ZUB123 antennas to the UEBGEN5 and the TASSE5 using Habia cable, pre-fabricated cables and connection box. See Figure 9 for concept drawing.

For antenna connection it must be ensured that noise and other connection errors do not interfere with the transmission. Follow good practice and separate power cables from signal cables. Other requirements for cable installation, which are not part of this installation manual, may apply for the specific project.

Ground bars and connection of cable shields connected to the STM-DK Subrack TASSE5 and UEBGEN5 board are not part of the simple concept drawing in Figure 9.

For simplicity Inter connection cables between wagons are not a part of the concept drawing.

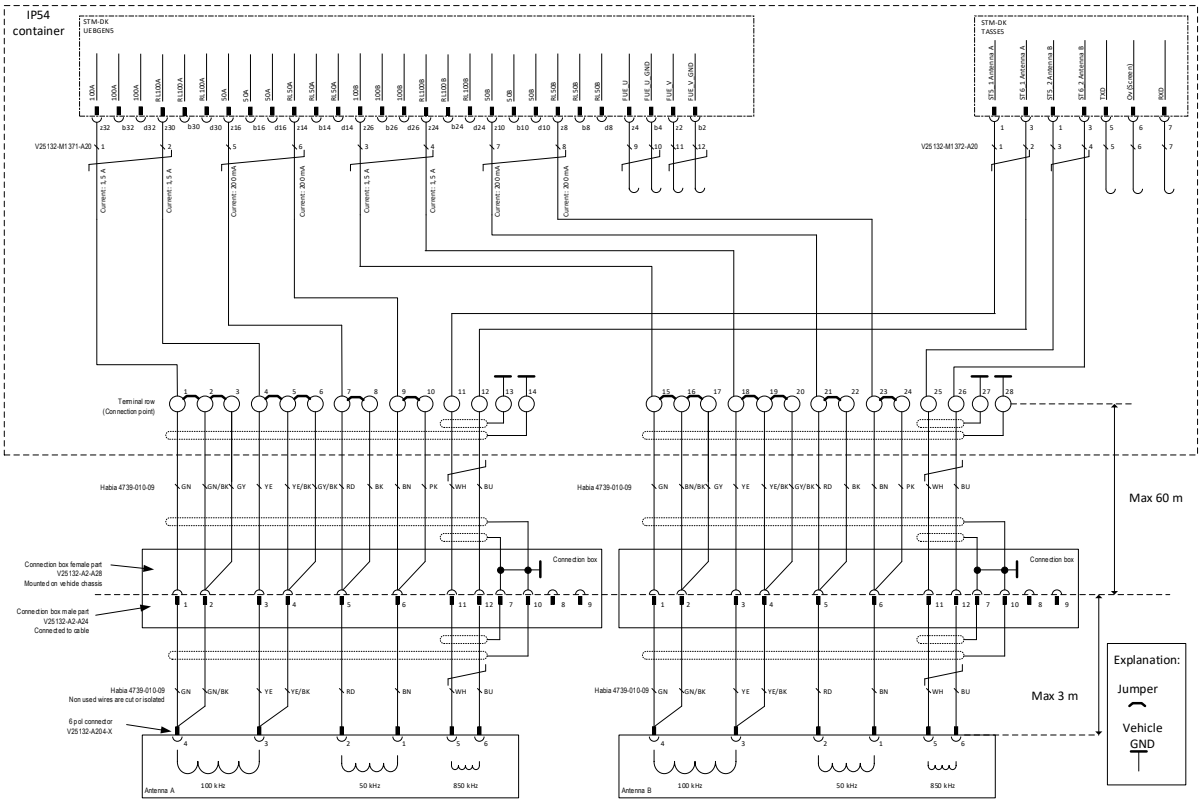


Figure 9 Siemens antenna connection concept

The shields in the antenna cable connected from antenna to connection box, shall be extended as close as possible to the plastic housing ot the connector to the antenna.

Unused wires from connection box to antenna shall be isolated.

See section 3.1.7, 4 and 5.12 for grounding concept and cable shield termination. See section 5.11 for connection box information.

5.11 Connection box

The most mechanically exposed part of the antenna cabling is the cabling that is connected to the antenna and placed outside the vehicle. A cable connection box as the one suggested in ref. /2/ can be installed on the frame of the vehicle close to the antenna. The cable connection box enables a fast replacement in case the cable is damaged close to the antenna. Further it eases disconnection if the vehicle is to be lifted from its bogies.

The connection box (ref. /2/) consists of the fixed part: Siemens V25132-A2-A24 and the removable part: Siemens V25132-A2-A28.

Note: The connection box has a restriction to the orientation, see ref. /2/.

The antenna connector box shall be mounted in a way, which ensure a good electrical connection to the vehicle chassis. The part to be installed on the train is grounding via the housing, there is no separate terminal for grounding the connector housing.

5.12 Antenna and Inter Coach Connection grounding requirements.

5.12.1 Antenna connection grounding

Antenna grounding:

The housing of the antenna must be connected to the vehicle chassis with low impedance.

When the antenna is installed on the boogie with and the earthing strap is also connected to the boogie, it shall be ensured that the boogie has good electrical connection to the vehicle chassis.

The antenna is grounded via one of the M10 bolts. A litz wire shall be used for the grounding of the antenna. The cross-section area of the litz wire shall be at least 10 mm^2, but 35 mm^2 is recommended and the litz wire shall not be longer than 0.8 m.

> NOTE: As a rule of thumb grounding straps can be selected with a length-to-width ratio of 5:1 to ensure a low-impedance and low-inductance grounding connection.

Antenna cable routing:

From the antenna connector box to the STM-DK Subrack it is recommended to run the cables in a closed metal tray. The tray should be grounded.

5.12.2 Inter-Coach Connections grounding

The grounding of the Inter Coach Connection Cables, “one end grounding” or “both end grounding”, is depending on the potential equalization between the coaches. It is the train integrator who shall ensure right inter coach connection grounding depending on the potential equalization between the coaches and other requirements that may be relevant for the train installation.

6 STM-DK Subrack Power Supply

The STM-DK Subrack power supply type SV5 is located at Slots 18, 19 and 20.

Depending on STM-DK Subrack version, one of the following power supply versions is used:

- V25515-B4003-A3 for nominal on board voltage of 24 VDC
- V25515-B4003-A4 for nominal on board voltage from 72 to 110 VDC

NOTE: After power on, the STM-DK Subrack shall return to state NP within 48 hours to enable a new self test. If this limit is exceeded, the STM-DK Subrack will enter FA mode by itself causing an emergency braking.

6.1 Requirements to the power source

		V25515-B4003-A3	**V25515-B4003-A4**	
Rated input voltage	V DC	24	72/96/110	Nominal battery voltage
Residual ripple	%	< 2%	< 2%	
Input voltage range	V DC	16,8 – 31,2 14,4 – 33,6	50,4– 143 43,2– 154	± 30% continuously ± 40% max 1s EN50155
Over voltage	Cat.	II	II	EN50124-1
Interruptions	Class	S1 (none)	S1 (none)	EN50155
Inrush current	A	≤ 16	≤ 8	≤ 100 ms
Input current con. X2 (at rated input voltage)	A	6,25	2 /1,6 /1,4	at 100% Load
Input current con. X1 Control signal (typical)	A	0,01	0,01	per input

Table 9 Requirements to power

The power supply is not loaded to its limit of approx. 150 W. The total power consumption of the STM-DK Subrack is approximately 60 W.

6.2 Reaction of SV5 to over- and undervoltage

Overvoltage monitor

		V25515-B4003-A3	V25515-B4003-A4
Threshold level	V DC	35	159
Tolerance	V DC	± 1	± 5
Response inside SV5	Control fuse	blown (unit off until repaired)	blown (unit off until repaired)
Response delay time	ms	< 20	< 20

Table 10 Overvoltage monitoring

If the overvoltage monitor is triggered, an internal fuse blows. The STM-DK Subrack must be removed from the vehicle and sent to Siemens for repair.

Undervoltage monitor

		V25515-B4003-A3	V25515-B4003-A4
Threshold level	V DC	14	42
Tolerance	V DC	± 0,5	± 1,1
Response inside SV5		completely switched off	completely switched off
Response delay time from normal operation	ms	> 200	> 200
Response delay time after turn on of the SV5	s	< 2	< 2

Table 11 Under voltage monitoring

If the under voltage monitor has been triggered, the STM-DK Subrack is turned off. It will re-enter service when supplied with a voltage within the specified limits. Function wise, it will behave as normal power-on.

6.3 Front view of SV5 (STM-DK Subrack power supply unit.)

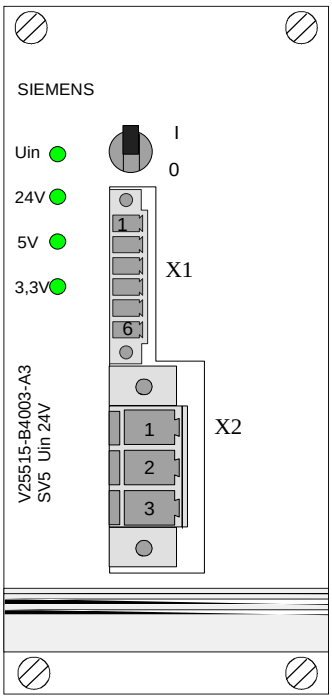


Figure 10 SV5 front

6.4 Pin Assignment and coding for Connector X1

Pin assignment for connector X1, for the system activation is assigned as shown in Table 12.

Pin	Position
1	Ust Fault Switch Signal
2	FS1 Signal Cab 1
3	FS2 Signal Cab 2 (not to be used)
4	FZG Signal Vehicle Pulled (not to be used)
5	PWR Signal Self-maintenance ON (not to be used)
6	UEN Board Voltage Minus (not to be used)

Table 12 Pin assignment for connector X1

See Figure 13 for connections.

6.4.1 Coding of Connector X1:

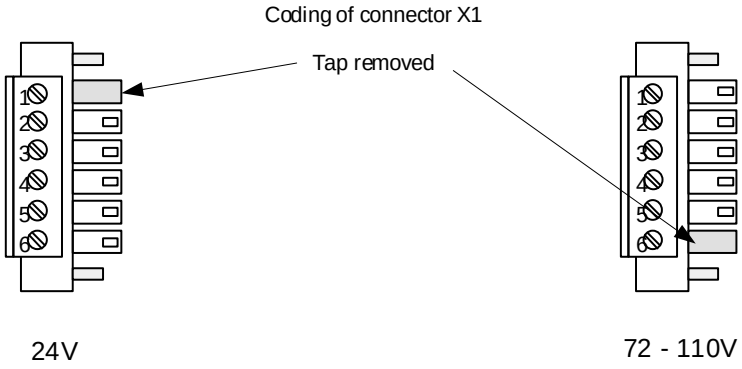


Figure 11 SV5 Terminals and coding of connector X1

6.4.2 Connector X1 parts:

Phoenix Mini-Combicon 6-pol 160V/8A.
Housing for 4-11 mm cable diameter. Max. wire cross section 1,5mm^2

Plug:	Phoenix MC1,5/6-STF-3,81-GY	order no 1827745
Housing:	Phoenix KGG-MC-1,5/6-GY	order no 1834385

6.5 Pin Assignment and coding for Connector X2

Board voltage (X2) is assigned as shown in Table 13.

Pin	**Position**
1	UEN Board Voltage **0V**
2	GND Front Panel (*)
3	UEP Board Voltage **Plus**

Table 13 Pin assignment for connector X2

(*) Not to be used. The shield of the cable is to be grounded close to the SV5. See section 4.1 and Figure 3 for further information.

6.5.1 Coding of connector X2:

The connector is shown with code taps (shaded areas) and without the housing

Figure 12 SV5 Terminals and coding of connector X1

X2:
Phoenix Power-Combicon 3-pol. 400V/20A
Housing for 4-8mm cable diameter. Max. wire cross section 4 mm^2

Plug:	Phoenix PC4/3-STF-7,62-GY	order no 1804917
Housing:	Phoenix KGG-PC4/3-GY	order no 1837324
Code tap	Phoenix CP-HCC 4	order no 1600027

6.6 Requirements for the STM-DK Subrack power supply

The power to the STM-DK Subrack shall be supplied through a Schaffner FN2060 or equivalent filter and through a suitable circuit breaker. The filter shall be dimensioned in accordance to the power supply voltage and the power consumption.

Depending on a risk assessment and the trains battery grounding concept, a single pole fuse/circuit breaker or two fuses/double pole circuit breaker shall be used as external fuse.

The power supply input(SV5/-X2) of the DK-STM Subrack is floating, compared to the STM-DK Subrack chassis.

The circuit breaker must withstand the inrush current without tripping.

If the connection to the power supply adhere to Table 14 (max 10 m cable), the demands are met.

Power supply	Unit	V25515-B4003-A3	V25515-B4003-A4	Description
Input voltage	V DC	24	72/96/110	Battery voltage
Maximum wire load current	A	8,9	3/2,2/2	72 / 96 / 110
Main Wire selection:				
Cross section	mm^2	2,5	1,5	Copper wire
Voltage drop on 10 m wire length (@ max load current)	V	1,2	0,7/0,5/0,46	Specific resistance = 0,0172 (copper wire)
Circuit breaker selection:				
Recommended MCB	A	10	6	B or C characteristic
Minimum short circuit current	A	50 / 100	30 / 60	B or C characteristic
Inrush current	A	≤ 16	≤ 8	≤ 100 ms
Mains filter selection:				
Current capacity	A	10	6	

Table 14 Specifications for Main Circuit Cable and Circuit Breaker Dimensioning (based EN50343)

6.6.1 Application rules

Requirements from application rules for power supply according to ref. /9/.

AppRule_21: Selection of the required dimension for the connection cable to the SV5 shall be done according to /EN50343/

AppRule_28: When the TCC including the SV5 is used without cabinet (steel cabinet) the cable shielding of the SV5 connections shall also be connected near to the frame of the module.

AppRule_29: An external filter (SIFI-E or similar) shall be inserted into the power connection to the SV5 connections. The filter shall be dimensioned according to power supply voltage and power consumption.

AppRule_31: The power cable for the SV5 shall be protected by a circuit breaker (over-current protection)

AppRule_32: Make sure that the over-current protection for the SV5 works as follows:

It shall protect the connected wires from overload.

The inrush current shall not release circuit breaker

The cable resistance shall not prevent releasing in case of short circuit.

AppRule_36: No higher demands regarding fluctuations in power source should be placed on STM-DK than defined in /EN50155/

AppRule_195: The storage life of the SV5 is limited to 10 years because of the components used (electrolytic capacitors)

6.7 Enabling of the power supply

The power supply is controlled by the auxiliary signals of connector X1. As the demand for power to the STM-DK Subrack is simple, the schematic diagram in Figure 13 will do.

6.8 Key Diagram, Connection to Power Supply

Key diagram for connection of power supply to STM-DK Subrack, for the power supply, is shown below.

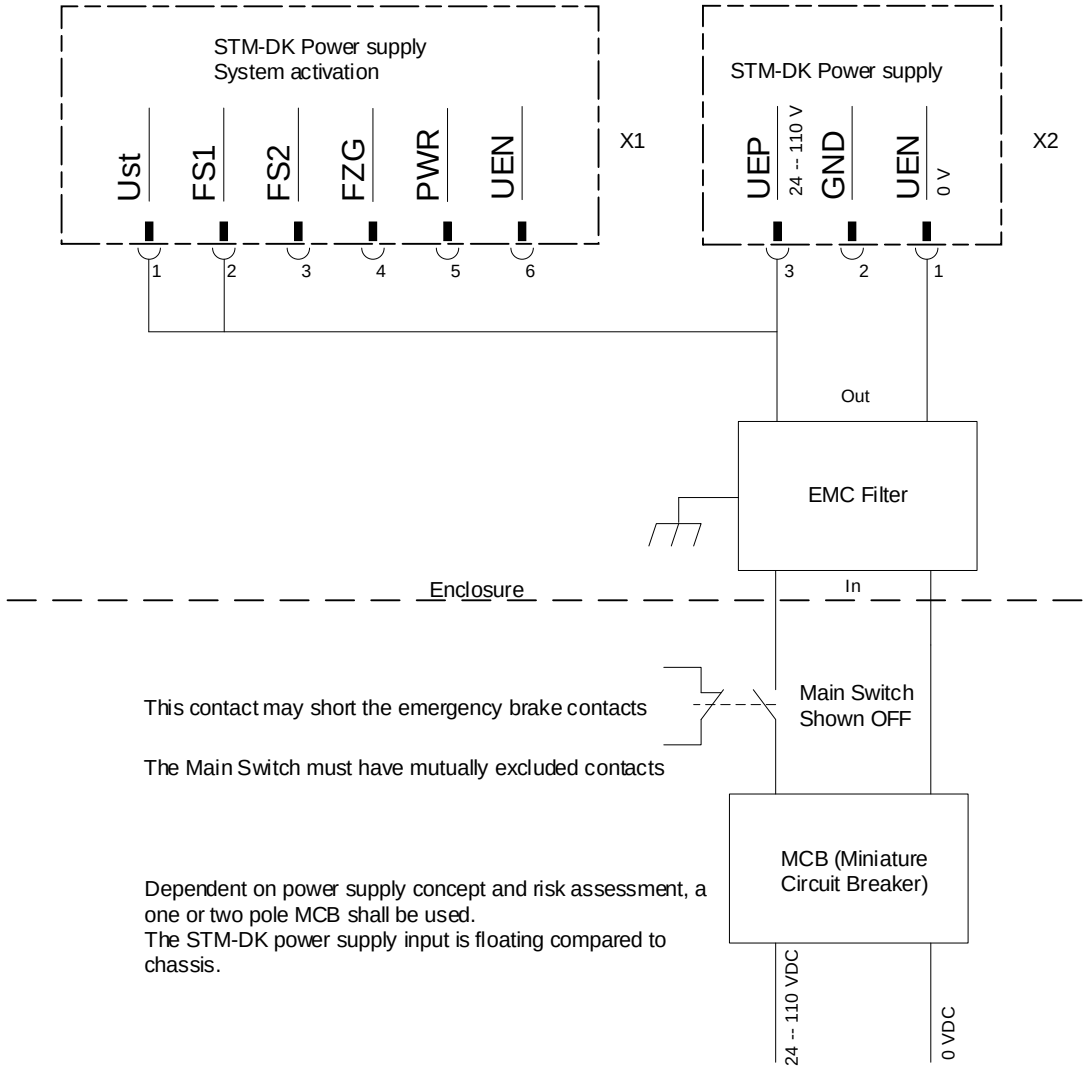


Figure 13 Key Diagram, Connection to Power Supply

It is not mandatory to use the main switch to short circuit the emergency brake contacts. See section 9.1.

7 Connection to Diagnose PC

The SERIO5 card at slot 1 has two connectors at the front plate: –X2 and –X8.

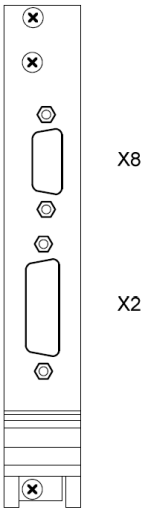


Figure 14 Serio5 Frontplate

Connector –X8 is not to use.

Connector –X2: only one interface is allowed to be used:

RS 232 (Ser_02): Interface to a diagnosis PC.
For use of this diagnosis interface(Ser_02), see section 13 for use of diagnosis.

The RS232 interface (Ser_02) is acc.to standard EIA RS232.

Note: If the diagnosis interface is used when the STM-DK Subrack is responsible for the safety, the national authorities shall give the acceptance and the exact conditions shall be agreed upon.

All power for the STM-DK Subrack interfaces must be cut-off before connecting the service cable to the STM-DK Subrack and the service PC.

The –X2 connector is a male 26 pin Sub-D connector High Density (Amplimite® HD-22) with UNC 4-40 threaded stud. See section 7.2 for suggested parts.

7.1 -X2 Pin Assignment for diagnose Connection

Pin no	Function	Interface name	Signal name	Signal SERIO5
12	Diagnosis RS 232	Ser_02	SER2_TXD_T+	TxD (SERIO5 transmit)
13			SER2_RXD_T-	RxD (SERIO5 receive)
5			SER1_SER2_GND	0V
All other terminals shall not be used.				

Table 15 Pin Assignment for Diagnose

7.2 Components for front connector X2 of the SERIO5

The RS232 connection on the SERIO5 board may only be used for troubleshooting purposes. See section 13 for use of diagnosis.

For EMC reasons the shield shall be terminated correctly.

See table Table 16 for suggested components and cable to use for connection.

RS232 (SER_02):
Maximum allowed cable capacitance: 2500 pF. (Max cable length depends on cable characteristics, the maximum allowed cable capacitance shall not be exceeded)

Suggested components for connecting to the X2 Connector on the SERIO5 Board.

Component	**Number of items**	**Supplier**	**Order no.**
Female crimp shell	1	Harting	09 56 200 4701
Crimp contacts	3	Harting	09 56 000 8267
Metal-Hood	1	Harting	09 67 015 0443

Table 16 Components etc. for SERIO5

Order no for crimp contacts refer to packages with multiple number of contacts.

The standard for EIA RS232 for connection of RS232 serial interface ser_02 must be followed. Ref. /9/ AppRule_77.

A service cable for connection between a service laptop and a can be ordered from Siemens. Part no. G81002-E3134-H500-A.

8 Connection to ETCS Onboard

The STM-DK Subrack is connected to the EVC via a profibus. On the STM-DK Subrack, the PROFI 5 card at slot 2 is used. It has a 9 pin Sub D female connector.

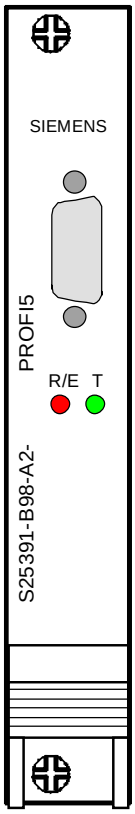


Figure 15 PROFI5 frontplate

A 9 pin Sub-D male with UNC 4-40 threaded stud, on PROFI5 card at Slot 2. The cable used for the connection shall be made of a profibus cable, with low capacitance. The required cable parameters are given at Table 17.

Parameter	**Value**
Impedance	135..165 Ω
Capacitance	<30 pF/m
Loop resistance	<110 Ω/km
Core diameter	>0,64 mm
Core cross-section	>0,34 mm^2

Table 17 Profibus Cable Parameters

The maximum cable length is 200 meters. The baud rate is fixed to 1.5 Mbit/s.

8.1 Pin Assignment for ETCS Onboard Connection

Pin assignment for X4, Profibus female connector, for connection of STM-DK Subrack to ETCS Onboard is assigned as shown in Table 18**Fejl! Henvisningskilde ikke fundet.**.

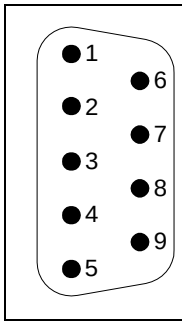
X4	Pin	Designation	Description	
	1	-	Not used	
	2	-	Not used	
	3	RxD / TxD-P	B	– Serial Channel, Wire B
	4	-	Not used	
	5	GND	M5	– Ground for 5V-Power supply *)
	6	VP	P5	– External 5V-Power supply *)
	7	-	Not used	
	8	RxD / TxD-N	A	– Serial Channel, Wire A
	9	-	Not used	

Table 18 Pin Assignment for Connection of STM-DK to ETCS Onboard

*) only for termination resistors

If the STM-DK Subrack is the last node on the profibus connection, it shall be equipped with termination resistors, e.g. in the connector housing. See Figure 16 for connections.

The profibus interface is galvanically separated from the internal circuits of the STM-DK Subrack.

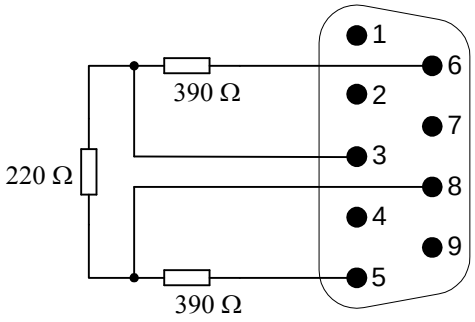


Figure 16 Termination resistors for PROFIBUS

9 Connection to emergency brake, service brake and Traction Cut-Off

The influence on the train brakes and the traction is made by two safe relay output boards SRAUS5 with a 48 pole front connector, at Slot 3 and Slot 5 in the STM-DK Subrack. Layout of the front connector is shown in Figure 17.**Fejl! Henvisningskilde ikke fundet.**

There are the following interfaces on the front connector:

- 2 contacts for Emergency Brakes
- 2 isolation relay contacts for bypassing the emergency brake contacts
- 1 contact for service brake
- 1 contact for traction cut off
- 2 control inputs for isolation relay coils

If the STM-DK Subrack shall be used in a 72 V DC installation, the supply for the SRAUS5 isolation relay coils shall correspond to the 110 V DC variant with the requirements for isolation coils as stated in section 9.5.1.

All accessible contacts of the output relays and the isolation relays are make contacts = contacts are open when no power is supplied.

The emergency brake contacts are open when emergency braking is required.
The isolation relay contacts are open when no bypassing is made. The input control signals are inactive.
See Figure 18.

The service brake contact is closed when service brake is required.
The traction cut off contact is closed when traction cut off is required.
See Figure 19.

The use of emergency brake contacts and the isolation relay contacts (if used) **are safety critical**. In connection with the design of the installation of the STM-DK Subrack it must be proved, that no short circuit in connecting cables etc. can cause a bypass of the emergency brake contacts.

For using voltages other than battery supply voltage see section 9.5 for requirements.

Opening of each of the two emergency brake contacts must cause the emergency braking. If the vehicle is equipped with two emergency brake valves, each contact may operate one of the valves if release of just one valve causes an emergency braking.

For vehicles with only 1 emergency brake circuit EBValve1 and EBValve 2 shall be connected in series.

The service brake and the traction cut off are not safety critical.

If higher contact loads for the service brake or the traction cut off are required, or if more contacts are required or if the reverse function (normally closed contact) is required, slave relays can be used. The system integrator shall prove the safety of possible slave relays.

Note the requirement for max 2 A fuse for short circuit protection of the SRAUS5 contacts and the maximum permissible load on the contacts. A slow blow fuse is recommended.

Short circuits between any conductors in the brake cables can compromise safety and shall be considered with respect to the wanted safety target. See ref. /9/ AppRule_52

Whether the emergency brake is connected in parallel or in serial depends on the train type. The emergency brake shall be applied if the emergency brake connections between the connections on the STM-DK Subrack are open, it shall be released if the connections are closed. See ref. /9/ AppRule_63

9.1 Emergency brake and emergency brake by-pass

The STM-DK Subrack is made in such a way, that the emergency brake relays are always energised (contacts closed) unless:

- STM-DK Subrack is in state "NP" (No Power).
- STM-DK Subrack is in state "PO" (Power On) checking the relays.
- STM-DK Subrack is in state "DA" (Data Available) and requires an emergency braking.
- A fatal condition has occurred inside the STM-DK Subrack (state “FA” (Failure))

This means, that the contacts are also closed, when the STM-DK Subrack works correctly and the ERTMS is in charge.

However, the vehicle shall be moveable if the STM-DK Subrack is faulty. To release the brake, the emergency braking contacts must be bypassed (shorted).

When the emergency brake contacts of the STM-DK Subrack are bypassed, it must be detected by the ETCS Onboard system.

There are two ways of bypassing the STM-DK Subrack emergency brake contacts:

- “External” bypass by isolation/main switch

  Using a STM-DK Subrack main switch with mutually excluded make and break contacts. When power to the STM-DK Subrack has been cut off, the emergency brake contacts are shorted. When the short circuit of the emergency brake contacts has been removed, the power is supplied to the STM-DK Subrack. STM-DK in state "NP" (no power) shall be recognised by the ERTMS Onboard.

- “Internal" bypass using SRAUS5 relays K3 and K4.

Applying a voltage to the two "Isolation relays" of the SRAUS5 board for the emergency brake. By applying a voltage to the “isolation relays” the STM-DK Subrack enters state “FA” (Failure). This shall be recognised by the ETCS. When both override relays have picked up, the make contacts of the emergency brake relays are shorted (= emergency braking by the STM-DK Subrack is impossible). In this mode, the power can be maintained to the STM-DK Subrack.

For using voltages other than battery supply voltage see section 9.5 for requirements.

An illustrative simple example of “internal” bypass using SRAUS5 relays K3 and K4 are shown in Figure 18.

NB: Ref. /9/ AppRule_75: *STM-DK is not responsible for the use of the emergency brake bypass function. The use of emergency brake bypass functionality shall be handled in the system safety case for the train.*

NB: *Ref. /9/ AppRule_79: For the emergency braking relay, a Hazard Rate contribution of 3,9*10^12/hour must be used in a system safety case.*
This is not a requirement for the user. The calculations are performed in the GASC
The hazard rate for the SRAUS5 is 6.4×10^{-12}/Hour providing that the specifications from section 9.5 are complied with.

9.2 Pin Assignment for Service Brake, Emergency Brake, Traction Control and Isolation Switch

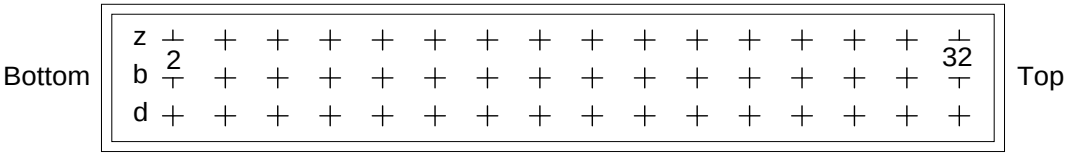


Figure 17 Pin Layouts at 48 pole Interface Male Connector

Pin assignment at SRAUS5 boards at Slot 3 and Slot 5 connector for Service Brake, Emergency Brake, Traction Control and Isolation switch is shown in Table 19.

SRAUS5, Slot 3		**SRAUS5, Slot 5**	
Pin no	Description	Pin nr.	Description
z26	Emergency Brake Contact	Z26	Service Brake Contact
z4		Z4	
d24	Isolation Relay contact		
d6			
z24	Emergency Brake Contact	Z24	Traction Control Contact
z6		Z6	
d28	Isolation Relay Contact		
z28			
z2 (-)	Isolation Relay Coil		
d2 (+)			
z32 (-)	Isolation Relay Coil		
d32 (+)			

Table 19 Pin Assignment for Service Brake, Emergency Brake, Traction Control and Isolation Switch

9.3 Example diagram for connection of Emergency Brake using internal SRAUS5 “isolation relays”

The below figure is an illustrative example for connection and use of “isolation relays” K3 and K4 for bypassing the emergency brake contacts. The example is only valid for STM-DK Subrack 110 V and 24 V versions used with nominal voltage of 110 V and 24 V not 72 V.

The example in Figure 18 shows the use of the “isolation relays” using battery voltage.

Note: See section 9.5 for electrical specifications for relay coils and contacts.
It is the task of the train integrator, to ensure that the emergency brake bypass complies with the safety requirements for the train installation.

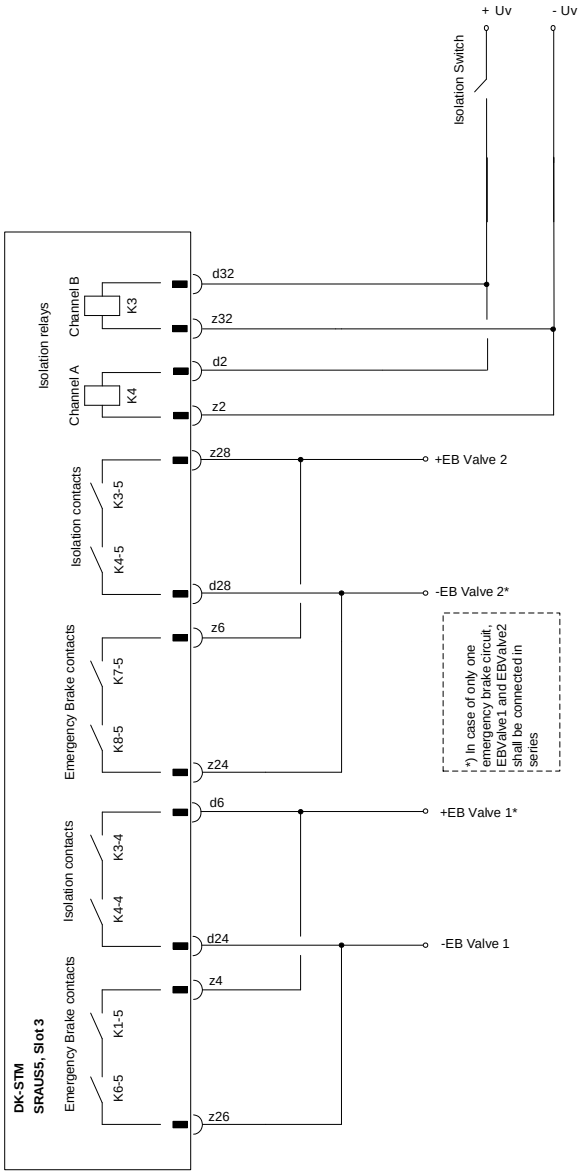


Figure 18 Key-diagram for connection of Emergency Brake

9.4 Key diagram for connection of Service Brake and Traction Cut-OFF

Key diagram at SRAUS5, Slot 5 interfaces for Service Brake and Traction Cut-OFF is shown at Figure 19.

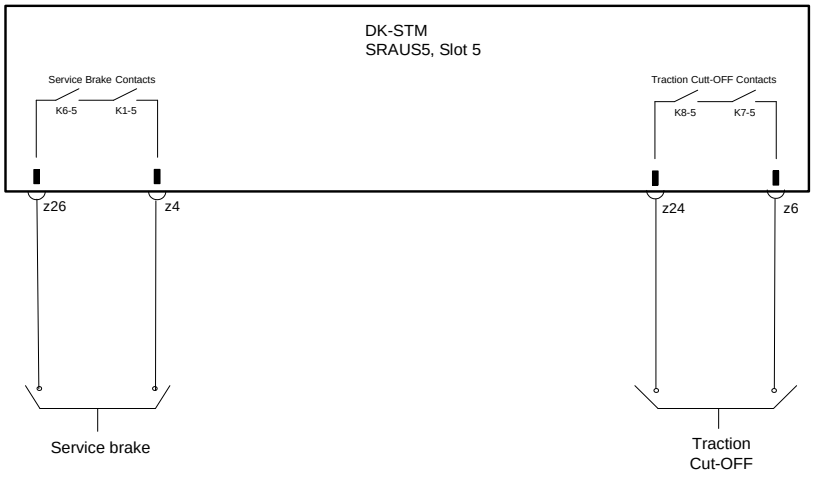


Figure 19 Key-diagram for Service Brake and Traction Cut-OFF

9.5 SRAUS5 Electrical Specifications

Requirements from application rules ref. /9/ AppRule_15 and AppRule_16 are incorporated into the following descriptions in section 9.5 and sub-sections.

Due to safety reasons, the specifications in section 9.5.1 and 9.5.2 shall not be exceeded. Exceeding of some of the parameters, can lead to an increased hazard rate.

If the voltage applied to the SRAUS5 contacts and/or “isolation relay coils”, is not coming from the battery, the allowed voltage tolerance is +- 30 %.
Short voltage deviations (<1second) up to +40 % are allowed.
This is safety relevant. The safety is related to the max. value of +30% and shall not be exceeded, not even due to a failure.

9.5.1 Isolation relays

The "isolation relays" shall be energised according to Table 19:

Isolation switch coils – Voltage supply **± 30 %** **(**short-term ≤ **1 s** to **+ 40 %**)			
Voltage range (Variant: -A2, 24 V DC nominal)	16.8 V_{DC}	24 V_{DC}	**31.2 V_{DC} (33.6 V_{DC})**
Current consumption (typ. for both relays together)		135 mA	
Voltage range (Variant: -A24, 110 V DC nominal)	77 V_{DC}	110 V_{DC}	**143 V_{DC} (154 V_{DC})**
Current consumption (typ. for both relays together))		30 mA	

Table 20 Operating voltage for Isolation Relays

9.5.2 Properties of the relay contacts

The contacts of the fail safe output relays and the "isolation relays" may be used in circuits with a voltage different from the supply voltage, but the load current shall be limited according to the Table 21 and Table 22.

For using voltages other than battery supply voltage see section 9.5 for requirements.

Relay coils with free wheeling diodes are regarded as resistive loads.

Contact loading of fail safe contacts by resistive load			
	Voltage (**+30** %, short-term ≤ **1 s** to **+40** %)	Max. operating load current/ Max. no of switch cycles	Maximum fuse rating for cable protection
Nominal 24 V DC	24 V **(max. 33.6 V)**	**1.5 A [1]/ 400 000**	**2 A (Slow blow fuse recommended)**
Nominal 36 V DC	36 V **(max. 50.4 V)**	**1.5 A [1] / 400 000**	
Nominal 48 V DC	48 V **(max. 67.2 V)**	**1 A [1] / 400 000**	
Nominal 72 V DC	72 V **(max. 100.8 V)**	**0.5 A [1] / 300 000**	
Nominal 110 V DC	110 V **(max. 154 V)**	**0.3 A [1] / 200 000**	

Table 21 Contact rating for resistive load

When switching inductive loads (to T0.95 ≤ 300 ms, category DC-13 after /EN60947-5-1/ for DC inductive loads), the load current shall be limited according to this table:

Contact loading of fail safe contacts by inductive load, $T_{0.95}$ ≤ 300 ms			
	Voltage (**+30** %, short-term ≤ **1 s** to **+40** %)	Max. operating load current/ Max. no of switch cycles	Maximum fuse rating for cable protection
Nominal 24 V DC	24 V **(max. 33.6 V)**	**1.5 A [1] / 300 000**	**2 A(Slow blow fuse recommended)**
Nominal 36 V DC	36 V **(max. 50.4 V)**	**1.5 A [1] / 200 000**	
Nominal 48 V DC	48 V **(max. 67.2 V)**	**1 A [1] / 150 000**	
Nominal 72 V DC	72 V **(max. 100.8 V)**	**0.5 A [1] / 100 000**	
Nominal 110 V DC	110 V **(max. 154 V)**	**0.3 A [1] / 50 000**	

Table 22 Contact rating for inductive load

1) It is essential that the operational load current does not exceed the specified values since the max. 2 A fuse is only for cable and connector protection.

9.6 Front Connectors for SRAUS5

See Table 22 for necessary components for connecting to X2 Connector on SRAUS5 Board at Slot3 and Slot5.

Component	**Number of item**	**Supplier**	**Order no.**
Metal house	2	Intermas EL	409 118 572
Cable accessories	2	Intermas EL	409 118 571
Coding accessories	2	Intermas EL	409 034 725
Plug	2	Harting	09 06 248 3201
Crimp contact	16	Harting	09 06 000 7472

Table 23 Components for SRAUS5 front connector

10 Retrofit

This section provides information regarding retrofit for STM-DK Subrack from ATC ZUB123. The section describes decommissioning, components that can be reused and other information necessary for the retrofit.

10.1 Decommission of the ATC ZUB123

10.1.1 Before decommissioning

- It shall be ensured, that the power to the ATC ZUB123 is disconnected.

Warning

REMARK: The ATC system may be powered from both end of the train

Warning

It shall be assured, that the power cannot be switched on during work on the system

This is a general description of the decommissioning. The decommissioning shall be described in detail for the specific installation.

10.1.2 ATC ZUB123 units to be removed

There are two different types of general ATC ZUB123 installations:

- Older installations: Train cables are connected to terminal blocks. See Figure 20.
- Newer installations: Train cables are connected to a cubicle, with multi connectors. See Figure 21.

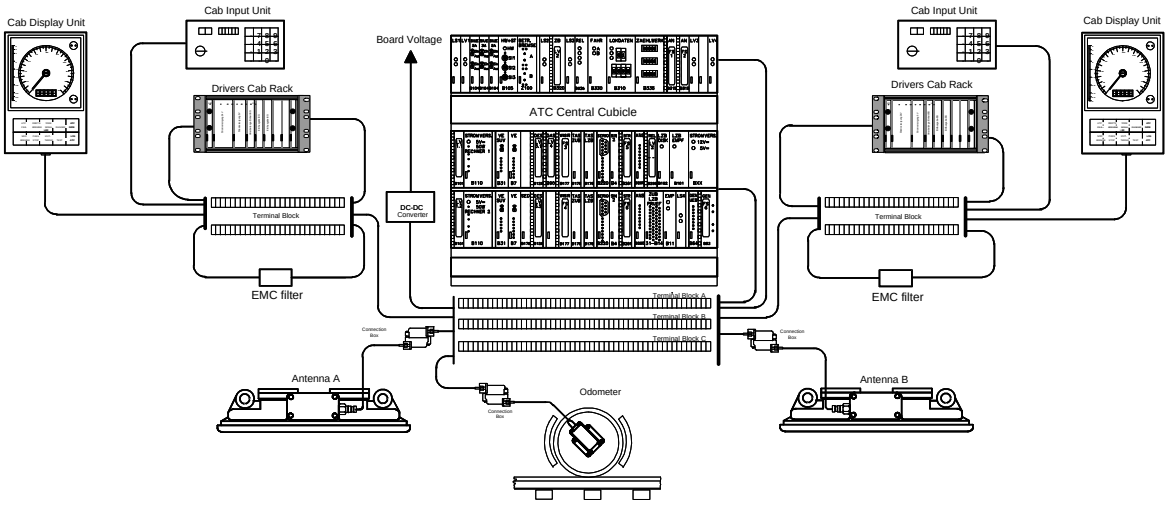


Figure 20 Older ATC ZUB123 installation

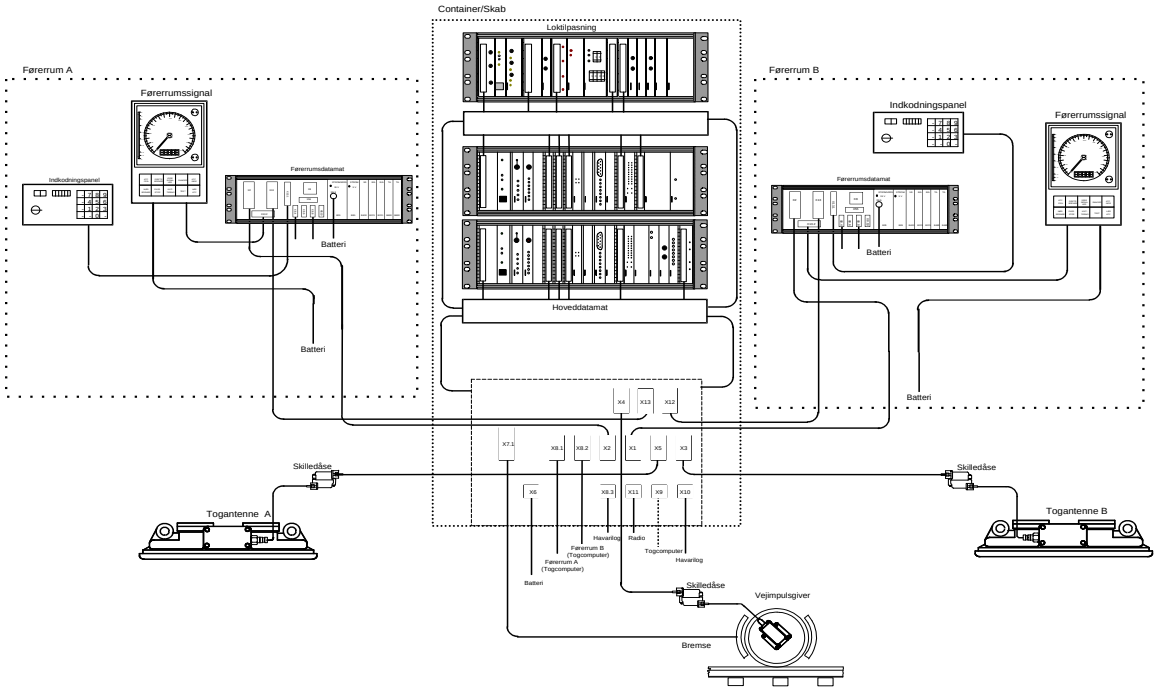


Figure 21 Newer ATC ZUB123 installation

For existing ATC ZUB123 installations it may be possible to reuse the existing ATC antennas and antenna cables for STM-DK Subrack installation.

All other equipment and cables is not necessary for the STM-DK Subrack installation. See Figure 20 and Figure 21 for details.

It may be possible to reuse other cables, components etc. further analysis shall be performed for the specific installation to decide if existing parts or cables can and shall be reused for STM-DK Subrack installation.

It is the task of the system integrator to ensure that cables and components used for connection to the STM-DK Subrack and the antenna(s), comply with the train installation requirements and the relevant standards.

It shall be agreed with the RU, which components and cables that shall be reused and which shall be removed.

Beware of ESD during decommissioning If ATC units shall be re-used.

10.2 Installation of STM-DK Subrack with existing ATC antennas

The ATC antenna wire allocation and colour from the existing installations to be used for STM-DK Subrack installation may differ from the descriptions in section 5.5 and 5.10.

In old installations with ZUB123, it is not always the case that all wires in the antenna cable from the ZUB123 on board unit to the antenna connection box were used as conductors for the antenna. Such unused wires may have to be grounded at the STM-DK Subrack enclosure similar to the grounding at the ZUB123 Onboard unit.

11 Configuration of the STM-DK Subrack

After installation of the STM-DK Subrack, it shall be configured and the antennas shall be tuned from the maintenance menu.

This is done on the DMI in the start-up sequence, where the Specific Train Data is requested for the STM-DK Subrack.

Note: The maintenance menu is entered via the DMI, by entering the maintenance code “3112” in the “data entry” menu.

A maintenance menu will appear where the current configuration is shown as pre-set values. It is possible to:

1. Read the Software Version Number
2. Change the Litra code/Train Type
3. Set the interval for transmitting the STM max speed
4. Tuning of Antenna A or Antenna B

After the configuration is done, the configuration shall be sent to the STM-DK Subrack by activating the “Confirm”-button.

After configuration or antenna tuning, the STM-DK Subrack must be restarted.

After first start-up it shall be controlled, that the STM-DK Subrack starts-up correctly, i.e. arrives at state DA with the ‘Valg’-button shown in the DMI.

See ref. /9/ AppRule_43 for antenna tuning. The necessary requirements from ref. /9/AppRule_43 are incorporated in section 11 and subchapters of section 11.

After first setup of the correct setup train type in the maintenance, menu according to section 11.2, it shall be ensured that the train type is not changed during configuration or maintenance work. See ref. /9/ AppRule_174.

11.1 Software Version Number

The below software versions and baseline is an example and may be different in real installation. It shall be verified that the software version and baseline is correct for the specific installation.

Caption: “STM-DK SW version”
Type: not editable string

Example:
Software 03.00.11
Baseline 3

11.2 Litra Code / Train Type

Caption: “LITRA number”
Type: integer

If the Litra Code is changed, it shall be verified and retained (normally done in the commissioning protocol for the train) after the next start-up, that the correct Litra Code is shown in the Maintenance Menu.

The train type determines 3 parameters

- over speed
- type factor
- monitoring of balises during reverse shunting

Note: The designation "Litra" needs not correspond to the actual train type, but to the choice the "over speed", "type factor" and "reverse monitoring" properties, and these shall correspond for the actual train type.

See section. 11.2.5 for available litra codes

11.2.1 ATP train

If the train is given the Litra Code 75, then the train will be treated as an ATP train, which means, that the train will react immediately on a balise error instead of waiting 25m as a normal ATC train will do.

11.2.2 Over speed

The parameter "over speed" set to "yes" permits the train to use the over speed profile of the infrastructure coded in the ZUB123 balises. To use this over speed, all vehicles of the train shall comply with specific Banedanmark requirements on track forces when travelling at high cant deficiencies, and the train type must possess a formal permission from Banedanmark.

The choice is safety critical.

11.2.3 Type factor

The type factor, TypFak, relates to calculation of brake curves.
The max deceleration B [m/s2) is calculated from the brake percentage λ by the Mindener formula.
The emergency deceleration BZ is always calculated to 0.833 x B.

The service brake deceleration is calculated as B x TypFak.
There is a choice between three fixed values: 0.7, 0.61 and 0.63.

Generally, the value 0.7 is used, but on trains, where a magnetic rail brake is included in the calculation of λ (the magnetic brake is supervised), the TypFak is set to 0.61. This lowers the service brake curve, enabling the driver manually to brake the train under the service brake curve without applying the magnetic rail brake.

The choice is not safety critical, but if a train wrongly gets the value 0.7, it might be difficult for the engine driver manually to brake the train below the emergency brake curve without applying the magnetic rail brake.

11.2.4 Monitoring balises during reverse movement

The parameter set to "yes" causes a train shunting in reverse direction (as seen from the manned cab) to stop the train if a balise or loop transmitting "STOP" or "NØDSTOP" (emergency stop) is read by the antenna in the direction of travel.

The value "yes" requires two antennas connected to the STM-DK Subrack.

The choice is not safety critical.

11.2.5 Available Litra codes

Litra	Litra code	Over speed	Type-Factor	Reverse monitoring
MZ I + II	00	no	0.7	yes
MY / MX	01	no	0.7	yes
MZ III	20	no	0.7	yes
MZ IV	30	no	0.7	yes
EG	31	no	0.7	yes
BR 185	32	no	0.7	yes
EB / BR 189 / Vectron / Taurus	33	no	0.7	yes
Class 66	34	no	0.7	yes
Class 66	35	no	0.7	yes
MR / MRD	40	no	0.7	yes
ME	50	no	0.7	yes
EA	60	no	0.7	yes
Test /a	61	no	0.7	yes
ABns	70	no	0.7	**no**
SW98a1	71	no	**0.61**	yes
SW98a2	72	**yes**	**0.61**	yes
SW98a3	73	**yes**	**0.61**	yes
SW98a4	74	no	0.7	yes
Lokaltog with ATP on HHGB	75	no	0.7	yes
Coridia	76	no	0.7	yes
NBTc	77	no	0.7	yes
MQ (Desiro)	78	no	0.7	yes
NBTe	79	no	0.7	yes
Bns-e	80	no	0.7	**no**
IC4a	81	no	0.7	yes
MG (IC4)	82	**yes**	0.7	yes
MF (IC 3)	90	**yes**	**0.63**	yes
ER (IR 4)	91	**yes**	**0.63**	yes
ET (OTU)	92	**yes**	0.7	yes
X2 med traktion	93	no	0.7	**no**
X2 uden traktion	94	no	0.7	**no**
Test /#	95	no	0.7	yes
ABS (styrevogn)	96	no	0.7	**no**

Table 24 Litra Code / Train Type

After a Litra code has been written, the STM-DK Subrack changes to the FA-state and must be restarted.

If the train is configured to a Litra code, which does not exist, it will not be accepted. To check if the configuration of a Litra code has been successful, it is necessary to open the maintenance menu again after restart, and see if the correct Litra code appears in the “Litra number” field.

11.3 New Train Type

If the STM-DK Subrack is to be installed in a new train type not in the list in Table 24, a suitable litra code must be selected. The choice must be approved by BDK.

11.4 Set the transmitting interval for STM max speed

The train can be parameterized to frequently send its supervision speed in the transition area, where the STM-DK Subrack is ordered to the state “HS”

Caption: “V_MAX interv(100ms)”

Values:
0 no STM max speed will be send
1 will automatically be treated as 2
2 -250 Raster in 100 ms, when the STM max speed will be send (200ms to 25s)

According to ref. /10/ “V_MAX interv (100ms)” shall always be set to “0” in the configuration menu.

11.5 Tuning of Antenna A or Antenna B

Requirements for antenna tuning:

- The antenna shall not be closer than 2 meters to any balises or loops.
- The vehicle shall stand on a normal type of track, i.e. without extra metal parts within 2 m from the antenna.
- The vehicle shall be in thermal equilibrium with the surroundings. The temperature shall be in the interval between -10°C and +40°C.
  To ensure the thermal equilibrium, the vehicle can be placed in the specified temperature interval for approximately 4 hours.
- The STM-DK Subrack shall be powered for at least 5 minutes, before performing antenna tuning.
- The tuning of the antenna at Cab A shall be initiated from Cab A.
- The tuning of the antenna at Cab B shall be initiated from Cab B.

11.5.1 Antenna tuning procedure

From the DMI the STM-DK maintenance menu shall be entered.

In the “Data Entry” position the Maintenance window is selected by entering 3112 in the Maintenance code and Antenna Tuning is selected by CAB A or CAB B

The tuning of the antenna at Cab A is initiated from Cab A, and the antenna at Cab B is initiated from Cab B.
Definition: By Alstom Cab A is the Cab closest to the EVC.

Caption: “Antenna Tuning”
Type: pick-up list

Values:

“no”	no tuning will be performed (preset value)
“Cab A”	tune antenna of cab A
“Cab B”	tune antenna of cab B

Tuning takes app. 1 minute.

After tuning has been selected following text appears: “running A” or “running B”, dependent of the selected antenna.

By pressing the “enter-button” on the DMI after 1 minute, the result of the tuning will be shown on the DMI.

The result will be one of the following:

1. FF555: selected antenna has been tuned, OK
2. FF590: selected antenna B has been tuned OK, but antenna A still needs to be tuned
3. FF591: selected antenna A has been tuned OK, but antenna B still needs to be tuned
4. FF592 tuning of 100 kHz failed
5. FF593 tuning of 50 kHz failed
6. In all other cases: FF556: selected antenna has been tuned, NOT OK

FF591 will be shown as OK result at tuning of antenna on train with only one antenna, as this antenna will be installed as antenna in the A-end.

In order to finish the tuning, the ”X” button is pressed on the DMI.

After the antenna tuning the STM-DK Subrack shall be restarted.

12 Functional Test

After the installation, the correct function of all interfaces of the STM-DK Subrack must be tested. The functional test is performed according to “Dokumenteret Slutafprøvning”, see ref. /10/.

See ref. /9/ AppRule_174.

13 Diagnosis

To use the diagnosis, the following equipment shall be used:

- PC with a serial RS232 COM Port
- DB26 pin high density SUB D - DB9 service cable (See section 7 for connection)
- Terminal program

The terminal program shall use the following communication parameters:

- 1200 Baud
- 8 Data bit
- Odd parity
- 1 Stop bit

When using the diagnosis connection the PC shall be isolated from the train battery in accordance with EN 50124-1 – basic isolation.

Hint: Fulfilled by a laptop PS.

Note: If the diagnosis interface is used when the STM-DK Subrack is responsible for the safety, the national authorities shall give the acceptance and the exact conditions shall be agreed upon.

The relevant information in the debug terminal may be information about antenna tuning or received balisedata. The debug terminal is only for trouble shooting purposes. For STM-DK Subrack in normal use, information from the DMI and the JRU (EVC) is enough.

To access the diagnosis menu use the:

LOGIN<space><Return>

Then the following appears:

```
01) FIFO Informationen. . . .[YN]   02) Dekodierte Streckentel. .[YN]
03) LA   Informationen. . . .[YN]   04) GKS  Informationen. . . .[YN]
05) BetriebsZustandsWechsel .[YN]   06) BetriebsZustandsDaten . .[YN]
07) Richtungsbearbeitung. . .[YN]   08) ZugdatenAnzeige . . . . .[YN]
09) ZugdatenTask Messages . .[YN]   10) FST-Anzeigen bei Wechsel.[YN]
11) FST-Anzeigen zyklisch . .[YN]   12) Bremsverursacher Info . .[YN]
13) V_BB, V_ZB, Restweg . . .[YN]   14) ZKS-Anschaltung . . . . .[YN]
15) WISIR Informationen . . .[YN]   16) GleitSchleuderProtkl. .[KMYN]
17) Interruptinformationen. .[YN]   18) FahrzeugTelegrammProtkl .[YN]
```

The meaning of the different items in the menu is described in: ”Beschreibung der ATC-Diagnose-Schnittstelle”, ref. /7/.

Item 02 and 04 can be useful for balise data information.

See below example of antenna tuning succes and BZBPR balise information. For further information please see *ref.* /7/.

Se Figure 22, Figure 23 and Figure 24 for examples.

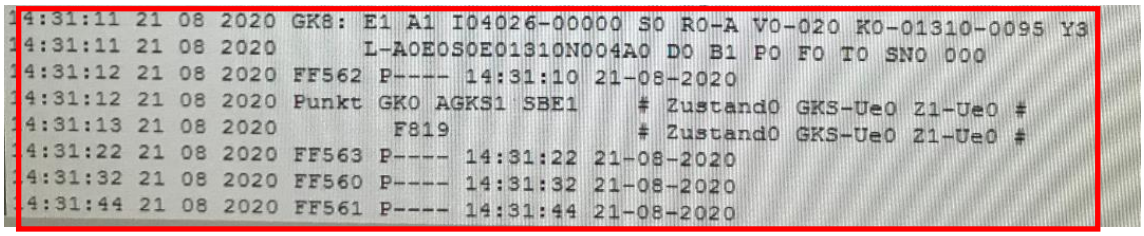


Figure 22 Debugterminal BZPR (Brake test telegram) balise with MENU ME02 and ME04 selected.

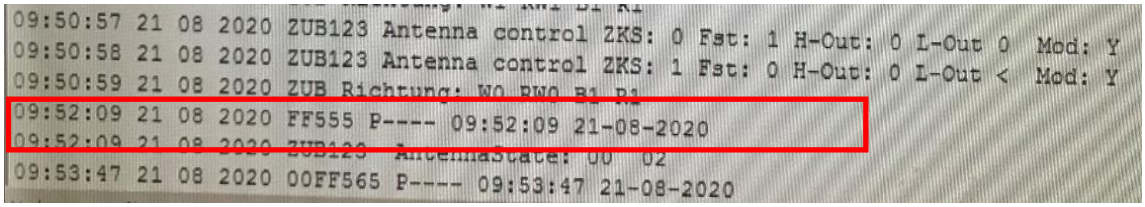


Figure 23 Debugterminal Antenna tuning result.

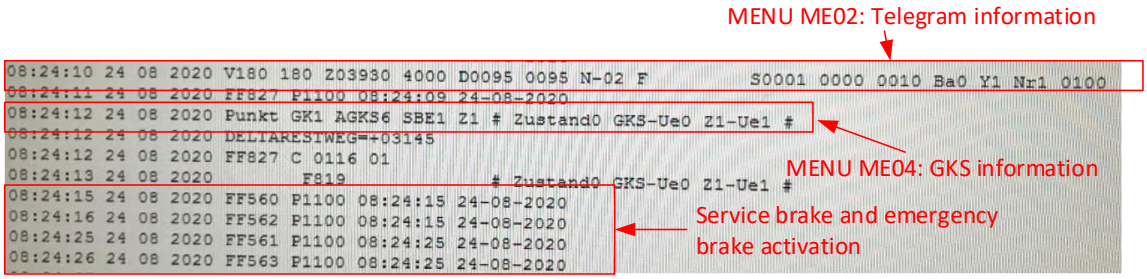


Figure 24 Debugterminal MENU ME02 and ME04 balise telegram receive plus FF codes for service brake and emergency brake example from STM-DK Cubicle test.