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Document kind	Application rules	Protection Class
Title	Application rules	Restricted
Product name		
Project	STM-DK Cubicle	

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Contents

1 Introduction

1.1 Change List

Version	Date	Author	Changed Sections	Reason for Change
A draft	2015-05-04	Per Petersen-Sonn	all	New. First review
A draft2	2015-06-15	Per Petersen-Sonn	all	Updated
A	2015-06-18	Per Petersen-Sonn	all	Released
B	2017-12-15	Per Petersen-Sonn	1.1 + 1.3 + 1.5	Update of STM-DK Subrack application rules to version 09. (G81001-X3107-L005-09). The following Apprules have been deleted: 4 + 64 + 65 + 68 + 69 + 73 + 78 + 81 -> 86 + 88 + 89 + 91 + 92 + 95 + 99 -> 103. Apprule 174 has been added. Reference to STM-DK Subrack installation manual has been added.
C	2022-03-30	Per Petersen-Sonn	1.1 + 1.3 + 1.4 + 1.5	Update of STM-DK Subrack application rules to version 10. (G81001-X3107-L005-10). Reference to STM-DK Subrack installation manual has been removed. The following Apprules have been changed: 43 + +47 + 61 + 66 + (90) + 97 + 104 + 174 + 200 + + 204 + 219. The following Apprules have been added: 187 + 188 + 191 + 192 + 199 + 225 + 226 +227 + 228.

1.2 Purpose

Purpose

To state the application rules for the STM-DK_Cubicle.

Valid for:

STM-DK Cubicle, 24 VDC: G81002-E3134-H024
STM-DK Cubicle, 72 VDC: G81002-E3134-H072
STM-DK Cubicle, 110 VDC: G81002-E3134-H110

1.3 References, Input/Output documents

Input documents

Reference ID	Document incl. Title, Unequivocal identifier and version
[STM-DK_R_APP-RULE]	DK-STM Application Rules G81001-X3107-L005-10 Baseline 5.0, 2022-01-27

Output documents

Reference ID	Document incl. Title, Unequivocal identifier and version
[STM-DK_C_INST_MAN]	STM-DK Cubicle Installation Manual IN 655.00Q4432 Version 3.03 or newer
[STM-DK_C_MAINT_MAN]	STM-DK Cubicle Maintenance Manual VN 655.00 Q4433 Version 3.03 or newer

References

Reference ID	Document incl. Title, Unequivocal identifier and version
[EN 50155]	Railway Application - Electronic equipment used on rolling stock 2017-10

Reference ID	Document incl. Title, Unequivocal identifier and version
[EN 50121-3-2]	Railway applications - Electromagnetic compatibility - Part 3-2: Rolling stock – Apparatus Dated 2016/A:2019
[EN 50124-1]	Railway applications -Insulation coordination Part 1: Basic requirements Clearances and creepage distances for all electrical and electronic equipment. Dated 2017
[EN 50343]	Railway applications – Rolling stock – Rules for installation of cabling Dated 2015-02+A1/2017
[EN 60529]	Degrees of protection provided by enclosures (IP Code) Dated 2002
[EN 60721-3-2]	Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 2: Transportation Dated 1997
[EN 61373]	Railway applications Rolling stock equipment - Shock and vibration tests dated 2010

1.4 Terms and Abbreviations

The following abbreviations are used here:

Abbreviation	Term
ATC	Legacy “Automatic Train Control”. In this context, ZUB123 system from Siemens.
EMC	ElectroMagnetic Compatibility.
EVC	European vital computer (Train onboard computer).
LRU	Least/ Lowest Replaceable Unit.
Profibus	Profibus is a standardized serial fieldbus protocol, used for connecting industrial devices (in this case EVC and STM). See www.profibus.com.
RST	Rolling Stock.
STM-DK	STM = Standard transmission module. STM-DK = STM for the Danish ATC. Replaces the existing mobile ATC and interfaces between the ATC train antenna and the EVC.
STM-DK_Subrack	19” equipped Subrack with STM-DK functionality.

1.5 How to read this document

This document is written as follows:

App Rule number	Text	Category

Where “App Rule number” is a running number, “Text” is the application rule and “Category” is where the application rule shall be used.

Category	**Explanation**
Acceptance test	Conditions established to ensure completion of the development project by means of testing in the first test train running under STM control. The test must demonstrate correct STM functionality in a train installation typically on test tracks.
Bdk	Conditions to be fulfilled by the infrastructure

Infrastructure	owner, Banedanmark, when installing and operating the STM in the legacy ATC environment and the mixed ATC- ERTMS environment.
BDK procedures and instructions	Conditions to be fulfilled by the infrastructure owner, Banedanmark.
EVC requirements	Requirements to the functionality of the ERTMS equipment.
Installation manual	Conditions to be fulfilled when installing the STM-DK Cubicle. Is assigned to [STM-DK_C_INST_MAN]
Maintenance manual	Conditions to be fulfilled when performing maintenance of the STM-DK Cubicle. Is assigned to [STM-DK_C_MAINT_MAN].
Specific application	Conditions to be fulfilled for each train or train type in order to prove the safety.

App Rule number	Text	Category
APPRU_3	The user of the tiu function shall use an idle cycle timeout that enables reconnecting the profibus connection for the tiu function in less than 1,5 seconds. This can be understood as a requirement for 1 second timeout value on TIU connections.	EVC requirements
APPRU_5	The maximum system speed at HS-area shall be covered by trackside engineering.	Bdk Infrastructure

<table>
<tr><th>App Rule number</th><th>Text</th><th>Category</th></tr>
<tr><td>APPRU_6</td><td>The STM shall have the possibility to use indicators on 5 positions on the DMI.
The mapping shall be:

<table>
<tr><th>NID_ INDPOS</th><th>Position CENELEC</th><th>Position ERA</th><th>Indication</th></tr>
<tr><td>5</td><td>C5</td><td>C2</td><td>DRIFTSBREMSE (yellow)
NØDBREMSE (red)</td></tr>
<tr><td>6</td><td>C6</td><td>C3</td><td>PASS STOP (red)</td></tr>
<tr><td>7</td><td>C7</td><td>C4</td><td>ATC INDE (green)
RANGER (yellow)
YDRE SIGNAL (yellow)
LØS ATC (green)</td></tr>
<tr><td>8</td><td>C2</td><td>C5</td><td>Yellow display</td></tr>
<tr><td>9</td><td>C3</td><td>C6</td><td>Red display</td></tr>
</table>
</td><td>EVC requirements</td></tr>
</table>

<table>
<tr><th>App Rule number</th><th>Text</th><th>Category</th></tr>
<tr><td>APPRU_7</td><td>The STM needs to use Buttons on 4 possible positions.
The mapping shall be:

<table>
<tr><th>NID_ BUTPOS</th><th>Position CENELEC</th><th>Position ERA</th><th>Push Button</th></tr>
<tr><td>1.</td><td>F6.</td><td>F8.</td><td>Valg
Afbryd
AFBRYD RANGER
Retur</td></tr>
<tr><td>2.</td><td>F7.</td><td>F9.</td><td>RANGER
YDRE SIGNAL
LØS ATC</td></tr>
<tr><td>3.</td><td>F8.</td><td>F10.</td><td>PASS STOP
LØS BREMSE (Yellow – driftsbremse)
LØS BREMSE (red – nødbremse)</td></tr>
</table>
</td><td>EVC requirements</td></tr>
<tr><td>APPRU_8</td><td>The train data shall be displayed in order of the related N_ITER value in packet STM-179 (starting with the lowest value).</td><td>EVC requirements</td></tr>
</table>

App Rule number	Text	Category
APPRU_9	If the ETCS on-board is compatible to Baseline 2.3.0d, it shall additionally fulfil the requirements of UNISIG CR 618.	EVC requirements
APPRU_26	Connection of the antenna Use only the following antenna types: S25441-M1-A3 S25441-M1-A4 S25441-M2-A3 S25441-M2-A4 Only shielded cable with specified data shall be used. Isolation min. 60Veff Impulse min. 1032Vp The housing of the antenna must be connected to the vehicle chassis with low impedance. The values for the antenna isolation between housing and internal electronics can be considered the same as for the cable. This is given for the mentioned antennas above. At the connection point it shall be ensured that re-inforced isolation to other potentials is sufficient according to [EN 50124-1].	Installation manual

App Rule number	Text	Category
	When connecting the two wires (Fahrtrichtung A and Fahrtrichtung B) to the module (Uebgen5) the following apply: - The two 100kHz connections shall be galvanic insulated from each other - The two 50kHz connections shall be galvanic insulated from each other.	
APPRU_34	The ETCS Onboard shall support the STM Functions • STM CONTROL • CLOCK • TIU • BIU • ODOMETER • JRU • DMI CAB A • DMI CAB B	EVC requirements

App Rule number	Text	Category
APPRU_37	Check after first start up and after maintenance work that the STM-DK starts up correctly. Verify that the self test has been run without errors.	Installation manual Maintenance manual
APPRU_43	Tuning of the antennas shall be done from the EVC/DMI. Tuning shall be done when: - First use of the STM-DK Cubicle After all service and maintenance like - Exchange of STM-DK_Subrack. - By exchange of the antenna. - By exchanging the cable connection. - By moving the cables. - If the position of the antenna has changed. Recommendation: Tuning during maintenance, once each year. Tuning shall take place during the following conditions: - Ambient temperature. -10°C…40°C. Where the vehicle shall be in thermal equilibrium with the surroundings. To ensure the thermal equilibrium, the vehicle can be placed in the specified temperature interval for approximately 4 hours. - 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 any extra metal parts within 2 m from the antenna.	Installation manual Maintenance manual
APPRU_47	The user must confirm by tests that the PROFIBUS bandwidth used by the ZUB123-STM is compatible with the ETCS on-board equipment.	EVC requirements

App Rule number	Text	Category
APPRU_58	The user must ensure that PROFIBUS node addresses and SAP numbers are unique in the entire system (/Subset-35) Id 14.5.1.9.).	EVC requirements
APPRU_61	If the STM CONTROL-Function connection is disconnected, the ETCS Onboard shall apply the safe action. The safe action shall be the emergency brake.	EVC requirements
APPRU_66	After receiving the state order HS (or DA, when HS is not used), the DK-STM uses 2s to activate the train antenna. With maximum speed of 200 km/h this means: The distance between the Transition Location and the first Zub123 Balise (danish ATC balise) shall be greater than 110 meter.	Bdk Infrastructure
APPRU_67	The STM train specific data values are safety relevant. The ETCS Onboard shall implement a safe STM specific data entry procedure for data to the legacy ZUB123-STM software. The safety level for this ETCS function is SIL4. Safe data input from driver is to be realized by ETCS Onboard.	EVC requirements
APPRU_70	Train data entered by Driver on the DMI shall be secured using proper data protection.	EVC requirements
APPRU_71	The DMI shall have a MTBF of at least 10000 hours.	EVC requirements
APPRU_90	After the installation the correct functionality of the system STM-DK_Cubicle must be shown in a field test with the aspects speed measurement and receiving of track information, The train speed during the test must be up to 200 km/h including reading and treatment of balise pairs with a mutual distance of 21m.	Acceptance test

App Rule number	Text	Category
APPRU_97	After the installation the integration test on the vehicle must show that the STM-DK_Cubicle does not disturb other Profibus participants.	Installation manual
APPRU_104	For STM to STM-Transitions, the ETCS Onboard shall follow the definitions of [SUBSET-035] including the definitions regarding STM TRIP situation (conditional CS order).	EVC requirements
APPRU_105	In case of a STM-STM-Transition, the ETCS Onboard shall follow the requirements of [SUBSET-035] regarding the “conditional cold standby”.	EVC requirements
APPRU_108	The Clock used in ETCS Onboard must have the safety relevant THR=10-9/h or better.	EVC requirements
APPRU_174	Working procedures shall ensure reading out and noting down train type information after any access to the DK-STM maintenance menu during installation and maintenance work. This will prevent inadvertent changes to train type, which might be hazardous.	Installation manual Maintenance manual
APPRU_187	The STM-DK can be started by applying power to the unsupplied SV5 Power Supply. (STM-DK = LRU STM-DK Subrack)	Installation manual Maintenance manual
APPRU_188	The STM-DK can be turned off by switching off the power supplied to the SV5 Power Supply. (STM-DK = LRU STM-DK Subrack)	Installation manual Maintenance manual

App Rule number	Text	Category
APPRU_191	Before the STM-DK with Release 03.01.00 (VE6) can be used for operation, it shall first successfully pass following qualification test (EGO, Experience Gathering Operation): - Read/pass 5000 balises. (STM-DK = LRU STM-DK Subrack or STM-DK Cubicle)	Acceptance test
APPRU_192	When using the UPort interface on the VE6 board, the connected Laptop shall be CE marked. The Laptop and cable shall be secured against unauthorized access. (Only relevant for LRU STM-DK Subracks equipped with VE6)	Maintenance manual
APPRU_199	Security rule: All threats and risks which have been exported to the user as security-related application conditions have to be considered by the user during risk assessment to identify possible impact on system safety. The exported security rules are: AppRule_48 and AppRule_192. Motivation: A threat may lead to a hazard if safety functions are assets to the user. Possible Solution: The user may perform a threat and risk analysis (TRA) to analyze all received security-related application conditions in regard to possible impact on system safety. (For STM-DK Cubicle, AppRule_48 is replaced by APPRU_201 in this document)	BDK procedures and instructions

App Rule number	Text	Category
APPRU_200	The RST shall not require more severe environmental conditions for the STM DK Cubicle than for : - noise immunity than defined in [EN 50121-3-2], - transient/noise emissions than defined in [EN 50121-3-2], - electro statical discharge than defined in [EN 50121-3-2], - transport and storage than defined in [EN 60721-3-2] class 2M2. und 2K2, - mechanical conditions than defined in [EN 50155], class 1B ([EN 61373]), - temperature than min -25 °C and max 40 °C, - isolation conditions than pollution degree PD3 and overvoltage category OV2 according to [EN 50124-1], - altitude than max 2000 meter above sea level, and 400 m below. - air pressure than max 106 kPa and min to 80 kPa. - degree of protection for housing than [EN 60529], IP54, - for power supply than [EN 50155]. Supply voltages are either 24 VDC, 72 VDC or 110 VDC. - for power supply interruptions than [EN 50155], S1.	Specific application Installation manual
APPRU_201	The STM-DK Cubicle shall be installed in a cabinet/room, not accessible for travelers and staff. Only maintenance staff are allowed to access the STM-DK_Cubicle.	Installation manual
APPRU_202	All external cables leaving the STM Cubicle(except for the internal diagnostic interface), shall have their cable shield EMC properly connected to the earthing bar on the STM-DK Cubicle.	Installation manual

App Rule number	Text	Category
APPRU_203	If the power supply is not from a battery, it shall be proven that the maximum voltage is within the specified limits [EN 50155], also in case of error, i.e. it is safety relevant that the voltage stays within the maximum limits.	Specific application Installation manual
APPRU_204	The cross section of the connecting cable for the power supply (connector -X6) shall be dimensioned acc. to [EN 50343].	Installation manual
APPRU_205	The cable for the power supply (connector -X6) shall be protected by a circuit breaker. The circuit breaker shall: - withstand the inrush current without tripping (max 8A in max 100 ms). - protect the cable from overload. - in case of a short circuit, not be prevented to trip due to cable resistance.	Installation manual
APPRU_206	The installer/maintainer is allowed to access the diagnose interface on the SERIO5. Normal ESD precautions shall be observed. It must be ensured that no higher voltages that 60V can be applied to the diagnose interfaces even in case of failure of the connected equipment. The door shall be attached after use. Standard EIA RS232 must be followed If this interface shall be used during normal service, i.e. where the STM-DK Cubicle is safety responsible, the national authorities shall give their acceptance and the exact conditions agreed upon. No other ports are allowed to be used.	Installation manual Maintenance manual
APPRU_207	For the emergency brake connection, it shall be ruled out that any short circuit in connecting cable etc can bypass the emergency brake contacts.	Specific application Installation manual

App Rule number	Text	Category
APPRU_208	The STM Cubicle emergency brake circuit (connector –X7) has two set of relay contacts, EB1 (EB1 (1) and EB1 (2)) and EB2 (EB2 (1) and EB2 (2)). Whether EB1 and EB2 are used in parallel(i.e used as two separate branches) or in serial(i.e connected together) depends on the train type. The brake shall be applied if the connection between these pins (EB1 (1) and EB1 (2) respectively EB2 (1) and EB2 (2)) is open. It shall be released if the connection is closed.	Specific application Installation manual
APPRU_209	The STM-DK_Cubicle shall be fastened on the vehicle using the mounting holes shown in [STM-DK_C_INST_MAN], using either: 1) all the bottom holes or 2) all the left and right side holes. The STM-DK_Cubicle shall only be mounted in a position where the connection plate is at the topmost position.	Specific application Installation manual
APPRU_210	When being transported, the connectors on the STM-DK Cubicle shall be protected by environmental caps, protecting the interior of the STM-DK_Cubicle against dust.	Installation manual Maintenance manual
APPRU_211	The vehicle connectors being attached to the connection plate shall be coded acc. to [STM-DK_C_INST_MAN].	Installation manual
APPRU_212	The RST supplier shall protect the two sets of emergency brake relay contacts(EB1 and EB2) against overload. This is safety relevant.	Installation manual

App Rule number	Text	Category
APPRU_213	If only one antenna is used, Ant-A shall be used, and Ant-B shall be covered by an environmental cap(EMC version), protecting the interior of the STM-DK_Cubicle against dust.	Installation manual Maintenance manual
APPRU_216	If the voltage used as activation voltage for the isolation switch function is not from a battery, it shall be proven that the maximum voltage is within the specified limits, also in case of error, i.e. it is safety relevant that the voltage stays within the following maximum stated limits: STM-DK_Cubicle, 24 VDC version: - Nom: 24 VDC - Min: 16,8 VDC - Max 30 VDC (for < 1 s: 33,6 VDC) STM-DK_Cubicle, 72 VDC version: - Nom: 72 VDC - Min: 50,4 VDC - Max 90 VDC (for < 1 s: 100,8 VDC) STM-DK_Cubicle, 110 VDC version: - Nom: 110 VDC - Min: 77 VDC - Max 137,5 VDC (for < 1 s: 154 VDC)	Installation manual
APPRU_217	If isolation switch function is not used, the connector “-X7.2” shall be covered by an environmental cap(EMC version), protecting the interior of the STM-DK_Cubicle against dust.	Installation manual Maintenance manual

App Rule number	Text	Category
APPRU_219	The emergency brake relay contacts (connector -X7) are for short circuit protection reasons, internally fuse protected with a 6,3 A slow blow fuse. Load: Min: 10 mA, Max: 6 A @ max 110 VDC 1,6 A @ max 137,5 VDC 1,6 A @ max 154 VDC in 0,1 s Load current applies to non-inductive load	Installation manual
APPRU_221	Before applying power to the STM_DK_Cubicle, check that the version of the STM-DK_Cubicle is suited for the applied supply voltage (i.e. 24 VDC, or 72 VDC or 110 VDC).	Installation manual Maintenance manual
APPRU_222	The cable for the isolation switch interface (-X7.2) shall be protected by a circuit breaker/fuse.	Installation manual
APPRU_223	Except for diagnosis purposes, the door shall be attached to the STM-DK_Cubicle. This is to keep the IP54 classification of the STM-DK_Cubicle.	Installation manual Maintenance manual
APPRU_224	LRU part must only be replaced, when the STM-DK Cubicle is without power.	Maintenance manual
APPRU_225	LRU units must only be repaired by a Siemens authorized repair shop.	Maintenance manual

App Rule number	Text	Category
APPRU_226	When changing the LRU STM-DK Subrack, it shall be ensured that the new STM-DK Subrack has the identical data/software as the old one. Only then the STM-DK Cubicle/STM-DK Subrack can be used for operation	Maintenance manual
APPRU_227	The storage life of the LRU STM-DK Subrack is limited to 10 years because of the components used. This shall be taken into account for the STM-DK Cubicle and for the LRU STM-DK Subrack.	Installation manual Maintenance manual

App Rule number	Text	Category
APPRU_228	To prevent heating problems, the following requirements shall be adhered to. For STM-DK Cubicle containing LRU STM-DK Subrack with VE5 a) At least one vertical side shall have at least 50 mm free space to the surroundings. For STM-DK Cubicle containing LRU STM-DK Subrack with VE6 (For LRU STM-DK Subrack with VE5: Not a requirement, but a recommendation.) 1) At least one vertical side shall have at least 50 mm free space to the surroundings. 2) The other vertical sides shall have at least 10 mm free space to the surroundings. For the back side, a metal bracket and/or metal plate is acceptable as "surrounding" without the need for 10 mm free space. 3) Beneath the STM-DK Cubicle, there shall at least be 10 mm free space. It is allowable to have a metal bracket for mounting purposes between the STM-DK Cubicle and the “10 mm free space”. General note for STM-DK Cubicle containing LRU STM-DK Subrack(VE6) or LRU STM-DK Subrack(VE5) a) High ambient temperature, compared to low ambient temperature, influences reliability negatively b) Although possible. it is not recommended to cover all allowable surfaces and at the same time, exposing the STM-DK Cubicle for max allowable temperature, for a longer period of time.	Installation manual Maintenance manual