

Test Report

Electromagnetic Compatibility (EMC)

HELEM2505000142-1 V1.1



TESTS ACCORDING TO FCC PART 15 B REQUIREMENTS

Equipment Under Test:	CAN Switch
Model:	TCS-10
Trademark:	TK Engineering
Customer:	TK Engineering Oy Hovioikeudenpuistikko 13 A FI-65100 Vaasa Finland
FCC Rule Part:	FCC CFR 47 Part 15 Subpart B, Class B

Date: 12 September 2025

Issued by: 
Pekka Kälviäinen
Testing Engineer

Date: 12 September 2025

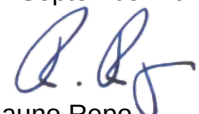
Checked by: 
Rauno Repo
Senior EMC Specialist

TABLE OF CONTENTS

TABLE OF CONTENTS	2
GENERAL REMARKS.....	3
Disclaimer	3
RELEASE HISTORY	4
PRODUCT DESCRIPTION	5
Equipment Under Test (EUT)	5
General description	5
Samples and modifications	5
Ports and cables	5
Peripherals	6
TEST CONDITION	7
EUT Test Conditions During EMC-Testing	7
Operation modes	7
Emission Measurement Uncertainty	7
SUMMARY OF TESTING.....	8
EMISSION TESTS	9
Conducted Emissions In The Frequency Range 150 kHz - 30 MHz.....	9
Radiated Emissions In The Frequency Range 30 MHz - 1000 MHz.	11
TEST EQUIPMENT	13

GENERAL REMARKS

Disclaimer

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com/en/Terms-and-Conditions/Terms-e-Document.aspx>

Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.

RELEASE HISTORY

Version	Changes	Issued
1.0	Initial release	13 June 2025
1.1	ICES 003 removed	12 September 2025

PRODUCT DESCRIPTION

Equipment Under Test (EUT)

EUT information	
General Product Description	CAN Switch
Trademark	TK Engineering
Model	TCS-10
Serial number	3092
Power input port type	DC
Rated voltage	10 - 40V (24 V was used in Radiated Emissions test and 20 V Conducted in Emissions test)
Rated current	-
Rated power	3.5 W
EUT Highest operation freq.	80 MHz
Hardware Version (if any)	10.02
Software Version (if any)	0x1002E
Mechanical size of the EUT (mm)	31 x 72 x 105
Parallel models	-
Radio module or chip	-

The EUT was tested as a table-top standing unit.

General description

The CAN Switch TCS-10 forwards messages between up to four CAN Bus networks.

Samples and modifications

No.	Name	Description
1	Sample 1	Test sample supplied by the customer

Ports and cables

Port name and purpose	Connected from-to	Length	Type (e.g. two-wire, cat5, coax, etc.)	Shielded
DC Power input	DC supply to EUT	5 m	2 x 0.34 mm ²	☒ Yes ☐ No
CAN A	EUT to PC adapter	30 m	CAN bus cabel 120Ω	☒ Yes ☐ No
CAN 1	EUT to PC adapter	29 m	CAN bus cabel 120Ω	☒ Yes ☐ No
CAN 2	EUT to PC adapter	29 m	CAN bus cabel 120Ω	☒ Yes ☐ No
CAN 3	EUT to PC adapter	28 m	CAN bus cabel 120Ω	☒ Yes ☐ No
CAN 4	EUT to PC adapter	24 m	CAN bus cabel 120Ω	☒ Yes ☐ No
PE cable	EUT installation plate to Protective earth	2 m	1 x 6 mm ²	☐ Yes ☒ No
AC mains *)	LISN to AC adapter	1 m	3 wires	☐ Yes ☒ No

*) Only conducted emissions test

Peripherals

Peripheral	Description / Usage
Test PC *)	Device configuration
CAN USB adapter *)	Kvaser U100, 5 units
USB HUB *)	TP-Link UH720
AC adapter, 20 VDC**)	Lenovo ADLX65WNCT3A, s/n: 11S45N0321Z1ZLZ359187

*) The peripherals were supplied by the customer. Located outside of the test area.

***) Only conducted emissions test

TEST CONDITION

EUT Test Conditions During EMC-Testing

The configuration of the EUT was made to correspond as closely as possible to actual operating conditions. The EUT was monitored with peripheral PC using software provided by the manufacturer.

The test conditions and the performance criteria were proposed (supplied) by the customer.

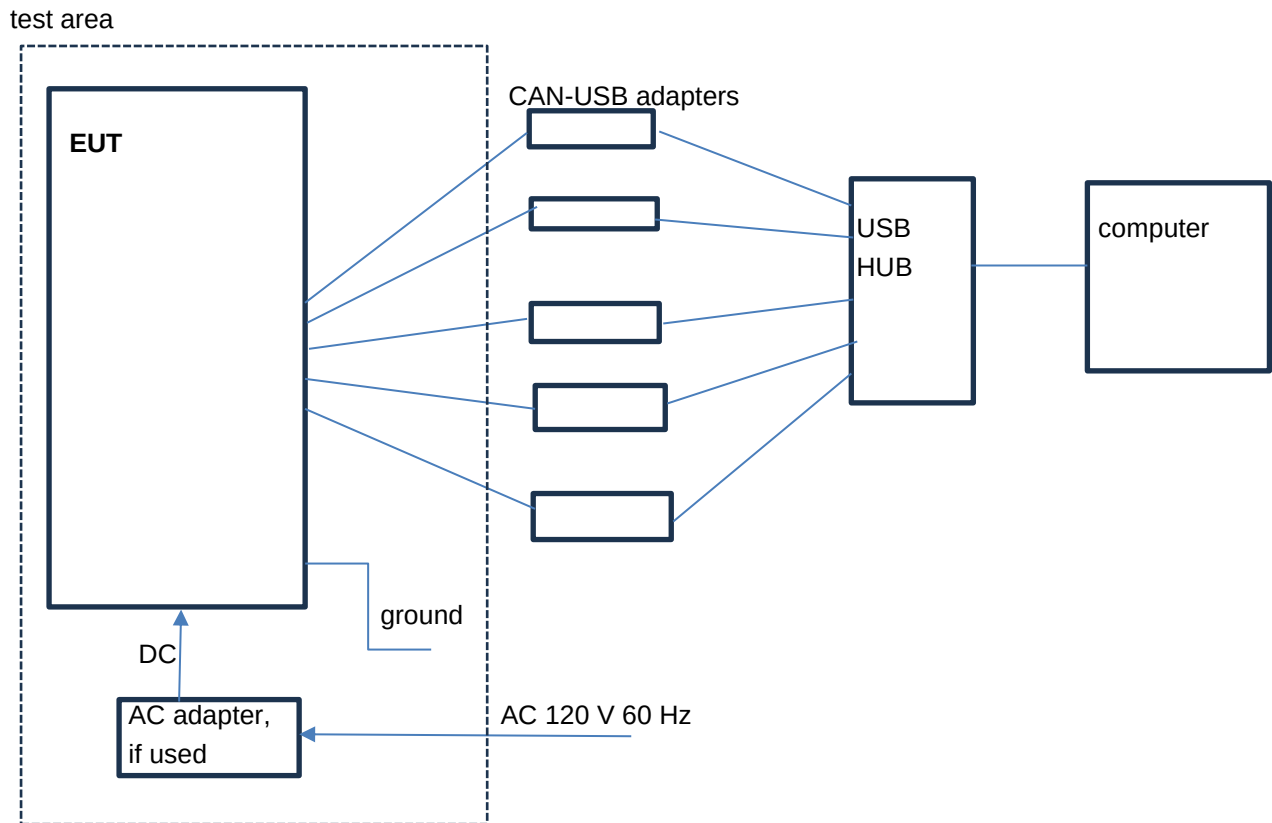


Figure 1: Test setup block diagram

Operation modes

During the tests the EUT was in the following operation modes:

Mode	Description
1	Power on with the device in operational state. All CAN channels were operating under a reasonable load.

Emission Measurement Uncertainty

The uncertainties comply with CISPR 16-4-2 ed.2 requirements ($U_{lab} < U_{Cispr}$).

Summary of Testing

SUMMARY OF TESTING

Test Specification	Description of Test	Result
FCC CFR 47 15/B §15.107	Conducted Emissions, Class B	PASS
FCC CFR 47 15/B §15.109	Radiated Emissions, Class B	PASS

Decision rule used for the emission tests are defined in standard CISPR 16-4-2 / EN 55016-4-2 clause 4.2

Test Facility

Testing Laboratory / address: FCC designation number: FI0002	SGS Fimko Ltd Karakaarenkuja 4 FI-02610, ESPOO FINLAND
Test Site:	☐ K10LAB ☒ K5LAB ☐ T10LAB

Conducted Emissions In The Frequency Range 150 kHz - 30 MHz

EMISSION TESTS

Conducted Emissions In The Frequency Range 150 kHz - 30 MHz

Standard:	ANSI C63.4	(2014)
Tested by:	PKA	
Date:	11 June 2025	
Humidity:	30 – 60 %	
Temperature:	22 ± 3 °C	
Barometric pressure:	860 – 1 060 mbar	
Measurement uncertainty:	± 2.9 dB	Level of confidence 95 % (k = 2)

Test Plan

Conducted disturbance voltage was measured with an artificial main network from 150 kHz to 30 MHz with a resolution bandwidth of 9 kHz. Measurements were carried out with peak and average detectors from the phase(s) and neutral lines of the power supply cable.

The EUT was working as described in the section “EUT Test Conditions”.

Class B limits:

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

Conducted Emissions In The Frequency Range 150 kHz - 30 MHz

Test results

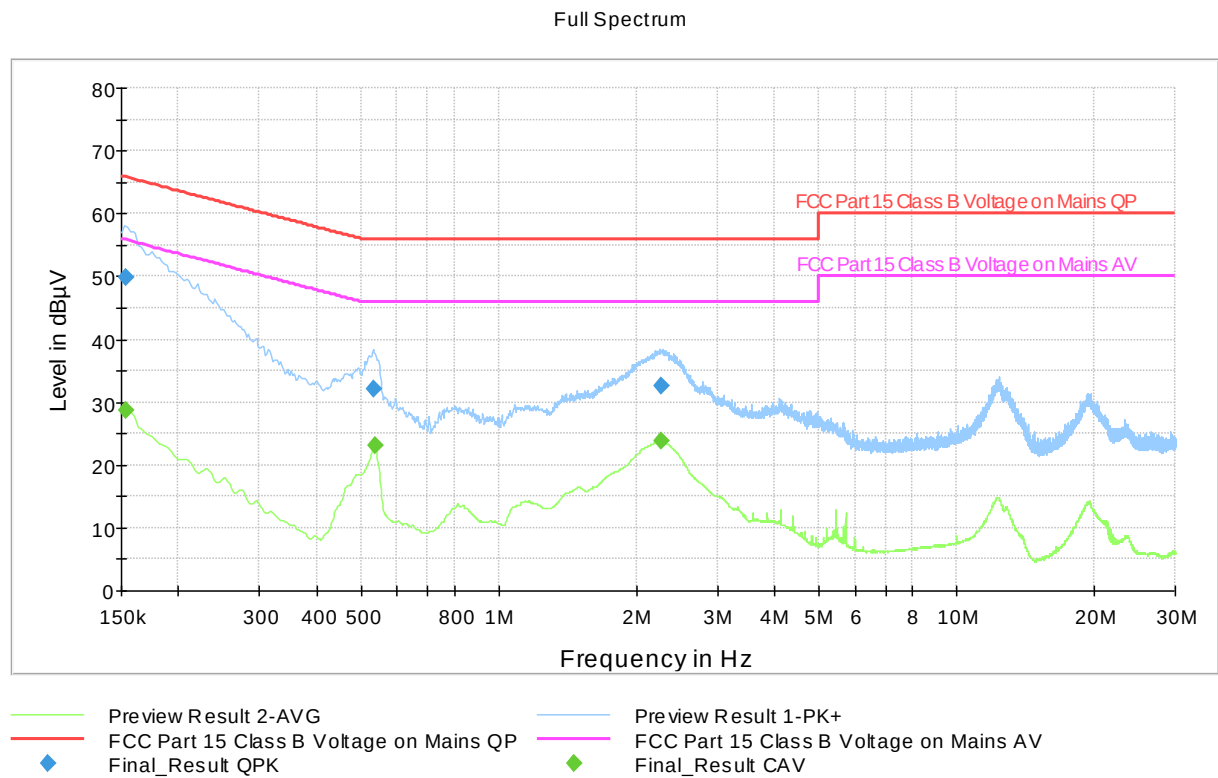


Figure 2: The measured results

Final measurements from the worst frequencies

Table 1: Final quasi-peak and average results

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.154000	49.75	---	65.78	16.03	1000.0	9.000	N	9.7
0.154000	---	28.64	55.78	27.14	1000.0	9.000	L1	9.7
0.535500	32.02	---	56.00	23.98	1000.0	9.000	N	9.7
0.537750	---	23.16	46.00	22.84	1000.0	9.000	N	9.7
2.263000	---	23.74	46.00	22.26	1000.0	9.000	N	9.9
2.265500	32.62	---	56.00	23.38	1000.0	9.000	L1	9.9

Correction factor (dB) in the final result tables contains the sum of the transducers (cables + LISN).

QuasiPeak and Average values are the measured values corrected with the correction factor.

Radiated Emissions In The Frequency Range 30 MHz - 1000 MHz

Radiated Emissions In The Frequency Range 30 MHz - 1000 MHz

Standard:	ANSI C63.4 (2014)	
Tested by:	PKA	
Date:	11 June 2025	
Humidity:	30 – 60 %	
Temperature:	22 ± 3 °C	
Barometric pressure:	860 – 1 060 mbar	
Measurement uncertainty:	± 4.9 dB (30 – 200 MHz)	Level of confidence 95 % (k = 2).
	± 4.1 dB (200 – 1000 MHz)	

Test plan

The radiated emission measurements were done within a semi anechoic screened chamber. The measurement distance was 3 meters. The worst interferences were determined during measurements by rotating the turntable and adjusting the antenna height. The measurements were done in horizontal and vertical antenna polarizations. The supply voltage to the turntable was fed through the filter.

The EUT was working as described in the section “EUT Test Conditions”.

Radiated measurement settings**Preliminary testing:**

Turntable movement:	15 ° step
Turntable position:	0 ° to 345°
Antenna movement:	1.5 m step
Antenna height:	1.0 m to 4.0 m
Antenna polarization:	Vertical and horizontal

Final testing:

Turntable movement:	Continuous
Turntable position:	± 30 °
Antenna movement:	Continuous
Antenna height:	± 1.5 m
Antenna polarization:	Vertical and horizontal

Radiated Emissions In The Frequency Range 30 MHz - 1000 MHz

Measured Quasi-Peak Values In The Frequency Range 30 MHz - 1000 MHz

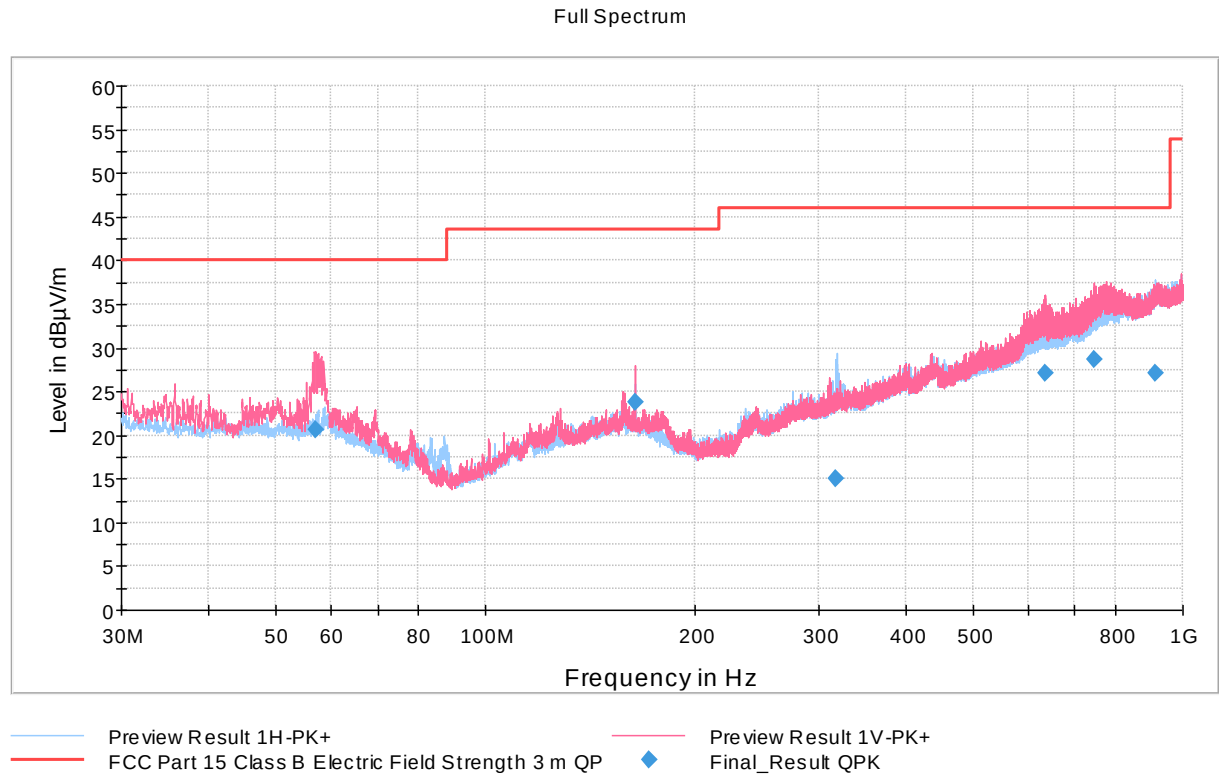


Figure 3: Measured results

Final measurements from the worst frequencies

Table 2: Final quasi-peak results

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
56.880000	20.71	40.00	19.29	1000.0	120.000	100.0	V	105.0	18.3
163.840000	23.86	43.50	19.64	1000.0	120.000	100.0	V	281.0	19.0
318.240000	15.02	46.00	30.98	1000.0	120.000	146.0	H	45.0	21.1
633.860000	27.12	46.00	18.88	1000.0	120.000	100.0	V	280.0	28.6
744.890000	28.75	46.00	17.25	1000.0	120.000	100.0	V	282.0	30.5
914.650000	27.10	46.00	18.90	1000.0	120.000	395.0	H	66.0	32.8

Correction factor (dB) in the final result tables contains the sum of the transducers (antenna + cables).

QuasiPeak values are measured values corrected with the correction factor.

TEST EQUIPMENT

Radiated Emissions

Equipment	Manufacturer	Type	Inv or serial	Prev Calib	Next Calib
COAX CHAIN K5 EMI < 1GHz	-	C053+FP3AirC+C138A	sn:-	2025-03-26	2026-03-26
TURNTABLE	MATURO	DS430 UPGRADED	inv:10182	NCR	NCR
MAST & TURNTABLE CONTROLLER	MATURO	NCD	inv:10183	NCR	NCR
ANTENNA MAST	MATURO	TAM 4.0E	inv:10181	NCR	NCR
ATTENUATOR	PASTERNAK	PE 7004-4 (4dB)	inv:10126	2024-12-11	2026-12-11
TEST SOFTWARE	ROHDE & SCHWARZ	EMC-32	-	NCR	NCR
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW26	inv:10679	2024-06-12	2025-06-11
ANTENNA	ROHDE & SCHWARZ	HFH2-Z2 , 335.4711.52	inv:8013	2024-11-18	2025-11-18
ANTENNA	SCHWARZBECK	VULB 9168	inv:8911	2024-12-11	2026-12-11

Conducted Emissions

Equipment	Manufacturer	Type	Inv or serial	Prev Calib	Next Calib
COAX CHAIN K5 EMI CE 9kHz- 30MHz	-	C132+FP1SF+C153	sn:-	2025-03-26	2026-03-26
TEST SOFTWARE	ROHDE & SCHWARZ	EMC-32	-	NCR	NCR
LISN	ROHDE & SCHWARZ	ENV216	inv:9611	2025-02-18	2026-02-18
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW26	inv:10679	2024-06-12	2025-06-11

NCR = No calibration required

END OF REPORT