

TECHNICKÝ SKÚŠOBNÝ ÚSTAV PIEŠŤANY, š.p. Product Certification Body Krajinská cesta 2929/9, 921 01 Piešťany Slovak Republic

CERTIFICATE

No. 0021/104/2023

Manufacturer: VOIPAC TECHNOLOGIES s.r.o. Gen. M. R. Štefánika 6670/19 911 01 Trenčín Slovak Republic

Product: iMX8M Industrial Development Kit Pro

Part number: iMX8M-IDK-22221-101-11111

This certificate confirms the compliance of the product type characteristics with the technical requirements given in:

EN 301 489-1 V2.2.3 EN 301 489-17 V3.2.4 EN IEC 61000-6-2:2019

The certificate has been issued on the basis of the tests of the product type sample. The results are recorded in the Conformity assessment report No. 230500034 dated 07.03.2023

This certificate is issued under the following conditions:

- 1. The certificate applies to the product type and its variations specified in the above mentioned Conformity Assessment report.
- 2. The production process/factory production control is not covered by this certificate.
- The certificate does not imply that the certification body has performed any surveillance or control of the production process.
- 4. The manufacturer shall ensure the conformity of subsequent production items with the certified type.
- 5. Changes that may have an impact on maintaining conformity with the certification requirements may require confirmation of the validity of the certificate by demonstrating compliance with the conditions under which the certificate was issued or by conducting an additional evaluation.
- 6. The holder of this certificate must keep the conditions specified in the General Rules for Product Certification, which are freely available at www.tsu.eu

Issue date:	08.03.2023
Expiry date:	07.03.2026
Issue:	1





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Number of pages: 4 Number of annexes: 1

CONFORMITY ASSESSMENT REPORT

No: 230500034

Product	16 16	iMX8M Industrial Development Kit Pro
Part number		iMX8M-IDK-22221-101-11111
Manufacturer	200 0	VOIPAC TECHNOLOGIES s.r.o. Gen. M. R. Štefánika 6670/19 911 01 Trenčín Slovak Republic

Distribution list:

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This report is the output from the review of information and results relating to the evaluation of the product:

"iMX8M Industrial Development Kit Pro, part number: iMX8M-IDK-22221-101-11111"

1. PRODUCT DESCRIPTION

This embedded system with i.MX 8M ARM® Cortex®-A53 and Cortex-M4 cores was designed as a development platform for the iMX8M Industrial Module Pro, which includes all of the layout and technologically intensive parts. The module's robust industrial-grade connectors and highly efficient standardized heatsink with mounting tabs and springs are essential for stable-performance embedded system.

Besides the CPU, the development kit features all of the essential high-speed interfaces such as eMMC NAND Flash, LP-DDR4 RAM, PCI Express, USB 3.0 together with several HD video options, and further supports numerous communication peripherals like WiFi, Bluetooth, Ethernet, or Audio - all of them soldered right on the COM.

Product:



2. CONFORMITY ASSESSMENT

2.1 Conformity assessment procedure

The conformity assessment has been carried out in accordance with the certification scheme TSU No.1.

2.2 Regulations and technical standards used for the conformity assessment

- EN 301 489-1 V2.2.3 ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard for ElectroMagnetic Compatibility
- EN 301 489-17 V3.2.4 ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for Broadband Data Transmission Systems; Harmonised Standard for ElectroMagnetic Compatibility
- EN IEC 61000-6-2:2019 Electromagnetic compatibility (EMC). Part 6-2: Generic standards. Immunity standard for industrial environments

2.3 Documents used for conformity assessment

For the conformity assessment the documents submitted by the applicant and the documents drawn up by TSÚ Piešťany, š.p. were used. The list of documents is given in Clause 4.

2.4 Test sample

Tests were carried out on the following samples:

 1 pc of iMX8M Industrial Development Kit Pro, part number: iMX8M-IDK-22221-101-11111. The sample was recorded on 8th February 2023 under the registration number 230500034/317/5311.

3. REVIEW RESULTS

3.1 Summary of conformity assessment results:

Serial No.	Product characteristic	Standard(s)	Evaluation
		EN 301 489-1 V2.2.3	
1	General requirements	EN 301 489-17 V3.2.4	Meets
		EN IEC 61000-6-2:2019	

3.1.1 General requirements according to EN 301 489-1 V2.2.3, EN 301 489-17 V3.2.4 and EN IEC 61000-6-2:2019

- conformity assessment was carried out on the basis of documents listed in Clause 4.2 and on the basis of the following documents:
 - Test report No.: 230500034/EMC on EMC dated 22.02.2023. The report was drawn up by TSÚ Piešťany, š.p.
- based on the review of test results and technical documentation, the conformity with technical requirements given in the relevant standard was found out.

4. DOCUMENTS USED

4.1 Basic documents

- Application for conformity assessment No. 230500034 registered on 13th February 2023.
- Confirmation of Application ref. No. 102/57/2023 dated 13th February 2023.

4.2 Documents submitted by the Applicant

- Technical description and quick guide of the product
- Datasheets of used antenna and power supply adaptor

4.3 Documents drawn up by TSÚ Piešťany, š.p.

1. Test report No. 230500034/EMC dated 22.02.2023

The test report listed in Clause 4.3 is attached to this conformity assessment report.

5. CONCLUSION

The review results shows that the product meets the technical requirements of the relevant European directives of the new approach referred to in Clause 2.2.

In Piešťany, date: 07.03.2023

Reviewed by: Ing. Dušan Vernarský

Technical expert

DECISION

Product Certification Body TSÚ Piešťany š.p. decided on the base of review results that:

- fulfilment of requirements has been proven,
- The Conformity Certificate will be issued.

Certificate validity: limited to a period of 3 years.

In Piešťany, date 07.03.2023





TECHNICKÝ SKÚŠOBNÝ® ÚSTAV PIEŠŤANY, š.p. Krajinská cesta 2929/9, 921 01 Piešťany, Slovak Republic



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POS.: 230500034/EMC

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TEST REPORT No.: 230500034/EMC

Test name	:	Electromagnetic compatibility tests	
Product name	:	: iMX8M Industrial Development Kit Pro	
Part number	:	iMX8M-IDK-22221-101-11111	
Manufacturer	:	VOIPAC TECHNOLOGIES s.r.o. Gen. M. R. Štefánika 6670/19 911 01 Trenčín Slovak Republic	
Applicant	:	COCV TSÚ Piešťany Krajinská cesta 2929/9 921 01 Piešťany Slovak Republic	
Testing location	:	Test Laboratory TSÚ Piešťany, š.p. Krajinská cesta 2929/9 921 01 Piešťany Slovak Republic	
Order no.	:	230500034	
Test procedure	:	See chap. 2	
Date of test	:	See chap. 2	
Distribution	:	Copy no.1 – manufacturer Copy no.2 – TSÚ Piešťany	
Date of issue	:	22.02.2023 TECHNICKÝ SKÚŠOBNÝ. ÚSTAV PIEŠŤANY, š.p.	
		Krajinskácesta 2929/9 92101 PIEŠŤANY -317-	
		2-	

Ing. Jakub Šiška

Test engineer

Tested by:

Approved by:

Ing. Ľuboš Vančo Technical head of RED and EMC testing body

Test results introduced in this test report are related to the test subject only. Test report can be reproduced or published as a whole, in parts only with written approval of TSÚ test body. COPYRIGHT © TSÚ Piešťany, š.p. T-10-13.1

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1 GENERAL INFORMATION

EMC emissions and immunity tests were performed on the equipment under test (EUT) in the testing laboratory of TSÚ, š.p. Piešťany, Slovak Republic, accredited by the SNAS.

All tests were conducted in an environment which ensured that the measurable influence or interference (background noise) not generated by EUT, was below the threshold limits defined in the standards.

2 TEST METHODS AND CONDITIONS

Test methods used :	MPS 01/5.11/2018 Measurement of electromagnetic compatibility
Standards :	EN 301 489-1 V2.2.3 ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements.
	EN 301 489-17 V3.2.4 ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for Broadband Data Transmission Systems;
	EN IEC 61000-6-2:2019 Electromagnetic compatibility (EMC). Part 6-2: Generic standards. Immunity standard for industrial environments
Place of testing :	EMC testing laboratory TSÚ Piešťany, š.p.
	Laboratory Pobedim TSÚ Piešťany, š.p.
	on-site:
Place and date of sample delivery :	The sample was delivered to TSÚ Piešťany, š.p. on 08.02.2023 and recorded under the registration number 230500034/317/5311
Start of test :	08.02.2023
End of test :	08.02.2023
Test procedure deviations :	Without test procedure deviation.
Tests conditions and results :	See chap. 3, 4, 7, 8

2.1 Environmental conditions

Temperature :	19 - 20 °C
Relative Humidity :	37 - 38 %
Atmospheric Pressure :	104.0 – 104.6 kPa

3 SUMMARY OF TESTS AND TEST RESULTS

Possible test case verdicts:

- test not applicable..... N/A
- test object does meet the requirement.....: PASS
- test object does not meet the requirement.....: FAIL

The tests were performed in accordance with the requirements of standards EN IEC 61000-6-2:2019, EN 301 489-17 V3.2.4 and referenced EN 301 489-1 V2.2.3. Basic standards referenced by EN 301 489-1 V2.2.3 as follows:

Harmonized Standard ETSI EN 301 489-17					
Classification of EUT: Radio equipment for fixed use.					
Emissions					
Clause No. of EN 301 489-1	Test Description	Referenced standard	Test Result	Condition	
8.2	Radiated emission, Enclosure of ancillary equipment	EN 55032	PASS	Class B Equipment intended primarily for use in an industrial environment shall meet the Class A limits	
8.3	Conducted emission, DC power input/output ports	EN 55032	N/A (Note1)	Only where equipment has DC power input and/or output ports with a cable length greater than 3 m or from a vehicle power supply	
8.4	Conducted emission, AC mains input/output ports	EN 55032	PASS	Class B Equipment intended primarily for use in an industrial environment shall meet the Class A limits	
8.5	Harmonic current emissions, AC mains input port	EN 61000-3-2 EN 61000-3-12	N/A (Note4)	EN 61000-3-2 Class D Equipment with input current ≤ 16 A per phase. Limits are not specified for equipment with a rated power of 75 W or less	
8.6	Voltage fluctuations and flicker, AC mains input ports	EN 61000-3-3 EN 61000-3-11	PASS	EN 61000-3-3 Equipment with input current ≤ 16 A per phase	
8.7	Conducted emission, Wired network ports	EN 55032	PASS	Class B Only where equipment has wired network ports	
Immunity					
Clause No. of EN 301 489-1	Test Description	Referenced standard	Test Result	Condition	
9.2	Radio frequency electromagnetic field (80 MHz to 6 000 MHz)	EN 61000-4-3	PASS		
9.3	Electrostatic discharge	EN 61000-4-2	PASS		
9.4	Fast transients, common mode	EN 61000-4-4	PASS (Note3)		
9.5	Radio frequency, common mode	EN 61000-4-6	PASS (Note3)		
9.6	Transients and surges in the vehicular environment	ISO 7637-2	N/A (Note2)	Only where equipment is connected to vehicle power supply	
9.7	Voltage dips and interruptions	EN 6000-4-11	PASS		
9.8	Surges	EN 61000-4-5	PASS		
Note 1: The EUT is	s powered from AC/DC adapter with cable le	ngth <3 m.			

Note 2: The EUT is not intended for vehicular environment.

Note 3: The manufacturer declares that all cables connected to the signal ports, wired network ports, control ports, and DC power ports are less than 3 meters long.

Note 4: The EUT with power rating less than or equal to 75 W, is deemed to comply according standard EN 61000-3-2 and is not required to be tested.

Standard EN IEC 61000-6-2:2019					
Requirement No. of EN IEC 61000- 6-2	Test Description	Referenced standard	Performance Criteria	Test Result	Remarks
1.2 1.3	Radio-frequency electromagnetic field	EN 61000-4-3	A	PASS	
1.4	Electrostatic discharge	EN 61000-4-2	В	PASS	
2.3 3.3 4.5	Fast transients	EN 61000-4-4	В	PASS	
2.1 3.1 4.1	Radio-frequency common mode	EN 61000-4-6	А	PASS	
1.1	Power-frequency magnetic field	EN 61000-4-8	А	N/A (Note5)	
4.2 4.3	Voltage dips and interruptions	EN 61000-4-11	B/C/C/C	PASS	
2.2 3.2 4.4	Surges, line-to-line and line-to- earth	EN 61000-4-5	В	PASS	
Note 5: The EUT does not contain devices susceptible to magnetic fields. Remarks: Detailed test conditions are in EN IEC 61000-6-2 Table 1, 2, 3, 4					

POS: 230500034/EMC

4 EQUIPMENT UNDER TEST

4.1 Description of EUT

Prototype :	
Production Version:	
Manufacturer:	VOIPAC TECHNOLOGIES s.r.o. Gen. M. R. Štefánika 6670/19 911 01 Trenčín Slovak Republic
Product name:	iMX8M Industrial Development Kit Pro
Part number: Serial number: Number of test samples:	iMX8M-IDK-22221-101-11111 00032 1 pc.
Description:	This embedded system with i.MX 8M ARM® Cortex®-A53 and Cortex-M4 cores was designed as a development platform for the iMX8M Industrial Module Pro, which includes all of the layout and technologically intensive parts. The module's robust industrial-grade connectors and highly efficient standardized heatsink with mounting tabs and springs are essential for stable-performance embedded system. Besides the CPU, the development kit features all of the essential high-speed interfaces such as eMMC NAND Flash, LP-DDR4 RAM, PCI Express, USB 3.0 together with several HD video options, and further supports numerous communication peripherals like WiFi, Bluetooth, Ethernet, or Audio - all of them soldered right on the COM.
Tested sample description:	 power supply: AC/DC adapter, input: 100 – 240 V AC, 47 – 63 Hz, 1.5 A, output: 5 V DC, 8 A, 40 W EUT functional temperature range: iMX8M Industrial Module Pro - min. 0, max +70 °C iMX8M Development Baseboard - min20, max +70 °C RF operational frequencies: Wi-Fi 2.4 GHz: 2412 – 2472 MHz, output power ≤ 18.5 dBm
	Wi-Fi 5 GHz (*): 5180 – 5240, 5260 – 5320, 5500 - 5700 MHz, output power < 15 dBm
	BT EDR, BLE: 2402 – 2480 MHz, output power < 4 dBm
	Pair of external SMA antennas Laird WTS 2450, gain 2.1 dBi at 2.45 GHz, 3.4 dBi at 5.875 GHz
	Note (*): The 5 GHz WiFi was not enabled during the testing.
Deviations from the Basic EMC standards:	none

4.2 Software and firmware

The EUT was delivered in the webshop configuration with standard software typical for its intended use.

4.3 Test modes

The EUT consists of two parts connected together - computer on module iMX8M Industrial Module Pro (tested sample P/N: iMX8M-IDM-22221-101-11111, S/N: 00018) and carrier board iMX8M Development Baseboard (tested sample P/N: iMX8M-IDB-00000-002-00000, S/N: 00030). The tests were carried out on the sample operated in test mode with the following hardware working together with the EUT and running the software listed below:

Hardware:

- Newhaven LVDS Capacitive Display Set (LCD PN: Newhaven Display NHD-10.1-1024600MB-LSXV-CTP)
- Digilent MIPI-CSI Camera Set (Camera PN: Digilent 410-358)
- WiFi and Bluetooth Antennas Set: 2x antennas connected via 2x 0.2 m long extension RF SMA cables
- USB-C Flash Drive 32GB (Kingston DataTraveler 80 32GB USB 3.2 Gen 1), connected through 1 m long USB-C extension cable (Cable PN: CLIFF FCR72003))
- 2x USB 3.0 Flash Drive 16GB (SanDisk Ultra Flair 16GB USB 3.2 Gen 1), each connected through 1 m long USB 3.2 Gen 1 extension cable (Cable PN: Molex 0687890035).
- Ethernet loopback 1 m long cable
- Audio mono Microphone with 1.5 m long cable
- Audio stereo Line Out connected via 2 m long cable
- Audio Headphones with 2 m long cable
- iMX8M Industrial Heatsink Set sized 30x30x25 mm
- Fasteners: Screws, nuts, springs, spacers and standoffs

Software:

- Yocto Project 3.1 operating system with Linux kernel version 5.4 VOIPAC NHD LCD version image and bootloader
- stress test application placing CPU, DDR4 Memory under a heavy load
- video stream captured by camera and displayed on the LCD monitor
- data transfer via Ethernet interface cable and received by WinSCP software running on the controlling PC placed outside of the test chamber (only run during the radio frequency electromagnetic field immunity test)

The EUT was tested as a table-top device. The EUT was powered from AE1. The EUT was communicating with AE2 via LAN or WiFi connection.

AE1: Power Supply 5V 40W AC/DC adapter, model: GTM96600-4005-T2A, manufacturer: GlobTek, Inc., the part of the recommended EUT accessories

AE2: WiFi router, model: Vigor 2760, serial number: 145002381779, manufacturer: DrayTek, laboratory test equipment

4.4 Input / output ports

Any connection point on equipment intended for connection of cables to or from that equipment is considered as a port:

AC power port	Enclosure port	, Antenna port
DC power port	EQUIPMENT	Sign al/control port
Earth port		Wired Network port

List of EUT ports:

- DC power port
- Wired Network port (1x LAN)
- Signal/control ports (2x USB-A 3.0, USB-B Micro, USB-C, HDMI, DisplayPort, 2x LVDS, NHD Touchscreen, MIPI-CSI, PCIe Mini, M.2, SD, CANbus Module, JTAG, UART, CSI, I2C + GPIO, SAI, Line Out, Microphone, Headphones)
- Antenna ports (2x SMA)

Note: No cable connected to the EUT may be longer than 3 m.

4.5 RF exclusion bands

The frequencies on which the EUT is intended to operate shall be excluded from the conducted and radiated RF emission and immunity tests.

The exclusion bands according to EN 301 489-1 and EN 301 489-17 apply to the EUT.

5 PERFORMANCE CRITERIA

The performance criteria are used to make an assessment whether radio equipment passes or fails immunity tests.

The test results shall be classified in terms of the loss of function or degradation of performance of the equipment under test, relative to a performance level defined by its manufacturer or the requestor of the test, or agreed between the manufacturer and the purchaser of the product.

based on the used product standard

based on the declaration of the manufacturer, requestor or purchaser

Performance criteria defined in clause 6.2 of EN 301 489-17 V3.2.4 apply:

performance criterion A for immunity tests with phenomena of a continuous nature; performance criterion B for immunity tests with phenomena of a transient nature; performance criterion C for immunity tests with power interruptions exceeding a certain time.

Criterion	During test	After test
А	Shall operate as intended. Shall be no loss of function. Shall be no unintentional transmissions.	Shall operate as intended. Shall be no degradation of performance. Shall be no loss of function. Shall be no loss of critical stored data.
В	May cause a loss of function.	Functions shall be self-recoverable. Shall operate as intended after recovering. Shall be no loss of critical stored data.
С	May cause a loss of function.	Functions shall be recoverable by the operator. Shall operate as intended after recovering. Shall be no loss of critical stored data.

NOTE: Operate as intended during the test allows a level of degradation in accordance with clause 6.2.2

Minimum performance level: For equipment that supports a PER or FER, the minimum performance level shall be a PER or FER less than or equal to 10 %.

For equipment that does not support a PER or a FER, the minimum performance level shall be no loss of the wireless transmission function needed for the intended use of the equipment.

		Performance criterion					
1	Performance criterion for	During the test, the equipment shall:					
	continuous phenomena	 continue to operate as intended; 					
		not unintentionally transmit;					
		 not unintentionally change its operating state; 					
		not unintentionally change critical stored data.					
2	Performance criterion for	For all ports and transient phenomena with the exception described below,					
	transient phenomena	the following applies:					
		• The application of the transient phenomena shall not result in a change of					
		the mode of operation (e.g. unintended transmission) or the loss of critical					
		stored data.					
		• After application of the transient phenomena, the equipment shall operate					
		as intended.					
		For surges applied to symmetrically operated wired network ports intended					
		to be connected directly to outdoor lines the following criteria applies:					
		• For products with only one symmetrical port intended for connection to					
		outdoor lines, loss of function is allowed, provided the function is self-					
		recoverable, or can be otherwise restored. Information stored in					
		non-volatile memory, or protected by a battery backup, shall not be lost.					
		• For products with more than one symmetrical port intended for connection					
		to outdoor lines, loss of function on the port under test is allowed, provided					
		the function is self-recoverable. Information stored in non-volatile memory,					
		or protected by a battery backup, shall not be lost.					

Performance criteria defined in clause 4 of EN IEC 61000-6-2:2019:

A functional description and a definition of specific performance criteria, during or as a consequence of immunity testing of equipment under test (EUT), shall be provided by the manufacturer and noted in the test report. They shall be consistent with one of the following general criteria for each test as specified in Table 1 to Table 4:

Criterion	Performance
A	The EUT shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the EUT is used as intended. If the performance level is not specified by the manufacturer, this may be derived from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.
В	The EUT shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the EUT is used as intended. The performance level may be replaced by a permissible loss of performance. However, during the test degradation of performance is allowed but no change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.
С	Temporary loss of function is allowed during the test, provided the function is self-recoverable or can be restored by the operation of the controls.
lf, as a resu dangerous c	It of the application of the tests defined in this standard, the EUT becomes or unsafe, it shall be deemed to have failed the test.

The results of applicable immunity tests based on these criteria are given in respective chapters.

6 TEST EQUIPMENT USED

Measurement of emissions

Used eq.	Name	Manufacturer	Туре	S/N	Registration no.	Date of calibration validity			
\boxtimes	EMI test receiver	Rohde & Schwarz	ESR7	1316.30003K07	540-316-022	29.03.2023			
\boxtimes	LISN type V	PMM Italy	PMM L3-32	122WT50407	540-316-018	24.04.2023			
	LISN type V	Hameg	HM6050-2	025880024	540-316-026	02.03.2023			
	BiConiLog Antenna	A.H. Systems	SAS-521F-2	272	540-317-097	24.08.2023			
\square	BiConiLog Antenna	ETS Lindgren	3143B	00157570	540-316-017	23.11.2023			
\square	Horn Antenna	ETS Lindgren	3119	00157903	540-316-016	16.12.2023			
	Three-phase network analyzer	Fluke	Fluke 435	DM9631006	130-316-85	17.05.2023			
\square	Mains network analyzer	Spitzenberger	B10	G80588	540-316-025	11.11.2023			
\boxtimes	LISN - 16A	Spitzenberger	Line - 16A	A2793 07/0 0701	540-316-023	11.11.2023			
\boxtimes	AC/ DC Power source	Spitzenberger	PAS 5000	A2793 01/0 0701	540-316-024	11.11.2023			
\boxtimes	Antenna mast	ETS Lindgren	2175			No cal due			
\square	Turntable	ETS Lindgren	2188			No cal due			
\square	Anechoic chamber	ETS Lindgren	FACT 3			No cal due			
\square	Atmosphere recorder	Comet System	C4130	13900371	412-316-001	04.04.2024			

Measu	Measurement of susceptibility								
Used eq.	Name	Manufacturer	Туре	S/N	Registration no.	Date of calibration validity			
	Multifunctional test generator for transients	EM test	UCS500 N5	07430/06	540-323-77	07.07.2023			
\square	Compact NX Generator	AMETEK CTS	NX5	1824221146	540-317-091	04.03.2024			
	ESD Simulator	Schaffner	NSG 432	1450	540-316-019	17.08.2023			
\square	Generator - ESD NX 30.1	emtest	ESD NX 30.1	11944	540-317-098	05.03.2026			
\square	Compact simulator conducted immunity	EM test	CWS500 N1	P1315117094	540-316-001	08.08.2024			
	Coupling and Decoupling network	EM test	CDN M1-32A	P1326119725	540-316-002	21.11.2023			
\square	Coupling and Decoupling network	EM test	CDN M2/M3	P1343125199	540-316-003	21.11.2023			
	Coupling and Decoupling network	EM test	CDN M5-32A	P1317117980	540-316-004	21.11.2023			
	Coupling and Decoupling network	EM test	CDN S4 USB	P1315117419	540-316-005	21.11.2023			
	Coupling and Decoupling network	EM test	CDN AF3	P1315117307	540-316-006	21.11.2023			
	Coupling and Decoupling network	EM test	CDN AF5	P1316117719	540-316-007	21.11.2023			
	Coupling and Decoupling network	EM test	CDN AF8	P1318118482	540-316-008	21.11.2023			
	Coupling and Decoupling network	EM test	CDN T4 RJ45	P1344125509	540-316-009	21.11.2023			
	Coupling and Decoupling network	EM test	CDN S19 HDMI	P1529161237	540-316-020	05.08.2023			
\square	Coupling and Decoupling network	EM test	CDN T8 RJ45	P1510151693	540-316-021	05.08.2023			
	Coupling and Decoupling network	Schaffner	CDN 117	17395	540-323-83	No cal. due			
	Coupling and Decoupling network	AMETEK CTS	CNI 508N2	P1907226998	540-317-090	27.02.2024			
\square	RF Amplifier	Prana	MT-200		1312-1464	No cal.due			
\square	RF Amplifier	Prana	SV-40DC		1312-1465	No cal.due			
	RF Amplifier	Prana	UX-30DC		1312-1466	No cal.due			
\square	Attenuator 6dB	EM test	ATT 6 / 75	P1306112990	540-316-010	21.11.2023			
	Adapter - R100N	EM test	R100N	P1324119059	540-316-011	21.11.2023			
\square	Field Probe	PMM Italy	EP 601	511WX30645	540-316-014	05.12.2023			
\square	Signal Generator	Rohde&Schwarz	SMB100A03	180253	540-316-027	02.05.2023			
\square	AC/ DC Power source	Spitzenberger	PAS 5000	A2793 01/0 0701	540-316-024	11.11.2023			
	Set to measurement of immunity to the magnetic field	TSU Piešťany, š.p.	9.15	201501	540-317-084	No cal.due			
	BiConiLog Antenna	A.H. Systems	SAS-521F-2	272	540-317-097	24.08.2023			
\square	BiConiLog Antenna	ETS Lindgren	3143B	00157570	540-316-017	23.11.2023			
	Horn Antenna	ETS Lindgren	3119	00157903	540-316-016	16.12.2023			
	Antenna mast	ETS Lindgren	2175			No cal due			
	Turntable	ETS Lindgren	2188			No cal due			
	Anechoic chamber	ETS Lindgren	FACT 3			No cal due			
\square	Atmosphere recorder	Comet System	C4130	13900371	412-316-001	04.04.2024			

7 EMISSIONS TESTS DESCRIPTION AND RESULTS

7.1 Radiated emission, Enclosure of ancillary equipment

General description:

This test is only applicable to ancillary equipment not incorporated in the radio equipment and intended to be measured on a stand-alone basis, as declared by the manufacturer. This test shall be performed on a representative configuration of the ancillary equipment.

This test is not applicable for ancillary equipment incorporated in the radio equipment, or for ancillary equipment intended to be measured in combination with the radio equipment. In these cases the requirements of the relevant product standard for the effective use of the radio spectrum shall apply.

Product related conditions for combined testing of radio and ancillary equipment may be contained in the relevant part of ETSI EN 301 489 series.

This test assesses the level of radiated electromagnetic noise from the ancillary equipment.

Test method:

The test method shall be in accordance with CENELEC EN 55032.



IEC



A facility validated against the FSOATS requirements shall be used for measurements above 1 GHz. An FSOATS may be a SAC/OATS with RF absorber on the RGP or a FAR.

Note: Abbreviations: FSOATS - Free Space Open Area Test Site FAR - Fully Anechoic Room OATS - Open Area Test Site SAC - Semi Anechoic Chamber

Limits:

The ancillary equipment shall meet the class B limits given in CENELEC EN 55032.

Alternatively, for ancillary equipment intended to be used exclusively in an industrial environment or telecommunication centers, the class A limits given in CENELEC EN 55032 may be used.

Requirements for radiated emissions								
Frequency		Measuren	Class A limits	Class B limits				
range	Facility Distance Detector type /		Detector type /	dB(µV/m)	dB(µV/m)			
MHZ		(m)	bandwidth					
30 to 230	OATSISAC	2	Quasi Peak /	50	40			
230 to 1 000	UATS/SAC	5	120 kHz	57	47			
1 000 to 3 000			Average / 1 MHz	56	50			
3 000 to 6 000	ESOATS	2	Average / T MITZ	60	54			
1 000 to 3 000	FSUATS	5	Dook / 1 MHz	76	70			
3 000 to 6 000				80	74			

Measurement data:

Test location:

- Semi anechoic chamber (30 MHz 1 GHz measurement)
- Semi anechoic chamber with floor absorbers (1 GHz 6 GHz measurement)

Distance of antenna - EUT: 3.0 m

Class B limits were applied to the evaluation of measurement.

Results of tests of radio disturbance emission – frequency range from 30 MHz to 1 GHz: Antenna polarization: **Vertical**

Scan Tab	le						
Scan Star Scan Stop Scan Type Transduce	t 3 e er Ar	0.00000 1.00000 ntenna 3 c	0000 MHz 0000 GHz TD Scan 143B new cal + cable				
Detector Star Freque	Trace 1: Quasi P t Stop ncy Frequency	eak S y	itep Size	RBW	RF Atten	Preamp	Input
30.00	0 MHz 1.000 (GHz 3	0.000 kHz 1	20.0 kHz	10.0 dB	30.0 dB	INPUT1
Peak List							
Margin Peaks			30.0 dB 25				
Trace	Frequency	L	evel (dBuV)	Phase	Detecto	or De	elta Limit/dB
1	31.620000000	MHz –	37.31		Ouasi	Peak	-2.69
1	45.120000000	MHz	22.87		Ouasi	Peak	-17.13
1	51.450000000	MHz	29.82		Quasi	Peak	-10.18
1	80.010000000	MHz	18.74		Quasi	Peak	-21.26
1	104.670000000	MHz	24.69		Quasi	Peak	-15.31
1	106.650000000	MHz	24.76		Quasi	Peak	-15.24
1	126.000000000	MHz	25.01		Quasi	Peak	-14.99
1	168.000000000	MHz	24.59		Quasi	Peak	-15.41
1	210.00000000	MHz	23.39		Quasi	Peak	-16.61
1	228.00000000	MHz	18.56		Quasi	Peak	-21.44
1	266.310000000	MHz	29.28		Quasi	Peak	-17.72
1	273.090000000	MHz	28.96		Quasi	Peak	-18.04
1	400.02000000	MHz	33.96		Quasi	Peak	-13.04
1	440.01000000	MHz	25.62		Quasi	Peak	-21.38
1	634.140000000	MHz	34.75		Quasi	Peak	-12.25
1	703.980000000	MHz	31.59		Quasi	Peak	-15.41
1	705.930000000	MHz	28.78		Quasi	Peak	-18.22

28.60

Quasi Peak

-18.40

Scan Diagram

1 707.58000000 MHz



Antenna polarization: Horizontal

Scan Tab	le							
Scan Star Scan Stop Scan Type Transduce	t) e er	A	30.000 1.000 ntenna	000000 MHz 000000 GHz TD Scan a 3143B new cal + cable				
Detector Star Freque 30.00	Trace t ncy 0 MHz	e 1: Quasi F Stop Frequenc 1.000	Peak Sy GHz	Step Size	RBW 120.0 kHz	RF Atten z 10.0 dB	Preamp	Input 3 INPUT1
Peak List								
Margin Peaks				30.0 dB 25				
Trace	Fr	equency		Level (dBµV)	Phase	Detecto	or D	elta Limit/dB
1	31.65	50000000	MHz	26.5	8	Quasi	Peak	-13.42
1	57.69	90000000	MHz	19.2	4	Quasi	Peak	-20.76
1	80.03	10000000	MHz	22.6	5	Quasi	Peak	-17.35
1	108.78	80000000	MHz	20.0	3	Quasi	Peak	-19.97
1	120.00	00000000	MHz	22.3	2	Quasi	Peak	-17.68
1	121.98	80000000	MHz	21.5	7	Quasi	Peak	-18.43
1	168.00	00000000	MHz	26.2	3	Quasi	Peak	-13.77
1	200.03	10000000	MHz	23.2	8	Quasi	Peak	-16.72
1	210.00	00000000	MHz	25.5	0	Quasi	Peak	-14.50
1	252.00	00000000	MHz	27.1	9	Quasi	Peak	-19.81
1	266.28	80000000	MHz	26.6	1	Quasi	Peak	-20.39
1	400.02	20000000	MHz	22.1	6	Quasi	Peak	-24.84
1	462.00	00000000	MHz	20.2	1	Quasi	Peak	-26.79
1	576.48	80000000	MHz	35.2	9	Quasi	Peak	-11.71
1	578.6	70000000	MHz	35.2	7	Quasi	Peak	-11.73
1	705.93	30000000	MHz	30.1	2	Quasi	Peak	-16.88
1	707.5	50000000	MHz	30.9	0	Quasi	Peak	-16.10

Scan Diagram



Results of tests of radio disturbance emission – frequency range from 1 GHz to 6 GHz: Antenna polarization: **Vertical**

Scan Table						
Scan Start Scan Stop Scan Type Transducer	An	1.000 6.000 tenna	0000000 GHz 0000000 GHz TD Scan 3119 + cable			
Detector	Trace 1: Max Pe	eak Tra	ace 2: CISPR AV			
Start	Stop		Step Size	RBW	RF Atten Pream	p Input
Frequence 1.000	GHz 6.000	Cy GHz	250.000 kHz	1.0 MHz	10.0 dB 30.0	dB INPUT1
Peak List						
Margin Peaks			27.0 dB 5			
Trace	Frequency		Level (dBµV)	Phase	Detector	Delta Limit/dB
1	1.009250000	GHz	47.07		Positive Peak	-22.93
2	1.025000000	GHz	32.00		CISPR AV	-18.00
1	1.506000000	GHz	45.16		Positive Peak	-24.84
2	1.548000000	GHz	31.22		CISPR AV	-18.78
2	1.600000000	GHz	34.46		CISPR AV	-15.54
1	1.919250000	GHz	48.54		Positive Peak	-21.46
1	2.403750000	GHz	65.17		Positive Peak	-4.83
2	2.431250000	GHz	36.17		CISPR AV	-13.83
1	3.054500000	GHz	53.33		Positive Peak	-20.67
2	3.054750000	GHz	39.30		CISPR AV	-14.70
2	3.756500000	GHz	42.30		CISPR AV	-11.70
1	3.815250000	GHz	56.40		Positive Peak	-17.60
2	4.770500000	GHz	44.00		CISPR AV	-10.00
1	4.771500000	GHz	58.17		Positive Peak	-15.83
2	5.966750000	GHz	46.52		CISPR AV	-7.48
1	5.994500000	GHz	60.22		Positive Peak	-13.78

Scan Diagram

Scan 🛭 🗧 1Pk Max 🗨 2CA Max					
90 dBuV					
80 dBuV					
		1			
20 dp.w/					
55032,RF,1-6GHZ,PK,B.LIN	+	1			
60 dBµV					a warman and
		j	sound wind another	which when the second	,
55032.RF.1-6GHZ.AV.B.LIN	marmin	manderson	•		
Mu year all how when the advanter when the		1	Sharen	www.www.www.www.www.www.www.www.www.ww	
40 dBµV		man	X		
×. ×i		1			
30 dBµV	 	1			
		1			
		1			
10 dBuV		1			
		1			
Start 1.0 GHz	1	1		Stop	6.0 GHz

Note: Emissions in the 2.4 GHz band are part of the working frequency band, they will be disregarded from the evaluation of results.

Antenna polarization: Horizontal

Scan Table										
Scan Start			1.00	0000000 G	Hz					
Scan Stop			6.00	0000000 G	Hz					
Scan Type				TD So	can					
Transducer		An	tenna	a 3119 + ca	ıble					
Detector	Trace	1: Max Pe	eak T	race 2: CIS	SPR AV					
Start		Stop		Step Siz	ze	RBW	RF Att	en	Preamp	Input
Frequen	cy I	Frequend	су	•					•	-
1.000	GHz	6.000	GHz	250.000	kHz	1.0 MHz	10.0	dB	30.0 dE	S INPUT1

Peak List

Margin Peaks

27.0 dB 5

Trace	Frequency		Level (dBµV)	Phase	Detector	Delta Limit/dB
1	1.020500000	GHz	45.77		Positive Peak	-24.23
2	1.025750000 (GHz	31.94		CISPR AV	-18.06
2	1.548000000	GHz	31.20		CISPR AV	-18.80
1	1.550250000 (GHz	45.41		Positive Peak	-24.59
2	1.891500000 (GHz	33.89		CISPR AV	-16.11
1	1.956500000	GHz	48.27		Positive Peak	-21.73
1	2.403750000	GHz	71.96		Positive Peak	1.96
1	2.429250000	GHz	94.22		Positive Peak	24.22
2	2.429750000	GHz	43.78		CISPR AV	-6.22
2	3.054750000	GHz	39.36		CISPR AV	-14.64
1	3.057250000	GHz	53.38		Positive Peak	-20.62
2	3.756500000	GHz	42.26		CISPR AV	-11.74
1	3.816500000	GHz	56.29		Positive Peak	-17.71
1	4.719000000	GHz	59.02		Positive Peak	-14.98
2	4.770750000	GHz	44.02		CISPR AV	-9.98
1	5.914750000 (GHz	60.28		Positive Peak	-13.72
2	5.966750000 (GHz	46.53		CISPR AV	-7.47

Scan Diagram



Note: Emissions in the 2.4 GHz band are part of the working frequency band, they will be disregarded from the evaluation of results.

EUT position in test:



7.2 Conducted emission, DC power input/output ports

General description:

This test is applicable for radio equipment and ancillary equipment for fixed use that may have DC cables longer than 3 m (manufacturer's declaration) and for vehicular use irrespective of cable length. If the DC power cable of the radio and/or the ancillary equipment is less than or equal to 3 m in length, and intended for direct connection to a dedicated AC/DC power supply, then the measurement shall be performed on the AC power input port of that power supply. If the DC power cable is longer than 3 m, then the measurement shall additionally be performed on the DC power port of the radio and/or ancillary equipment.

If the DC power cable between the mobile radio and/or ancillary equipment and the dedicated DC/DC power converter is less than or equal to 3 m in length, then the measurement can be limited to the DC power input port of that power converter only. If this DC power cable is longer than 3 m, then the measurement shall additionally be performed on the DC power port of the mobile radio and/or ancillary equipment.

This test shall be performed on a representative configuration of the radio equipment, the associated ancillary equipment, or a representative configuration of the combination of radio and ancillary equipment. This test assesses the level of internally generated electrical noise present on the DC power input/output ports.

Test method:

For all radio equipment other than intended to be connected to the vehicle's onboard DC mains, the test method for AC mains power port specified in CENELEC EN 55032 shall be used.

The measurement frequency range extends from 150 kHz to 30 MHz. When the EUT is a transmitter operating at frequencies below 30 MHz, then the exclusion band for transmitters applies for measurements in the transmit mode of operation.

For emission measurements on DC output ports the relevant port shall be connected via an AMN/AN to a load drawing the rated current of the source.

Limits:

The equipment shall meet the class B limits given in the clause 8.3 of EN 301 489-1.

Alternatively, for ancillary equipment intended to be used exclusively in an industrial environment or telecommunication centres, the class A limits given in the clause 8.3 of EN 301 489-1 may be used.

Frequency range MHz	Coupling device	Detector type / bandwidth	Class A limits dB(µV)	Class B limits dB(µV)
0.15 to 0.50			79	66 to 56
0.50 to 5	AMN/AN	Quasi Peak / 9 kHz	73	56
5 to 30			73	60
0.15 to 0.50			66	56 to 46
0.50 to 5	AMN/AN	Average / 9 kHz	60	46
5 to 30			60	50

Measurement data:

Test not applicable to the EUT.

7.3 Conducted emission, AC mains input/output ports

General description:

This test is applicable for radio equipment and/or ancillary equipment for fixed use powered by the AC mains.

This test shall be performed on a representative configuration of the radio equipment, the associated ancillary equipment, or a representative configuration of the combination of radio and ancillary equipment. This test assesses the level of internally generated electrical noise present on the AC power input/output ports.

Test method:

The test method shall be in accordance with CENELEC EN 55032 and the Artificial Mains Networks (AMNs) shall be connected to the AC mains power source.

The measurement frequency range extends from 150 kHz to 30 MHz. When the EUT is a transmitter operating at frequencies below 30 MHz, then the exclusion band for transmitters applies for measurements in the transmit mode of operation.

For emission measurements on AC output ports of the EUT the relevant port shall be connected via an AMN to a load drawing the rated current of the source. In case where the AC output port is directly connected (or via a circuit breaker) to the AC power input port of the EUT the AC power output port need not to be tested.

Typical test setup:



Limits:

The equipment shall meet the class B limits given in CENELEC EN 55032.

Alternatively, for ancillary equipment intended to be used exclusively in an industrial environment or telecommunication centers, the class A limits given in CENELEC EN 55032 may be used.

Frequency range MHz	Coupling device	Detector type / bandwidth	Class A limits dB(µV)	Class B limits dB(µV)
0.15 to 0.50			79	66 to 56
0.50 to 5	AMN	Quasi Peak / 9 kHz	73	56
5 to 30			73	60
0.15 to 0.50			66	56 to 46
0.50 to 5	AMN	Average / 9 kHz	60	46
5 to 30			60	50

Measurement data:

Test location: Test room

Class B limits were applied to the evaluation of measurement.

Results of tests of conducted emission, AC mains – frequency range from 150 kHz to 30 MHz: Phase: L

Scan Table

Scan Start Scan Stop Scan Type Transducer		150.000000000 30.000000000 TD \$ PMM L	kHz MHz Scan 3-32			
		L1(16).	TDF			
Detector	Trace 1: Quas	si Peak Trace 2: (CISPR AV			
Start	Sto	p Step S	ize RBV	V RF Atten	Preamp	Input
Frequen	cy Freque	ency				
150.000	kHz 30.00	0 MHz 2.25	0 kHz 9.0	kHz 10.0 dB	0.0 dB	INPUT1

Peak List

Margin Peaks			25.0 dB			
I Cans			20			
Trace	Frequency		Level (dBµV)	Phase	Detector	Delta Limit/dB
2	152.250000000	kHz	39.20		CISPR AV	-16.68
1	154.500000000	kHz	45.80		Quasi Peak	-19.95
1	264.750000000	kHz	45.65		Quasi Peak	-15.63
2	357.000000000	kHz	32.60		CISPR AV	-16.20
1	422.25000000	kHz	39.71		Quasi Peak	-17.69
2	422.25000000	kHz	38.66		CISPR AV	-8.74
1	703.500000000	kHz	37.65		Quasi Peak	-18.35
2	703.500000000	kHz	36.05		CISPR AV	-9.95
1	1.014000000	MHz	37.29		Quasi Peak	-18.71
2	1.014000000	MHz	34.78		CISPR AV	-11.22
2	1.592250000	MHz	33.05		CISPR AV	-12.95
1	1.594500000	MHz	37.00		Quasi Peak	-19.00
2	2.175000000	MHz	32.06		CISPR AV	-13.94
1	3.025500000	MHz	38.15		Quasi Peak	-17.85
2	3.333750000	MHz	31.56		CISPR AV	-14.44
1	3.601500000	MHz	38.99		Quasi Peak	-17.01
1	6.099000000	MHz	43.04		Quasi Peak	-16.96
2	6.099000000	MHz	37.05		CISPR AV	-12.95
1	10.821750000	MHz	46.39		Quasi Peak	-13.61
2	10.824000000	MHz	45.02		CISPR AV	-4.98
1	19.151250000	MHz	46.62		Quasi Peak	-13.38
2	19.223250000	MHz	45.84		CISPR AV	-4.16
1	21.513750000	MHz	46.96		Quasi Peak	-13.04
2	21.543000000	MHz	45.92		CISPR AV	-4.08

Scan Diagram



Scan Start Scan Stop Scan Type Transduce	e r	150.000 30.0000	000000 kHz 000000 MHz TD Scan PMM L3-32 N(16).TDF				
Detector Start Freque	Trace 1: Quas t Stop ncy Freque	i Peak Tr) ncy	ace 2: CISPR Step Size	AV RBW	RF Atten	Preamp	Input
150.000) kHz 30.000) MHz	2.250 kHz	9.0 kH:	z 10.0 dB	0.0 dB	INPUT1
Peak List							
Margin Peaks			25.0 dB 25				
Trace	Frequency	0 1-11-	Level (dBµV)	Phase	Detecto	r De	elta Limit/dB
2	350 25000000	0 kHZ	34. 29	99	CIS.	PRAV	-21.29
2	449.25000000	0 kHz	29.	57	CIS	PR AV	-17.32
1	453.7500000	0 kHz	32.	26	Quasi	Peak	-24.55
2	649.5000000	0 kHz	27.	74	CISI	PR AV	-18.26
2	951.0000000	0 kHz	24.	71	CISI	PR AV	-21.29
2	1.45275000	0 MHz	21.	76	CISI	PR AV	-24.24
1	3.25950000	0 MHZ	32.	55	Quasi	Peak	-23.45
1	4.56225000	0 MHz	41.	32	Ouasi	Peak	-14.68
2	4.56225000	0 MHz	35.	02	CIS	PR AV	-10.98
1	6.09675000	0 MHz	44.	28	Quasi	Peak	-15.72
2	6.09675000	0 MHz	38.	26	CISI	PR AV	-11.74
1	10.79925000	0 MHz	45.	13	Quasi	Peak	-14.87
2	10./9925000	0 MHz	44.	69	CIS	RAV	-5.96
2	19 14450000	0 MHz	45	36	Ouasi	Peak	-14 64
1	21.44400000	0 MHz	45.	82	Quasi	Peak	-14.18
2	21.44400000	0 MHz	44.	71	CIS	PR AV	-5.29
Scan Diag	ıram						
Scan 😑 1QF	Maxo2CA Max						
80 dspyit Ch				10 M	1Hz	_	
Line 550	32,88,QP,B	PASS					
55032,SS,QP,E	3.LIN						
оо авру							
50 dBµV	S.LIN					_	
40 dBµV				the the test	Å ÅÅ	_	
ВО ОВИЛ-	* *		and the second second	m V	MAY IN	3 ₆₆	
\$0 dBµV++	MAAAAA		WWWWWWWWW			- V V	
	N M M M M M	<u>, M M M M M M M M M M M M M M M M M M M</u>	<u> </u>			_	
0 dвµv						_	
-10 dBµV						_	

Phase: N Scan Table

Result of test: PASS

Start 150.0 kHz

ł

Stop 30.0 MHz

7.4 Harmonic current emissions, AC mains input port

General description:

The appropriate requirements of CENELEC EN 61000-3-2/A1 for harmonic current emission apply for equipment with an input current up to and including 16A per phase. For equipment with an input current of greater than 16A per phase CENELEC EN 61000-3-12 applies.

Test method:

The test procedure as described in CENELEC EN 61000-3-2 or EN 61000-3-12 if applicable shall be used.

Limits:

For the purpose of harmonic current limitation, the equipment is classified according EN 61000-3-2 as follows:

Class A:

 balanced three-phase equipment; household appliances, excluding equipment identified as Class D; tools, excluding portable tools; dimmers for incandescent lamps; audio equipment.

Equipment not specified in one of the three other classes shall be considered as Class A equipment.

Class B:

- portable tools; arc welding equipment which is not professional equipment.

Class C:

lighting equipment.

Class D:

Equipment having a specified power less than or equal to 600 W, of the following types:

- personal computers and personal computer monitors;

Limits defined in chapter 7 of EN 61000-3-2 or, for the EUT of input current over 16 A per phase limits in chapter 5 of EN 61000-3-12, applies

Limits for Class A equipment							
Harmonics Order no.	Max. permissible harmonics current (A)						
Odd ha	rmonics						
3	2.30						
5	1.14						
7	0.77						
9	0.4						
11	0.33						
13	0.21						
15<=n<=39	0.15x15/n						
Even ha	rmonics						
2	1.08						
4	0.43						
6	0.30						
8<=n<=40	0.23x8/n						

Measurement data:

Test not applicable to the EUT.

7.5 Voltage fluctuations and flicker, AC mains input ports

General description:

The appropriate requirements of CENELEC EN 61000-3-3 for voltage fluctuations and flicker apply for equipment with an input current up to and including 16A per phase, if no conditional connection is needed. Where a conditional connection is required then the requirements of CENELEC EN 61000-3-11 shall apply. For equipment with an input current of greater than 16A up to and including 75A per phase CENELEC EN 61000-3-11 applies.

Test method:

All types of voltage fluctuations may be assessed by direct measurement using a flickermeter which complies with the specification given in IEC 61000-4-15:2010. This is the reference method for application of the limits.

Tests to prove the compliance of the equipment with the limits shall be made using the test conditions defined in chapter 6 of EN 61000-3-3 and EN 61000-3-11 if applicable.

Limits:

Limits defined in chapter 5 of EN 61000-3-3 or, for the EUT of input current over 16 A per phase or/and where conditional connection is needed limits defined in chapter 5 of EN 61000-3-12, applies.

Measurement data:

Spitzenberger & Spies GmbH & Co. KG Viechtach

Nama		Carial rea	
Name:		Senar no.	
Department:	317	Operating modes:	normal
Company:	TSU	Comment1:	
Test report no:	1	Comment2:	
Device:		Comment3:	
Specimen:		Comment4:	
Manufacturer:		Date:	08.02.2023
Type:		Test date:	08.02.2023
Type:		Test date:	08.02.2

Test conditions: EN 61000-3-3:2013 / 230 V / 50 Hz / Phase L1 EN 61000-4-15:2011 / Obs 12 x 1 min / Ztest (0.400+j0.250) Ohm Ra+jXa (0.2400+j0.1500) Ohm / Rn+jXn (0.1600+j0.1000) Ohm

FLICKER: Test PASS!								
Time	Pmax	Pst	Sliding Plt	Tmax [s]	dmax [%]	dc [%]	PASS	FAIL
14:46:05	0.000	0.0070		0.000	+0.000		Х	
14:47:05	0.000	0.0070		0.000	+0.000		Х	
14:48:05	0.000	0.0090		0.000	+0.000		Х	
14:49:05	0.000	0.0090		0.000	+0.000		Х	
14:50:05	0.000	0.0100		0.000	+0.000		Х	
14:51:05	0.000	0.0080	0.0085	0.000	+0.000		Х	
14:52:05	0.000	0.0080	0.0086	0.000	+0.000		Х	
14:53:05	0.000	0.0090	0.0089	0.000	+0.000		Х	
14:54:05	0.000	0.0090	0.0089	0.000	+0.000		Х	
14:55:05	0.000	0.0080	0.0087	0.000	+0.000		Х	
14:56:05	0.000	0.0090	0.0085	0.000	+0.000		Х	
14:57:05	0.000	0.0100	0.0089	0.000	+0.000		Х	
Limits:		1.000	0.650	0.500	6.000	3.300		
Plt: 0.008687 (calculated over 12 periods)								
Evaluated:	PST, PLT,	Sliding PLT	, dc, dmax, 1	Гтах				

FLICKER: Source test PASS!									
Time	Pmax	Pst	Sliding Plt	Tmax [s]	dmax [%]	dc [%]	PASS	FAIL	
14:46:05	0.000	0.0020		0.000	+0.000		Х		
14:47:05	0.000	0.0020		0.000	+0.000		Х		
14:48:05	0.000	0.0020		0.000	+0.000		Х		
14:49:05	0.000	0.0020		0.000	+0.000		Х		
14:50:05	0.000	0.0020		0.000	+0.000		Х		
14:51:05	0.000	0.0020		0.000	+0.000		Х		
14:52:05	0.000	0.0020		0.000	+0.000		Х		
14:53:05	0.000	0.0020		0.000	+0.000		Х		
14:54:05	0.000	0.0020		0.000	+0.000		Х		
14:55:05	0.000	0.0020		0.000	+0.000		Х		
14:56:05	0.000	0.0020		0.000	+0.000		Х		
14:57:05	0.000	0.0020		0.000	+0.000		Х		
Plt: 0.002000 (calculated over 12 periods)									
Evaluated	: PST <= 0.4	4 dmax <	20 % dmax1						

7.6 Conducted emission, Wired network ports

General description:

This test is applicable for radio equipment and/or ancillary equipment for fixed use which have wired network ports.

This test shall be performed on a representative configuration of the radio equipment, the associated ancillary equipment, or a representative configuration of the combination of radio and ancillary equipment.

This test assesses the level of unwanted emissions present at the wired network ports.

Test method:

The test method shall be in accordance with CENELEC EN 55032.

The measurement frequency range extends from 150 kHz to 30 MHz. When the EUT is a transmitter operating at frequencies below 30 MHz, then the exclusion band for transmitters applies for measurements in the transmit mode of operation.

Limits:

The wired network ports shall meet the class B limits given in CENELEC EN 55032.

Alternatively, for equipment intended to be used exclusively in an industrial environment or telecommunication centres, the class A limits given in CENELEC EN 55032 may be used.

Frequency range MHz	Coupling device	Detector type / bandwidth	Class A limits dB(µV)	Class B limits dB(µV)
0.15 to 0.50	0.0 N		97 to 87	84 to 74
0.50 to 30	AAN		87	74
0.15 to 0.50	0.0.NI		84 to 74	74 to 64
0.50 to 30	AAN	Average / 9 kHz	74	64

Measurement data:

Test location: Test room

Class B limits were applied to the evaluation of measurement.

Results of tests of conducted emission, wired network ports – frequency range from 150 kHz to 30 MHz: Port: LAN

Scan Tab	le					
Scan Star Scan Stop Scan Type Transduce	t 1. b 3 e er	50.00000 30.000000 ISI	0000 kHz 0000 MHz TD Scan N T8.TDF			
Detector Star	Trace 1: Quasi F t Stop	Peak Trac S f	e 2: CISPR AV tep Size	, RBW	RF Atten Pream	ip Input
Freque 150.00	ncyFrequenc0 kHz30.000	Y MHz 2	2.250 kHz	9.0 kHz	10.0 dB 0.0	dB INPUT1
Peak List						
Margin Peaks			30.0 dB 25			
Trace	Frequency	Le	evel (dBµV)	Phase	Detector	Delta Limit/dB
1	192.75000000	kHz	66.50		Quasi Peak	-15.42
2	192.750000000	kHz	61.23		CISPR AV	-10.69
1	300.750000000	kHz	70.43		Quasi Peak	-7.79
2	300.750000000	kHz	65.30		CISPR AV	-2.92
1	483.00000000	kHz	64.75		Quasi Peak	-9.54
2	485.25000000	kHz	61.78		CISPR AV	-2.47
1	615.750000000	kHz	64.51		Quasi Peak	-9.49
2	615.750000000	kHz	63.59		CISPR AV	-0.41
1	1.036500000	MHz	63.81		Quasi Peak	-10.19
2	1.036500000	MHz	62.11		CISPR AV	-1.89
1	1.421250000	MHz	63.08		Quasi Peak	-10.92
2	1.587750000	MHz	59.05		CISPR AV	-4.95
2	2.20200000	MHz	55.64		CISPR AV	-8.36
1	2.818500000	MHz	59.23		Quasi Peak	-14.77
2	4.422750000	MHz	55.96		CISPR AV	-8.04
1	4.425000000	MHz	59.51		Quasi Peak	-14.49
1	7.359000000	MHz	67.10		Quasi Peak	-6.90
2	7.359000000	MHz	63.90		CISPR AV	-0.10
1	9.674250000	MHz	56.21		Quasi Peak	-17.79
2	9.674250000	MHz	54.86		CISPR AV	-9.14
1	13.506000000	MHz	48.72		Quasi Peak	-25.28
2	13.508250000	MHz	43.70		CISPR AV	-20.30
2	27.012750000	MHz	40.74		CISPR AV	-23.26

Scan Diagram



8 IMMUNITY TESTS DESCRIPTION AND RESULTS

8.1 Radio frequency electromagnetic field (80 MHz to 6 000 MHz)

General description:

This test is applicable for radio equipment and associated ancillary equipment. This test shall be performed on a representative configuration of the radio equipment, the associated ancillary equipment, or a representative configuration of the combination of radio and ancillary equipment. This test assesses the ability of the EUT to operate as intended in the presence of a radio frequency electromagnetic field disturbance.

Test method:

The test method shall be in accordance with CENELEC EN 61000-4-3.

The following requirements and evaluation of test results shall apply:

- the test level shall be 3 V/m (measured unmodulated). The test signal shall be amplitude modulated to a depth of 80 % by a sinusoidal audio signal of 1 000 Hz. If the wanted signal is modulated at 1 000 Hz, then an audio signal of 400 Hz shall be used;
- the test shall be performed over the frequency range 80 MHz to 6000 MHz with the exception of the exclusion band for transmitters, receivers and duplex transceivers, as appropriate;
- for receivers and transmitters the stepped frequency increments shall be 1 % frequency increment of the momentary used frequency;
- the dwell time of the test phenomena at each frequency shall not be less than the time necessary for the EUT to be exercised and to be able to respond.
- the frequencies selected and used during the test shall be recorded in the test report.



Example of suitable test facility

Performance criteria:

For transmitters the performance criteria for continuous phenomena (see chap. 5) for transmitters shall apply.

For receivers the performance criteria for continuous phenomena for receivers shall apply. For ancillary equipment the pass/failure criteria supplied by the manufacturer shall apply, unless the ancillary equipment is tested in connection with a receiver or transmitter in which case the corresponding performance criteria above shall apply.

Measurement data:

Test specifications:

Test location	Semi anechoic chamber with floor absorbers
Frequency band (MHz)	80 to 6000 (*)
Test signal level (V/m)	3
Exclusion Bands – multi-mode (MHz)	(see chap. 4.5)
Frequency step	1%
Dwell time	1 s
Performance criterion	A

Test results:

		Test results / EUT side exposure results				
Frequency range (MHz)	Antenna polarization	Front	Back	Left	Right	
80 - 1000	V	PASS	PASS	PASS	PASS	
1000 - 6000 (*)	V	PASS	PASS	PASS	PASS	
80 - 1000	Н	PASS	PASS	PASS	PASS	
1000 - 6000 (*)	Н	PASS	PASS	PASS	PASS	

Note (*): The exclusion bands are applicable in this frequency range.

8.2 Electrostatic discharge

General description:

This test is applicable for radio equipment and associated ancillary equipment. This test shall be performed on a representative configuration of the radio equipment, the associated ancillary equipment, or a representative configuration of the combination of radio and ancillary equipment. This test assesses the ability of the EUT to operate as intended in the event of an electrostatic discharge.

Test method:

The test method shall be in accordance with CENELEC EN 61000-4-2.

For radio equipment and ancillary equipment the following requirements and evaluation of test results shall apply.

The test severity level for contact discharge shall be ± 4 kV and for air discharge ± 8 kV. All other details, including intermediate test levels, are contained within CENELEC EN 61000-4-2.

Electrostatic discharges shall be applied to all exposed surfaces of the EUT except where the user documentation specifically indicates a requirement for appropriate protective measures.



Example of test set-up for table-top equipment, laboratory tests:

Performance criteria:

For transmitters the performance criteria for transient phenomena (see chap. 5) for transmitter shall apply. For receivers the performance criteria for transient phenomena for receivers shall apply. For ancillary equipment the pass/failure criteria supplied by the manufacturer shall apply, unless the ancillary equipment is tested in connection with a receiver or transmitter in which case the corresponding performance criteria above shall apply.

Measurement data:

The EUT was tested as a table top device.

Test s	pecifications	and	results
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Discharge type	Discharge level (kV)	Discharge location	Number of discharges per location for each polarity (number of locations)	Performance criterion	Test result
Direct air discharge	±8	Non metallic parts	10 (17)	В	PASS
Direct contact discharge	±4	Metallic parts	10 (9)	В	PASS
Indirect contact discharge	±4	HCP - Front	10	В	PASS
Indirect contact discharge	±4	HCP - Left	10	В	PASS
Indirect contact discharge	±4	HCP - Right	10	В	PASS
Indirect contact discharge	±4	HCP - Rear	10	В	PASS
Indirect contact discharge	±4	VCP - Front	10	В	PASS
Indirect contact discharge	±4	VCP - Left	10	В	PASS
Indirect contact discharge	±4	VCP - Right	10	В	PASS
Indirect contact discharge	±4	VCP - Rear	10	В	PASS

Note: The EUT was without exposed conductive surfaces.

HCP - Horizontal coupling plane

VCP - Vertical coupling plane

Points of ESD Test:



Air discharge Contact discharge





8.3 Fast transients, common mode

General description:

This test shall be performed on the AC mains power port (if any) of radio equipment and associated ancillary equipment.

This test shall be additionally performed on signal ports, wired network ports, control ports, and DC power ports, of radio equipment and associated ancillary equipment, if the cables may be longer than 3 m. Where this test is not carried out on any port because the manufacturer declares that it is not intended to be used with cables longer than 3 m, a list of ports, which were not tested for this reason, shall be included in the test report.

This test shall be performed on a representative configuration of the radio equipment or a representative configuration of the combination of radio and ancillary equipment.

This test assesses the ability of the EUT to operate as intended in the event of fast transients present on one of the input/output ports.

Test method:

The test method shall be in accordance with CENELEC EN 61000-4-4.

The following requirements and evaluation of test results shall apply:

- the test level for signal ports, wired network ports (excluding xDSL), and control ports shall be 0.5 kV open circuit voltage at a repetition rate of 5 kHz as given in CENELEC EN 61000-4-4;
- the test level for xDSL wired network ports shall be 0.5 kV open circuit voltage at a repetition rate of 100 kHz as given in CENELEC EN 61000-4-4;
- the test level for DC power input ports shall be 0.5 kV open circuit voltage at a repetition rate of 5 kHz as given CENELEC EN 61000-4-4;
- the test level for AC mains power input ports shall be 1 kV open circuit voltage at a repetition rate of 5 kHz as given CENELEC EN 61000-4-4

Performance criteria:

For transmitters the performance criteria (see chap. 5) for transient phenomena for transmitter shall apply. For receivers the performance criteria for transient phenomena for receivers shall apply. For ancillary equipment the pass/failure criteria supplied by the manufacturer shall apply, unless the ancillary equipment is tested in connection with a receiver or transmitter in which case the corresponding performance criteria shall apply.

Measurement data:

Direct coupling with a Coupling/Decoupling Network

Impulse	Level	Coupling	Required criteria	Test result
5/50 ns	±1.0 kV	L1	В	PASS
5/50 ns	±1.0 kV	Ν	В	PASS
5/50 ns	±1.0 kV	L1-N	В	PASS

8.4 Radio frequency, common mode

General description:

This test shall be performed on the AC mains power port (if any) of radio equipment and associated ancillary equipment.

This test shall be additionally performed on signal ports, wired network ports, control ports, and DC power ports, of radio equipment and associated ancillary equipment, if the cables may be longer than 3 m. Where this test is not carried out on any port because the manufacturer declares that it is not intended to be used with cables longer than 3 m, a list of ports, which were not tested for this reason, shall be included in the test report.

This test shall be performed on a representative configuration of the radio equipment, the associated ancillary equipment, or a representative configuration of the combination of radio and ancillary equipment. This test assesses the ability of the EUT to operate as intended in the presence of a radio frequency disturbance on the input/output ports.

Test method:

The test method shall be in accordance with CENELEC EN 61000-4-6.

The following requirements and evaluation of test results shall apply:

- the test level shall be severity level 2 as given in CENELEC EN 61000-4-6 corresponding to 3 V rms unmodulated. The test signal shall then be amplitude modulated to a depth of 80 % by a sinusoidal audio signal of 1 000 Hz. If the wanted signal is modulated at 1 000 Hz, then the test signal of 400 Hz shall be used;
- the test shall be performed over the frequency range 150 kHz to 80 MHz with the exception of an exclusion band for transmitters, and for receivers and duplex transceivers;
- for receivers and transmitters the stepped frequency increments shall be 1 % frequency increment of the momentary frequency in the frequency range 150 kHz to 80 MHz;
- the injection method to be used shall be selected according to the basic standard CENELEC EN 61000-4-6;
- responses on receivers or receiver parts of transceivers occurring at discrete frequencies which are narrow band responses (spurious responses), are disregarded from the test;
- the dwell time of the test phenomena at each frequency shall not be less than the time necessary for the EUT to be exercised and to be able to respond;
- the frequencies of the immunity test signal selected and used during the test shall be recorded in the test report.

Typical test setup:



Performance criteria:

For transmitters the performance criteria for (see chap. 5) transient phenomena for transmitter shall apply. For receivers the performance criteria for transient phenomena for receivers shall apply. For ancillary equipment the pass/failure criteria supplied by the manufacturer shall apply, unless the ancillary equipment is tested in connection with a receiver or transmitter in which case the corresponding performance criteria shall apply.

Test severity levels:

Level	Voltage Level (EMF)	
1	1 V	
2	3 V	
3	10 V	
x	Specified	

NOTE:

• x is an open class. This level can be specified in the product specification.

Measurement data:

Test no.1 Specifications: input port					
Test levels and limits defined according to standard 301 489-1 V2.2.3 – AC power port					
Frequency - range :	0.15 MHz - 80 MHz				
Voltage level (EMF) :	□ 1V ⊠ 3V □ 10V □ x				
Modulation :	AM : 80 % / sinus 1000Hz				
Frequency step :	1 %				
Dwell time :	3 sec.				
Cable description :	AC power line 230 VAC				
Test specification :	Coupling with Coupling/Decoupling Network (CDN) or Electromagnetic Injection Clamp				
Coupling via :	CDN M2/M3				
Screening :	Unscreened				
Status :	Active				
Signal transmission :	Analog				
Test result					
The requirements are :	FULFILLED				
Performance required criterion	A				
Performance observed criterion :	A				
Remarks: :	No failure according to the performance criteria in the used standard was observed during or after the test.				

8.5 Transients and surges in the vehicular environment

General description:

These tests are applicable to radio and ancillary equipment intended for vehicular use.

These tests shall be performed on nominal 12V and 24V DC supply voltage input ports of mobile radio and ancillary equipment, which are also intended for mobile use in vehicles.

These tests shall be performed on a representative configuration of the mobile radio equipment, the associated ancillary equipment, or a representative configuration of the combination of radio and ancillary equipment.

These tests assess the ability of the EUT to operate as intended in the event of transients and surges present on their DC power input ports in a vehicular environment.

Test method:

The test method shall be in accordance with ISO 7637-2 for 12V DC and 24V DC powered equipment. The test method shall be in accordance with ISO 7637-2, applying pulses 1, 2a, 2b, 3a, 3b, and 4, using immunity test level III. For the purpose of EMC testing it is sufficient to apply pulses 1, 2a, 2b and 4, 10 times each, and apply the test pulses 3a and 3b for 20 minutes each.

Performance criteria:

For transmitters, pulse 3a and 3b the performance criteria for continuous phenomena for transmitters shall apply.

For pulse 1, 2a, 2b, and 4 the performance criteria for transient phenomena for transmitter shall apply, with the exception that a communication link need not to be maintained during the EMC exposure and may have to be re-established.

For receivers, pulse 3a and 3b the performance criteria for continuous phenomena for receivers shall apply.

For pulse 1, 2a, 2b, and 4 the performance criteria for transient phenomena for receivers shall apply, with the exception that a communication link need not to be maintained during the EMC exposure and may have to be re-established.

For ancillary equipment the pass/failure criteria supplied by the manufacturer shall apply, unless the ancillary equipment is tested in connection with the radio equipment in which case the corresponding performance criteria above shall apply.

Measurement data:

Test not applicable to the EUT.

8.6 Voltage dips and interruptions

General description:

This test shall be performed on the AC mains power port (if any) of radio equipment and associated ancillary equipment.

These tests shall be performed on a representative configuration of the radio equipment, the associated ancillary equipment, or a representative configuration of the combination of radio and ancillary equipment. These tests assess the ability of the EUT to operate as intended in the event of voltage dips and interruptions present on the AC mains power input ports.

Test method:

The following requirements and evaluation of test results shall apply.

The test method shall be in accordance with CENELEC EN 61000-4-11 or for equipment requiring a mains current of greater than 16 A CENELEC EN 61000-4-34 shall be used.

The test levels shall be:

- voltage dip: 0 % residual voltage for 0.5 cycle;
- voltage dip: 0 % residual voltage for 1 cycle;
- voltage dip: 70 % residual voltage for 25 cycles (at 50 Hz);
- voltage interruption: 0 % residual voltage for 250 cycles (at 50 Hz).

Performance criteria:

For a voltage dip the following performance criteria apply:

- for transmitters the performance criteria for transient phenomena for transmitter shall apply (see clause 6 of the relevant part of ETSI EN 301 489 series dealing with the particular type of radio equipment);
- for receivers the performance criteria for transient phenomena for receiver shall apply (see clause 6 of the relevant part of ETSI EN 301 489 series dealing with the particular type of radio equipment);
- for ancillary equipment the pass/failure criteria supplied by the manufacturer (see clause 6.4) shall apply, unless the ancillary equipment is tested in connection with a receiver or transmitter in which case the corresponding performance criteria above shall apply.

For a voltage interruption the following performance criteria apply:

- in the case where the equipment is fitted with or connected to a battery back-up, the performance criteria for transient phenomena for transmitters or for receivers shall apply (see clause 6 of the relevant part of ETSI EN 301 489 series dealing with the particular type of radio equipment);
- in the case where the equipment is powered solely from the AC mains supply (without the use of a parallel battery back-up) volatile user data may have been lost and if applicable the communication link need not to be maintained and lost functions should be recoverable by user or operator;
- no unintentional responses shall occur at the end of the test;
- in the event of loss of function(s) or in the event of loss of user stored data, this fact shall be recorded in the test report;
- for ancillary equipment the pass/failure criteria supplied by the manufacturer (see clause 6.4) shall apply, unless the ancillary equipment is tested in connection with a receiver or transmitter in which case the corresponding performance criteria above shall apply.

Supply voltage	Frequency	Time of dips	Ratio of dips	Required criteria	Test result
230 V	50 Hz	10 ms	0 %	В	PASS
230 V	50 Hz	20 ms	0 %	В	PASS
230 V	50 Hz	500 ms	70 %	С	PASS
230 V	50 Hz	5000 ms	0 %	С	PASS

Measurement data:

8.7 Surges

General description:

This test shall be performed on the AC mains power input port (if any) of radio equipment and associated ancillary equipment.

This test shall be additionally performed on wired network ports, if any.

These tests shall be performed on a representative configuration of the radio equipment, the associated ancillary equipment, or a representative configuration of the combination of radio and ancillary equipment. These tests assess the ability of the EUT to operate as intended in the event of surges present on the AC mains power input ports and wired network ports.

Test method:

The test method shall be in accordance with CENELEC EN 61000-4-5.

The requirements and evaluation of test results given in clause 9.8.2.1 of EN 301 489-1 (wired network ports, outdoor cables), clause 9.8.2.2 of EN 301 489-1 (wired network ports, indoor cables) and clause 9.8.2.3 of EN 301 489-1 (mains ports) shall apply, but no test shall be required where normal functioning cannot be achieved, because of the impact of the CDN on the EUT.

Test method for mains ports:

The test level for ac mains power input ports shall be 2 kV line to ground, and 1 kV line to line, with the output impedance of the surge generator as given in CENELEC EN 61000-4-5 [5]. In telecom centres 1 kV line to ground and 0.5 kV line to line shall be used.

The test generator shall provide the 1.2/50 µs pulse as defined in CENELEC EN 61000-4-5 [5].

Performance criteria:

For transmitters the performance criteria for transient phenomena for transmitters shall apply (see clause 6 of the relevant part of ETSI EN 301 489 series [i.13] dealing with the particular type of radio equipment). For receivers the performance criteria for transient phenomena for receivers shall apply (see clause 6 of the relevant part of ETSI EN 301 489 series [i.13] dealing with the particular type of radio equipment). For ancillary equipment the pass/failure criteria supplied by the manufacturer (see clause 6.4) shall apply, unless the ancillary equipment is tested in connection with a receiver or transmitter in which case the corresponding performance criteria above shall apply.

Measurement data:

AC power port:

Pulse	Voltage	Coupling	Required criteria	-	Fest resulf	ts - polarit	y
1 0,00	Voltago			0°	90°	180°	270°
1.2/50 µs	±1.0 kV	L1-N	В	PASS	PASS	PASS	PASS

9 IMMUNITY TESTS ACCORDING TO EN IEC 61000-6-2 DESCRIPTION AND RESULTS

9.1 Radio-frequency electromagnetic field

Testing provided according to standard EN IEC 61000-4-3:2020.

Severity levels for the radio-frequency electromagnetic field test defined according to standard EN IEC 61000-6-2:2019.

Typical test setup:



Test location: Semi anechoic chamber with floor absorbers

Test severity levels:

Level	Voltage Level (EMF)
1	1 V/m
2	3 V/m
3	10 V/m
x	Specified

Note:

• x is an open class. This level can be specified in the product specification.

Measurement data:

Modulation: AM 80%, 1kHz sine wave, Dwell time: 1000ms Frequency step size: 1% of preceding frequency value Test location: Anechoic chamber, Distance of antenna – EUT: 3.0m					
Frequency (MHz)	Antenna polarization	Face	Fieldstrength	Required criteria	Result
80 ÷ 1000	Vertical	Front	10 V/m	А	PASS
80 ÷ 1000	Vertical	Rear	10 V/m	A	PASS
80 ÷ 1000	Vertical	Left side	10 V/m	A	PASS
80 ÷ 1000	Vertical	Right side	10 V/m	A	PASS
80 ÷ 1000	Horizontal	Front	10 V/m	A	PASS
80 ÷ 1000	Horizontal	Rear	10 V/m	A	PASS
80 ÷ 1000	Horizontal	Left side	10 V/m	A	PASS
80 ÷ 1000	Horizontal	Right side	10 V/m	A	PASS

Remarks: No failure according the to performance criteria in the used standard was observed during or after the test in the each of the operation mode.

Modulation: AM 80%, 1kHz sine wave, Dwell time: 1000ms Frequency step size: 1% of preceding frequency value Test location: Anechoic chamber. Distance of antenna – EUT: 3.0m					
Frequency (GHz)	Antenna polarization	Face	Fieldstrength	Required criteria	Result
1.4 ÷ 6.0	Vertical	Front	3 V/m	А	PASS
1.4 ÷ 6.0	Vertical	Rear	3 V/m	А	PASS
1.4 ÷ 6.0	Vertical	Left side	3 V/m	А	PASS
1.4 ÷ 6.0	Vertical	Right side	3 V/m	А	PASS
1.4 ÷ 6.0	Horizontal	Front	3 V/m	А	PASS
1.4 ÷ 6.0	Horizontal	Rear	3 V/m	А	PASS
1.4 ÷ 6.0	Horizontal	Left side	3 V/m	А	PASS
1.4 ÷ 6.0	Horizontal	Right side	3 V/m	А	PASS

Remarks: No failure according to the performance criteria in the used standard was observed during or after the test in the each of the operation mode.

9.2 Electrostatic discharge

Testing provided according to EN 61000-4-2:2009.

Severity levels for the electrostatic discharge immunity test defined according to standard EN IEC 61000-6-2:2019.

Typical test setup:



Test severity levels:

Contact discharge		Air Discharge		
Level	Test voltage (kV)	Level	Test voltage (kV)	
1	±2	1	±2	
2	±4	2	±4	
3	±6	3	±8	
4	±8	4	±15	
x	Specified	x	Specified	

Note:

• x is an open class. This level can be specified in the product specification.

Measurement data:

The EUT was tested as a table top device.

Test s	pecifications	and	results
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Discharge type	Discharge level (kV)	Discharge location	Number of discharges per location for each polarity (number of locations)	Performance criterion	Test result
Direct air discharge	±8	Non metallic parts	10 (17)	В	PASS
Direct contact discharge	±4	Metallic parts	10 (9)	В	PASS
Indirect contact discharge	±4	HCP - Front	10	В	PASS
Indirect contact discharge	±4	HCP - Left	10	В	PASS
Indirect contact discharge	±4	HCP - Right	10	В	PASS
Indirect contact discharge	±4	HCP - Rear	10	В	PASS
Indirect contact discharge	±4	VCP - Front	10	В	PASS
Indirect contact discharge	±4	VCP - Left	10	В	PASS
Indirect contact discharge	±4	VCP - Right	10	В	PASS
Indirect contact discharge	±4	VCP - Rear	10	В	PASS

Note: The EUT was without exposed conductive surfaces.

HCP - Horizontal coupling plane

VCP - Vertical coupling plane

Points of ESD Test:



Air discharge Contact discharge



9.3 Fast transients

Testing provided according to standard EN 61000-4-4:2012.

Severity levels for fast transients immunity test defined according to standard EN IEC 61000-6-2:2019.

Typical test setup:



Test severity levels:

The following test severity levels are recommended for the fast transient/burst test:

Open circuit output test voltage ± 10%				
Level	Level On Power Supply On I/O signal, data and			
1	0.50 kV	0.25 kV		
2	1.0 kV	0.50 kV		
3	2.0 kV	1.0 kV		
4	4.0 kV	2.0 kV		
x	Specified	Specified		

Note:

• x is an open class. This level can be specified in the product specification.

Measurement data:

Parameters of the test pulses:

<u> </u>	
Frequency :	5 kHz
Spikes :	15 ms
Repetition rate :	300 ms
No of groups :	6
Mains synchronisation :	asynchronous

The input power test facilities of the pulses were applied to one level of severity, with the voltage according to the table below for each mode of operation of the measured device.

Test was applied to the sample in each of the operation modes.

AC power port

Impulse	Level	Coupling	Required criteria	Result
5/50 ns	±2.0 kV	L1	В	PASS
5/50 ns	±2.0 kV	Ν	В	PASS
5/50 ns	±2.0 kV	L1-N	В	PASS

9.4 Radio-frequency common mode

Testing provided according to standard EN 61000-4-6:2014.

Severity levels for the conducted disturbances immunity test defined according to standard EN IEC 61000-6-2:2019.

Typical test setup:



Test location: Test room

Test severity levels:

Level	Voltage Level (EMF)
1	1 V
2	3 V
3	10 V
x	Specified

NOTE:

• x is an open class. This level can be specified in the product specification.

Measurement data:

Test was applied to sample in each of the operation modes.

Parameters of the test pulses:

Test no.1 Specifications: input port				
Test levels and limits defined according to standard EN IEC 61000-6-2:2019: AC power port				
Frequency - range :	0.15 MHz - 80 MHz			
Voltage level (EMF) :	□ 1V □ 3V ⊠ 10V □ x			
Modulation :	AM : 80 % / sinus 1000Hz			
Frequency step :	1 %			
Dwell time :	1 s			
Cable description :	AC power line 230 VAC			
Test specification :	Coupling with Coupling/Decoupling Network (CDN) or Electromagnetic Injection Clamp			
Coupling via :	CDN M2/M3			
Screening :	Unscreened			
Status :	Active			
Signal transmission :	Analog			
Length :	3.0 m			
Test result				
The requirements are :	FULFILLED			
Performance required criterion	A			
Result :	PASS			
Remarks: :	No failure according to the performance criteria in the used standard was observed during or after the test.			

No.	Name	Level start/stop [V]	Frequency start/stop [MHz]	Frequency step	Dwelltime [s]	Pausetime [s]	Modulation
1.	Level III	10.00 10.00	0.150 80.000	1.0 %	1.0	0.0	AM 1kHz 80%

9.5 Power-frequency magnetic field

Testing provided according to standard EN 61000-4-8:2010.

Severity levels for the conducted disturbances immunity test defined according to standard EN IEC 61000-6-2:2019.

Typical test setup:



Test severity levels:

Level	Magnetic field strength (A/m)
1	1
2	3
3	10
4	30
5	100
x	special

NOTE - x is an open class. This level can be specified in the product specification.

Measurement data:

Test not applicable to the EUT.

9.6 Voltage dips, short interruptions and voltage variations immunity tests

Testing provided according to standard EN IEC 61000-4-11:2020/AC:2020-06.

Severity levels for the voltage dips, short interruptions and voltage variations immunity test defined according to standard EN IEC 61000-6-2:2019.

Measurement data:

For each mode and for each type dips were applied five sequence dips. Period between dips was 20 sec.

Test specifications: Normal mode

Time of dips (ms)	Ratio of dips	Required criteria	Result	
20	0 %	В	PASS	
200	40 %	С	PASS	
500	70 %	С	PASS	
5000	0 %	С	PASS	

9.7 Surges, line-to-line and line-to-earth

Testing provided according to standard EN 61000-4-5:2014/A1:2017.

Severity levels for surge - immunity test defined according to standard EN IEC 61000-6-2:2019.

Test severity levels:

The following test severity levels are recommended for the surge immunity test:

Level	Open circuit output test voltage ± 10%		
1	0.5 kV		
2	1.0 kV		
3	2.0 kV		
4	4.0 kV		
x	Specified		

NOTE:

• x is an open class. This level can be specified in the product specification.

Result of test:

Test was applied to sample in the each of the operation mode.

Parameters of the test pulses:

Type of the wave :	1.2/50 μs
Output impedance :	2Ω for coupling between live wires 12 Ω for coupling between live wire and earthing
No of pulse :	5 for each coupling, polarity and voltage
Repetition rate :	60 s
Synchronisation contact discharges :	asynchronous / 0°; 90°; 180°; 270°;

Test levels and limits defined according to standard EN IEC 61000-6-2:2019.

AC power port

Pulse	Voltage	Coupling	Required criteria		Result -	polarity	
	, energe	000p9		0°	90°	180°	270°
1.2/50 µs	±1.0 kV	L1-N	В	PASS	PASS	PASS	PASS

10 MEASUREMENT UNCERTAINTIES

The measurement uncertainties are based on a 95% confidence level (based on the coverage factor k = 2) and calculated according to CISPR 16-4 and internal document 2017/1/316/NM of TSÚ Piešťany, š.p. The recorded value of measurement uncertainty is, for each measurement result, equal to or lower than the values required by the test-related standard.

If there are some measured values of the tested parameters in the measurement uncertainty band with their respective limits, there is the possibility that this sample or similar, selected out of production, may not meet the required limit if tested by another laboratory.

Uncertainty		
Conducted RF emissions	< 3.36 dB	
Radiated RF emissions	< 5.71 dB	
Harmonic current emissions EN 61000-3-2	< 5 %	
Voltage fluctuations and flicker EN 61000-3-3	< 8 %	
Electrostatic discharge EN 61000-4-2	< 0.3 kV for ± 4 kV < 0.4 kV for ± 8 kV < 0.6 kV for ± 15 kV	
Radio frequency electromagnetic field EN 61000-4-3	< 1.67 dB	
Electrical fast transients and bursts EN 61000-4-4	Pulse rise time	< 6.2 %
	Peak voltage level	8.64 % (related to 3.75 kV)
	Pulse width	< 5.9 %
Surges EN 61000-4-5	Pulse rise time	< 13.3 %
	Peak voltage level	8.63 % (related to 3.85 kV)
	Pulse width	< 5.9 %
Radio frequency conducted disturbance EN 61000-4-6	< 1.25 dB	
Voltage dips and interruptions EN 61000-4-11	< 3 dB	

11 PHOTOGRAPHS TAKEN DURING TESTING

EUT:



iMX8M Development Baseboard top:



iMX8M Development Baseboard bottom:



iMX8M Industrial Module top:

iMX8M Industrial Module bottom:



EUT in anechoic chamber, radiated emissions test:





EUT in anechoic chamber, radiated immunity test:





AE1 – Power Supply 5V 40W AC/DC Adapter:

