

cetecom
advanced

TEST REPORT

Test report no.: 1-7199-23-01-03_TR1-R02



Testing laboratory

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Accredited Testing Laboratory:

The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2018-03) by the Deutsche Akkreditierungsstelle GmbH (DAkkS).

The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number:

D-PL-12047-01-00.

ISED Testing Laboratory Recognized Listing Number: DE0001

FCC designation number: DE0002

Applicant

Kistler Instrumente AG

Eulachstrasse 22
8408 Winterthur / SWITZERLAND

Phone: +41 52-224 11 11

Contact: Christian Gerber

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Manufacturer

Kistler Instrumente AG

Eulachstrasse 22
8408 Winterthur / SWITZERLAND

Test standard/s

FCC - Title 47 CFR Part 15 FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices

RSS - 216 Issue 3 Wireless Power Transfer Devices

RSS - Gen Issue 5 incl. Amendment 1 & 2 Spectrum Management and Telecommunications Radio Standards Specification - General Requirements for Compliance of Radio Apparatus

For further applied test standards please refer to section 3 of this test report.

Test Item

Kind of test item: Telemetric Measurement System (TMS)

Model name: TMS Base unit

FCC ID: 2AWIT-5290A

ISED certification number: 28487-5290A

Frequency: min. 114 kHz | max. 131 kHz

Technology tested: WPT

Antenna: Integrated coil antenna

Power supply: 36 V to 57 V DC, through PoE

Temperature range: -20°C to +65°C

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

Test report authorized:

on behalf of

Christoph Schneider
Lab Manager
Radio Labs

Test performed:

Hans-Joachim Wolsdorfer
Lab Manager
Radio Labs

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2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. cetecom advanced GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

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This test report replaces the test report with the number 1-7199-23-01-03_TR1-R01 and dated 2025-01-28.

2.2 Application details

Date of receipt of order:	2024-04-19
Date of receipt of test item:	2024-01-10
Start of test:*	2025-01-13
End of test:*	2025-01-15
Person(s) present during the test:	Mr. Odermatt Mr. Gerber

*Date of each measurement, if not shown in the plot, can be requested. Dates are stored in the measurement software.

2.3 Test laboratories sub-contracted

None

3 Test standard/s, references and accreditations

Test standard	Date	Description
FCC - Title 47 CFR Part 15		FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 216 Issue 3	2024-09	Wireless Power Transfer Devices
RSS - Gen Issue 5 incl. Amendment 1 & 2	February 2021	Spectrum Management and Telecommunications Radio Standards Specification - General Requirements for Compliance of Radio Apparatus
Guidance	Version	Description
ANSI C63.10-2020	-/-	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
ANSI C63.30-2021		American National Standard of Methods of Measurements of Radio-Frequency Emissions from Wireless Power Transfer Equipment

4 Reporting statements of conformity – decision rule

Only the measured values related to their corresponding limits will be used to decide whether the equipment under test meets the requirements of the test standards listed in chapter 3.

The measurement uncertainty is mentioned in this test report, see chapter 9, but is not taken into account - neither to the limits nor to the measurement results. Measurement results with a smaller margin to the corresponding limits than the measurement uncertainty have a potential risk of more than 5% that the decision might be wrong."

measured value, measurement uncertainty, verdict



5 Test environment

Temperature	:	T_{nom}	+22 °C during room temperature tests
		T_{max}	+65 °C during high temperature tests
		T_{min}	-20 °C during low temperature tests*
Relative humidity content	:		52 %
Barometric pressure	:		1021 hpa
Power supply	:	V_{nom}	48 V DC, through PoE
		V_{max}	57 V
		V_{min}	36 V

* frequency stability test has been carried out with -20°C

6 Test item

6.1 General description

Kind of test item	:	Telemetric Measurement System (TMS)
Model name	:	TMS Base unit
HMN	:	-/-
PMN	:	TMS Base unit
HVIN	:	5290A
FVIN	:	1.0
S/N serial number	:	6464402
Hardware status	:	A
Software status	:	1.0
Firmware status	:	1.0
Frequency band	:	min. 114 kHz max. 131 kHz
Type of radio transmission	:	modulated carrier
Use of frequency spectrum	:	
Type of modulation	:	PSK
Number of channels	:	1
Antenna	:	Integrated coil antenna
Power supply	:	36 V to 57 V DC, through PoE
Temperature range	:	-20°C to +65°C

6.2 Additional information

The content of the following annexes is defined in the QA. It may be that not all of the listed annexes are necessary for this report, thus some values in between may be missing.

Test setup and EUT photos are included in test report:

1-7199-23-01-01_TR1-A101-R01
1-7199-23-01-01_TR1-A102-R01
1-7199-23-01-01_TR1-A104-R01

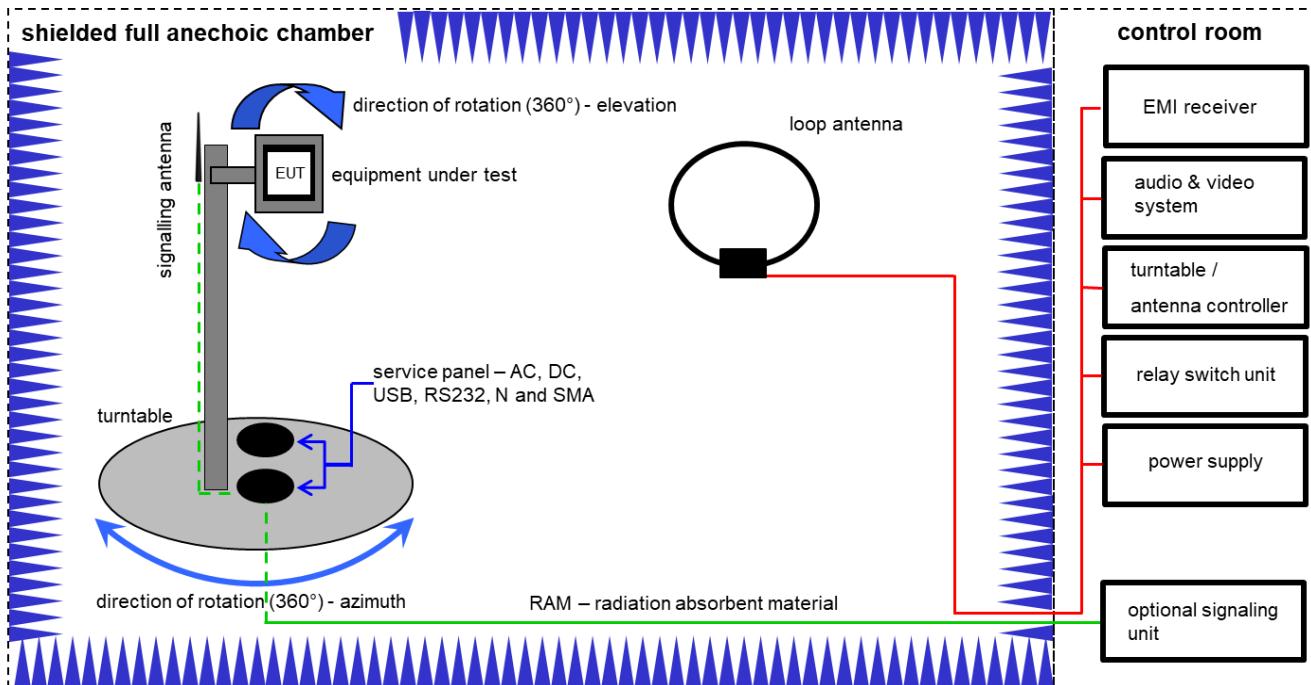
7 Description of the test setup

Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, RF generating and signaling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

Each block diagram listed can contain several test setup configurations. All devices belonging to a test setup are identified with the same letter syntax. For example: Column Setup and all devices with an A.

7.1 Shielded fully anechoic chamber



Measurement distance: loop antenna 3 meter

FS = UR + CA + AF

(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

Example calculation:

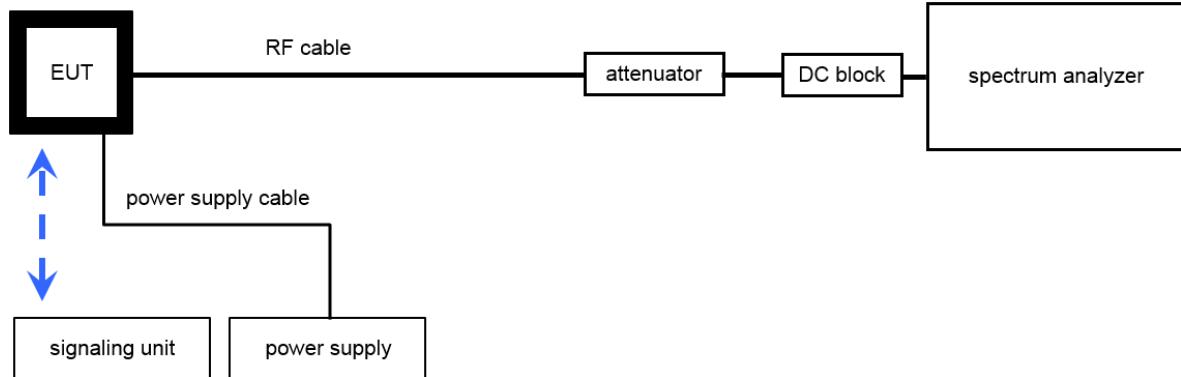
$$\text{FS [dB}\mu\text{V/m]} = 40.0 \text{ [dB}\mu\text{V/m]} + (-35.8) \text{ [dB]} + 32.9 \text{ [dB/m]} = 37.1 \text{ [dB}\mu\text{V/m]} (71.61 \mu\text{V/m})$$

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
2	A	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	11.12.2024	31.12.2025
3	A	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-
4	A	NEXIO EMV- Software	BAT EMC V2022.0.32.0	Nexio		300004682	ne	-/-	-/-
5	A	Active Loop Antenna 9 kHz to 30 MHz	6502	EMCO	2210	300001015	viKI!	02.08.2023	31.07.2025

7.2 Conducted measurements

Conducted measurements normal conditions



$$OP = AV + CA$$

(OP-output power; AV-analyzer value; CA-loss signal path)

Example calculation:

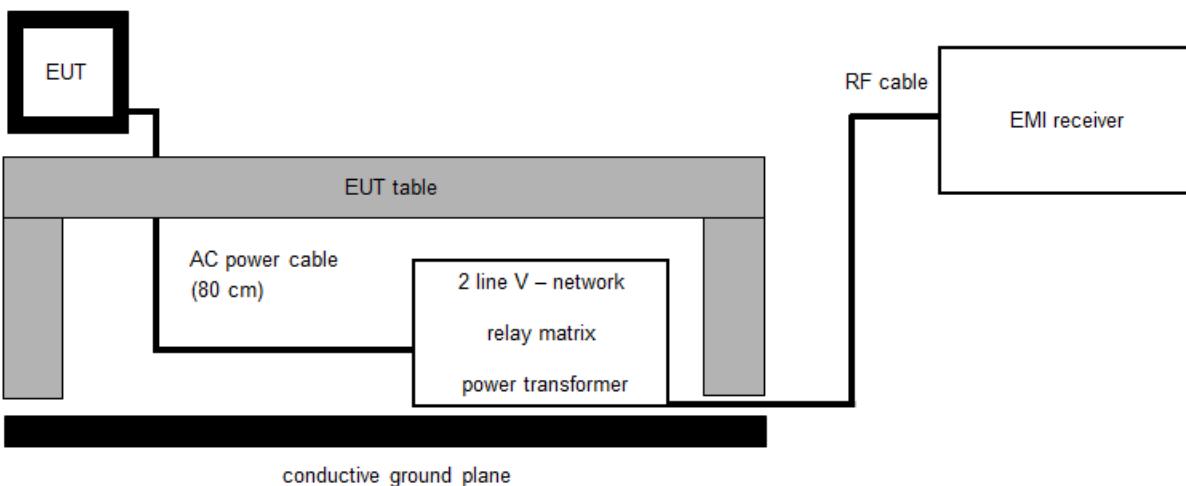
$$OP [dBm] = 6.0 [dBm] + 11.7 [dB] = 17.7 [dBm] (58.88 \text{ mW})$$

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Signal analyzer	FSW26	Rohde & Schwarz	101455	300004528	k	09.12.2024	31.12.2025
2	A	Power Supply	HMP2020	Rohde & Schwarz	101961	300006102	k	05.12.2024	31.12.2025
3	A	Loop Antenna	-/-	ZEG TS Steinfurt	-/-	400001208	ev	-/-	-/-
4	A	Temperature Test Chamber	VT 4011	Voetsch Industrietechnik	58566230600010	300005363	ev	11.07.2024	31.07.2026

7.3 AC conducted

AC conducted



$$FS = UR + CF + VC$$

(FS-field strength; UR-voltage at the receiver; CR-loss of the cable and filter; VC-correction factor of the ISN)

Example calculation:

$$FS [dB\mu V/m] = 37.62 [dB\mu V/m] + 9.90 [dB] + 0.23 [dB] = 47.75 [dB\mu V/m] (244.06 \mu V/m)$$

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Two-line V-Network (LISN) 9 kHz to 30 MHz	ESH3-Z5	Rohde & Schwarz	892475/017	300002209	vIKI!	12.12.2023	31.12.2025
2	A	RF-Filter-section	85420E	HP	3427A00162	300002214	NK!	-/-	-/-
3	A	Hochpass 150 kHz	EZ-25	R&S	100010	300003798	ev	-/-	-/-
4	A	PC	TecLine	F+W	-/-	300003532	ne	-/-	-/-
5	A	Analyzer-Impedance-System	AIS16/1	Spitzenberger + Spies GmbH & Co. KG	U02076 07/0 1023	400001751	k	19.10.2023	31.10.2025
6	A	EMI Test Receiver 3.6 GHz	ESR3	Rohde & Schwarz	102981	300006318	k	0312.2024	31.12.2025
7	A	Attenuator	WA81-30-33	Weinschel Associates	A145	300005327	ev	-/-	-/-

8 Sequence of testing

8.1 Sequence of testing radiated spurious 9 kHz to 30 MHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, it is placed on a table with 0.8 m height.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premasurement*

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 1 m.
- At each turntable position the analyzer sweeps with positive-peak detector to find the maximum of all emissions.

Final measurement

- Identified emissions during the pre-measurement are maximized by the software by rotating the turntable from 0° to 360°.
- Loop antenna is rotated about its vertical axis for maximum response at each azimuth about the EUT. (For certain applications, the loop antenna plane may also need to be positioned horizontally at the specified distance from the EUT)
- The final measurement is done in the position (turntable and elevation) causing the highest emissions with quasi-peak (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. A plot with the graph of the premeasurement and the limit is stored.

*Note: The sequence will be repeated three times with different EUT orientations.

9 Measurement uncertainty

Measurement uncertainty	
Test case	Uncertainty
Occupied bandwidth	± used RBW
Field strength of the fundamental	± 3 dB
Field strength of the harmonics and spurious	± 3 dB
Receiver spurious emissions and cabinet radiations	± 3 dB
Conducted limits	± 2.6 dB

10 Summary of measurement results

<input checked="" type="checkbox"/>	No deviations from the technical specifications were ascertained
<input type="checkbox"/>	There were deviations from the technical specifications ascertained
<input type="checkbox"/>	This test report is only a partial test report. The content and verdict of the performed test cases are listed below.

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	CFR Part 15 RSS 216 Issue 3 RSS Gen Issue 5	See table!	2025-08-14	-/-

Test specification clause	Test case	Temperature conditions	Power source conditions	C	NC	NA	NP	Remark
RSS Gen Issue 5 (6.6)	Occupied bandwidth	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
§ 15.209 RSS 216 Issue 3 (5.3)	Field strength of the fundamental	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
RSS 216 Issue 3 (5.5)	Frequency stability	extreme	extreme	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
§ 15.209 RSS Gen Issue 5 (6.13)	Field strength of the harmonics and spurious	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
§ 15.107 § 15.207	Conducted limits	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-

Note: NA = Not applicable; NP = Not performed; C = Compliant; NC = Not compliant

11 Additional comments

Reference documents: BaseDevice_CustomerQuestionnaire

Special test descriptions: WPT classification according RSS 216 issue 3:

Type 1 (interference-causing equipment)

Configuration descriptions: none

12 Measurement results

12.1 Occupied bandwidth

Measurement:

The emission bandwidth (x dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated x dB below the maximum in-band spectral density of the modulated signal.

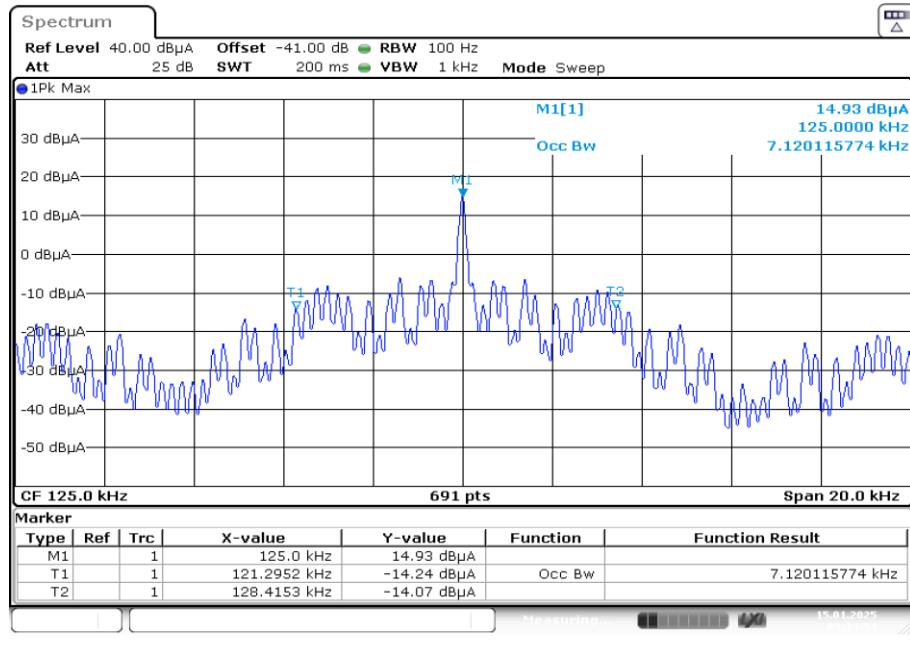
Measurement parameters	
Detector:	Peak
Resolution bandwidth:	1 % – 5 % of the occupied bandwidth
Video bandwidth:	≥ 3x RBW
Trace mode:	Max hold
Analyser function:	99 % power function
Used test setup:	See sub clause 7.2 A
Measurement uncertainty:	See sub clause 9

Limit:

IC
for RSP-100 test report coversheet only

Result:

99% emission bandwidth
7.12 kHz

Plot:**Plot 1: 99 % emission bandwidth**

12.2 Frequency stability

Measurement:

The maximum detected field strength for the spurious. Measurement performed according to ANSI C63.30, chapter 6.8

Measurement parameters	
Detector:	Peak detector
Resolution bandwidth:	5 Hz
Video bandwidth:	> RBW
Trace mode:	max hold
Used equipment:	see chapter 7.3B
Measurement uncertainty:	see chapter 9

Limit:

IC
The frequency stability requirements with respect to ambient temperature specified in subclause 10.4.2 of ANSI C63.30-2021 shall apply only for WPT source devices intended for outdoor operation. This test shall be performed at the rated power supply voltage and for three ambient temperatures: -20°C, +20°C and +50°C
The frequency stability with respect to power supply voltage shall apply to all WPT source devices.

Result: Temperature/ voltage variation

Frequency stability		
Measured frequency	Frequency error related to normal conditions	Conditions
124.99633 kHz	0 ppm	+20 °C & 37 V DC
124.99633 kHz	-/-	+20 °C & 48 VDC
124.99633 kHz	0 ppm	+20 °C & 56 V DC
124.99633 kHz	0 ppm	-20 °C & 48 VDC
124.99633 kHz	0 ppm	+50 °C & 48 VDC

12.3 Field strength of the fundamental

Measurement:

The maximum detected field strength for the carrier signal.

Measurement parameters	
Detector:	average
Resolution bandwidth:	200 Hz
Video bandwidth:	$\geq 3x$ RBW
Trace mode:	Max hold
Used test setup	See sub clause 7.1 A
Measurement uncertainty:	See sub clause 9

Limit:

FCC			
Frequency (MHz)	Field strength / (μ V/m)	Limit @ 125 kHz	Measurement distance
0.009 – 0.490	2400 / F/kHz	19.2 μ V/m 25.66 dB μ V/m	300 m

IC			
Frequency (MHz)	Field strength / (dB μ A/m)	Limit @ 128 kHz	Measurement distance
0.07 – 0.15 MHz	69 to 39	45.3 dB μ A/m	3m

Result:

Field strength of the fundamental		
frequency	125 kHz	
distance	@ 3 m	@ 300 m*
measured / calculated value	66.8 dB μ V/m	-13.2 dB μ V/m
measured value	15.56 dB μ A/m	-/-

*) 40 dB/dec conversion factor employed

12.4 Field strength of the harmonics and spurious

Measurement:

The maximum detected field strength for the harmonics and spurious.

Measurement parameters	
Detector:	Quasi peak / average or peak (worst case – pre-scan)
Resolution bandwidth:	F < 150 kHz: 200 Hz 150 kHz < F < 30 MHz: 9 kHz 30 MHz < F < 1 GHz: 120 kHz
Video bandwidth:	F < 150 kHz: 1 kHz 150 kHz < F < 30 MHz: 100 kHz 30 MHz < F < 1 GHz: 300 kHz
Trace mode:	Max hold
Used test setup:	9 kHz to 30 MHz: see sub clause 7.1A
Measurement uncertainty:	See sub clause 9

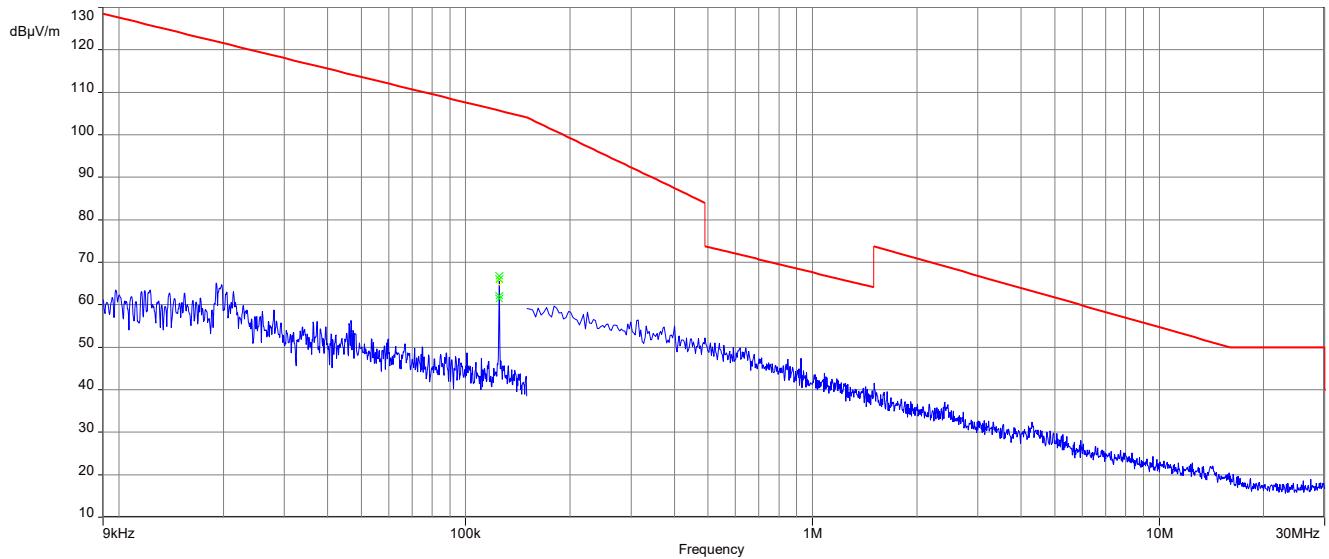
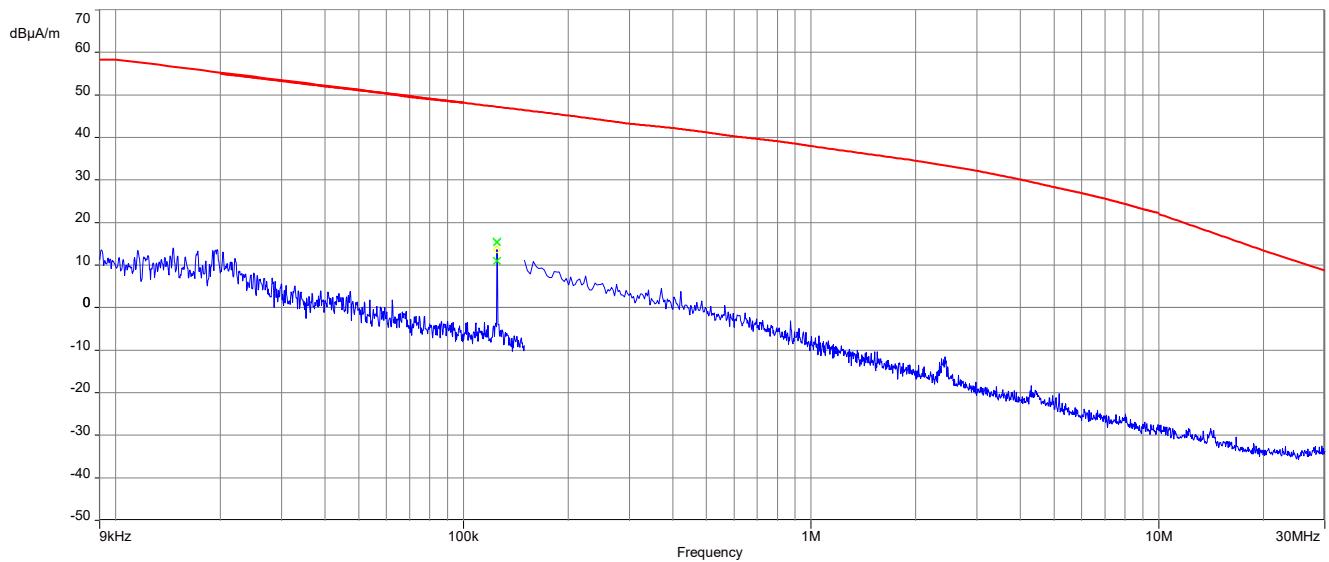
Limit:

FCC		
Frequency (MHz)	Field strength (dB μ V/m)	Measurement distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30 (29.5 dB μ V/m)	30
30 – 88	100 (40 dB μ V/m)	3
88 – 216	150 (43.5 dB μ V/m)	3
216 – 960	200 (46 dB μ V/m)	3

IC		
Frequency (MHz)	Field strength (dB μ A/m)	Measurement distance (m)
0.009 – 0.07	69	3
0.07 – 0.15	69 to 39	3
0.15 – 30	39 to 7	3

Result:

Detected emissions			
Frequency (MHz)	Detector	Resolution bandwidth (kHz)	Detected value
no peaks detected			

Plots:**Plot 1: 9 kHz – 30 MHz, magnetic spurious emissions FCC****Plot 2: 9 kHz – 30 MHz, magnetic spurious emissions IC**

12.5 Conducted limits

Measurement:

Measurement of the conducted spurious emissions for an intentional radiator that is designed to be connected to the public utility (AC) power line. Measurement performed according to ANSI C63.10, chapter 6.2

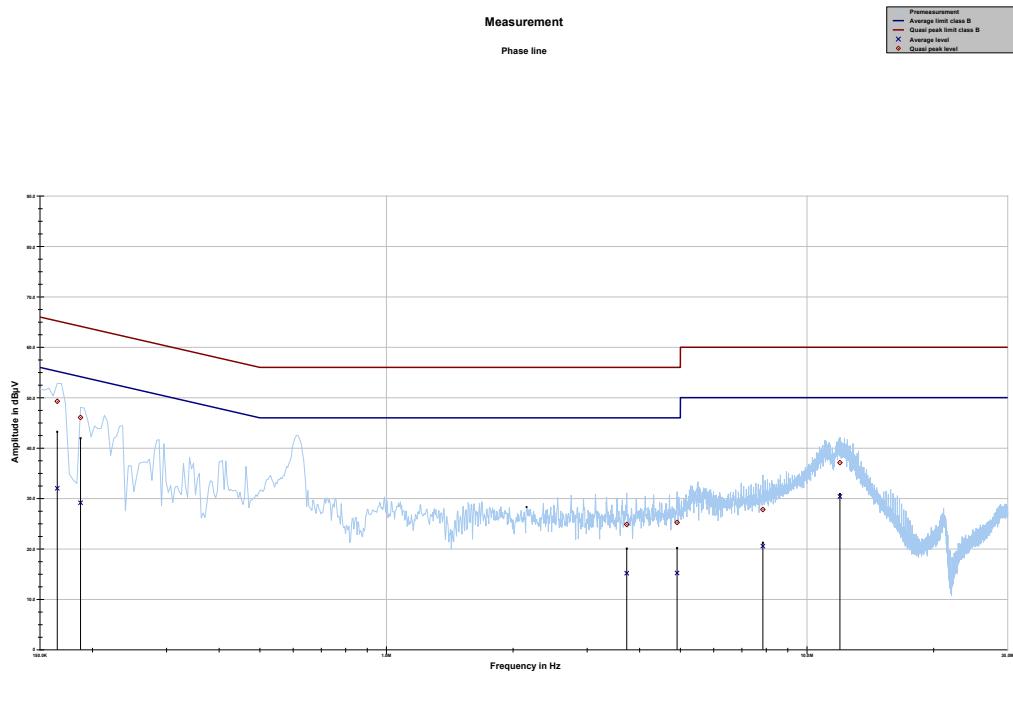
Measurement parameters	
Detector:	Quasi peak / average or peak (worst case – pre-scan)
Resolution bandwidth:	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Video bandwidth:	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Trace mode:	Max hold
Used equipment:	See chapter 7.3A
Measurement uncertainty:	See chapter 9

Limit:

FCC & IC		
Frequency / MHz	Quasi-peak / (dB μ V/m)	Average / (dB μ V/m)
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30.0	60	50

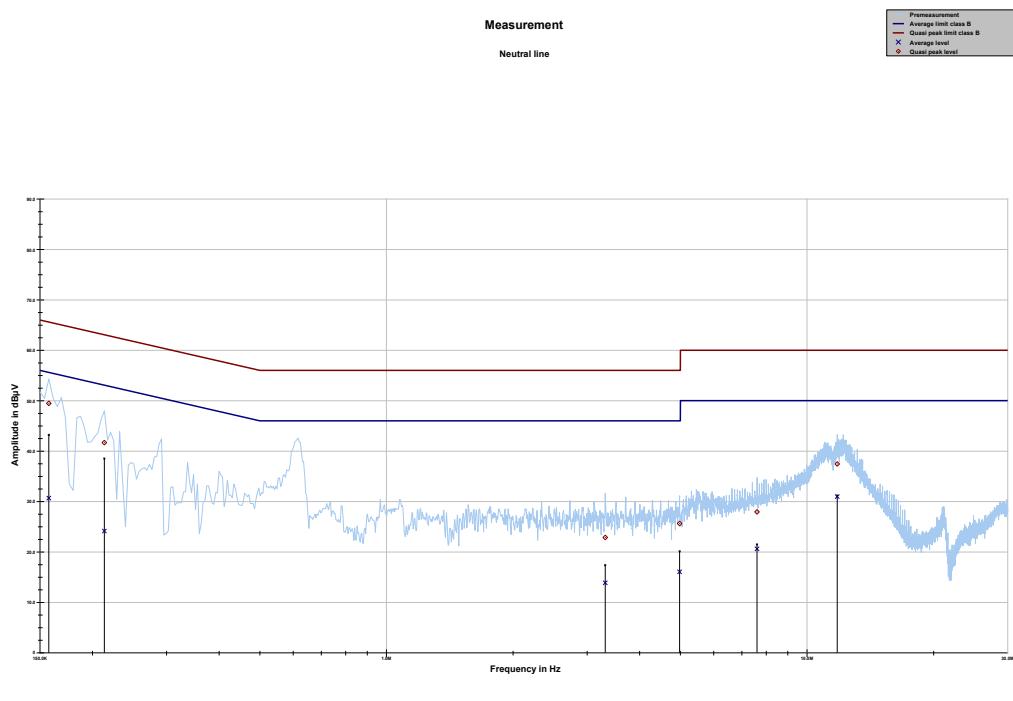
Result:

see table below plots

Plots:**Plot 1:** 150 kHz to 30 MHz, phase line

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.164925	49.29	15.92	65.212	32.02	23.55	55.574
0.187312	46.07	18.08	64.155	29.17	25.77	54.934
3.728269	24.85	31.15	56.000	15.18	30.82	46.000
4.911075	25.25	30.75	56.000	15.22	30.78	46.000
7.855031	27.81	32.19	60.000	20.56	29.44	50.000
11.974331	37.13	22.87	60.000	30.40	19.60	50.000

Plot 2: 150 kHz to 30 MHz, neutral line



Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin Average	Limit AV
MHz	dB μ V	dB	dB μ V	dB μ V	dB	dB μ V
0.157463	49.46	16.14	65.597	30.67	25.11	55.787
0.213431	41.69	21.39	63.071	24.14	30.05	54.188
3.314100	22.86	33.14	56.000	13.88	32.12	46.000
4.978237	25.64	30.36	56.000	16.05	29.95	46.000
7.605037	27.95	32.05	60.000	20.62	29.38	50.000
11.798963	37.46	22.54	60.000	30.97	19.03	50.000

13 Glossary

AVG	Average
C	Compliant
C/N₀	Carrier to noise-density ratio, expressed in dB-Hz
CAC	Channel availability check
CW	Clean wave
DC	Duty cycle
DFS	Dynamic frequency selection
DSSS	Dynamic sequence spread spectrum
DUT	Device under test
EN	European Standard
ETSI	European Telecommunications Standards Institute
EMC	Electromagnetic Compatibility
EUT	Equipment under test
FCC	Federal Communications Commission
FCC ID	Company Identifier at FCC
FHSS	Frequency hopping spread spectrum
FVIN	Firmware version identification number
GNSS	Global Navigation Satellite System
GUE	GNSS User Equipment
HMN	Host marketing name
HVIN	Hardware version identification number
HW	Hardware
IC	Industry Canada
Inv. No.	Inventory number
MC	Modulated carrier
NA	Not applicable
NC	Not compliant
NOP	Non occupancy period
NP	Not performed
OBW	Occupied bandwidth
OC	Operating channel
OCW	Operating channel bandwidth
OFDM	Orthogonal frequency division multiplexing
OOB	Out of band
OP	Occupancy period
PER	Packet error rate
PMN	Product marketing name
PP	Positive peak
QP	Quasi peak
RLAN	Radio local area network
S/N or SN	Serial number
SW	Software
UUT	Unit under test
WLAN	Wireless local area network

14 Document history

Version	Applied changes	Date of release
R01	Initial release	2025-01-28
R02	update EUT information chapter 6.1	2025-08-14

END OF TEST REPORT