

TEST REPORT

Test report no.: 1-1247-25-01-05_TR1-R02



Deutsche
Akkreditierungsstelle
D-PL-12047-01-00

Testing laboratory

cetecom advanced GmbH

Untertuerkheimer Strasse 6 – 10

66117 Saarbruecken / Germany

Phone: + 49 681 5 98 - 0

Fax: + 49 681 5 98 - 9075

Internet: <https://cetecomadvanced.com>

e-mail: mail@cetecomadvanced.com

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

ifm electronic gmbh

Friedrichsstraße 1

45128 Essen / GERMANY

Phone: +49 201 2422-0

Contact: Holger Wenzel

e-mail: Holger.Wenzel@ifm.com

Manufacturer

ifm electronic gmbh

Friedrichsstraße 1

45128 Essen / GERMANY

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 - 210 Issue 11	Spectrum Management and Telecommunications Radio Standards Specification - Licence-Exempt Radio Apparatus: Category I Equipment
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:	RFID read/write head HF
Model name:	DTI135 (TR44)
FCC ID:	UN6-DTI134
ISED certification number:	6799-DTI134
Frequency:	13.56 MHz
Technology tested:	RFID
Antenna:	Integrated antenna
Power supply:	18 V to 30 V DC, by external power supply
Temperature range:	-20°C to +60°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:

cn=Christoph Schneider, o=cetecom
advanced GmbH, ou=SND-230601,
email=christoph.schneider@cetecomad-
vanced.com, c=DE
2025.12.08 06:33:43 +01'00'

Christoph Schneider
Lab Manager
Radio Labs

Test performed:

cn=Joachim Wolsdorfer, o=cetecom
advanced GmbH, ou=WLD-230605,
email=joachim.wolsdorfer@cetecomadvan-
ced.com, c=DE
2025.12.08 06:55:20 +01'00'

Hans-Joachim Wolsdorfer
Lab Manager
Radio Labs

1 Table of contents

1	Table of contents.....	2
2	General information.....	3
2.1	Notes and disclaimer.....	3
2.2	Application details	3
2.3	Test laboratories sub-contracted.....	3
3	Test standard/s, references and accreditations.....	4
4	Reporting statements of conformity – decision rule	5
5	Test environment.....	6
6	Test item	6
6.1	General description	6
6.2	Additional information.....	6
7	Description of the test setup	7
7.1	Shielded semi anechoic chamber	8
7.2	Shielded fully anechoic chamber	10
7.3	AC conducted	11
7.4	Conducted measurements normal and extreme conditions	12
8	Sequence of testing	13
8.1	Sequence of testing radiated spurious 9 kHz to 30 MHz.....	13
8.2	Sequence of testing radiated spurious 30 MHz to 1 GHz	14
9	Measurement uncertainty	15
10	Summary of measurement results	16
11	Additional comments	16
12	Measurement results	17
12.1	Occupied bandwidth.....	17
12.2	Field strength of the fundamental.....	19
12.3	Field strength of the harmonics and spurious	20
12.4	Conducted limits.....	24
12.4.1	Plots with dummy load.....	25
12.4.2	Plots with build in antenna	29
12.5	Frequency error	33
13	Glossary.....	34
14	Document history	35

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.

The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of cetecom advanced GmbH.

The testing service provided by cetecom advanced GmbH has been rendered under the current "General Terms and Conditions for cetecom advanced GmbH".

cetecom advanced GmbH will not be liable for any loss or damage resulting from false, inaccurate, inappropriate or incomplete product information provided by the customer.

Under no circumstances does the cetecom advanced GmbH test report include any endorsement or warranty regarding the functionality, quality or performance of any other product or service provided.

Under no circumstances does the cetecom advanced GmbH test report include or imply any product or service warranties from cetecom advanced GmbH, including, without limitation, any implied warranties of merchantability, fitness for purpose, or non-infringement, all of which are expressly disclaimed by cetecom advanced GmbH.

All rights and remedies regarding vendor's products and services for which cetecom advanced GmbH has prepared this test report shall be provided by the party offering such products or services and not by cetecom advanced GmbH.

In no case this test report can be considered as a Letter of Approval.

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.

This test report replaces the test report with the number 1-1247-25-01-05_TR1-R01 and dated 2025-11-10.

2.2 Application details

Date of receipt of order:	2025-09-01
Date of receipt of test item:	2025-10-20
Start of test:*	2025-10-27
End of test:*	2025-11-10
Person(s) present during the test:	-/-

*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

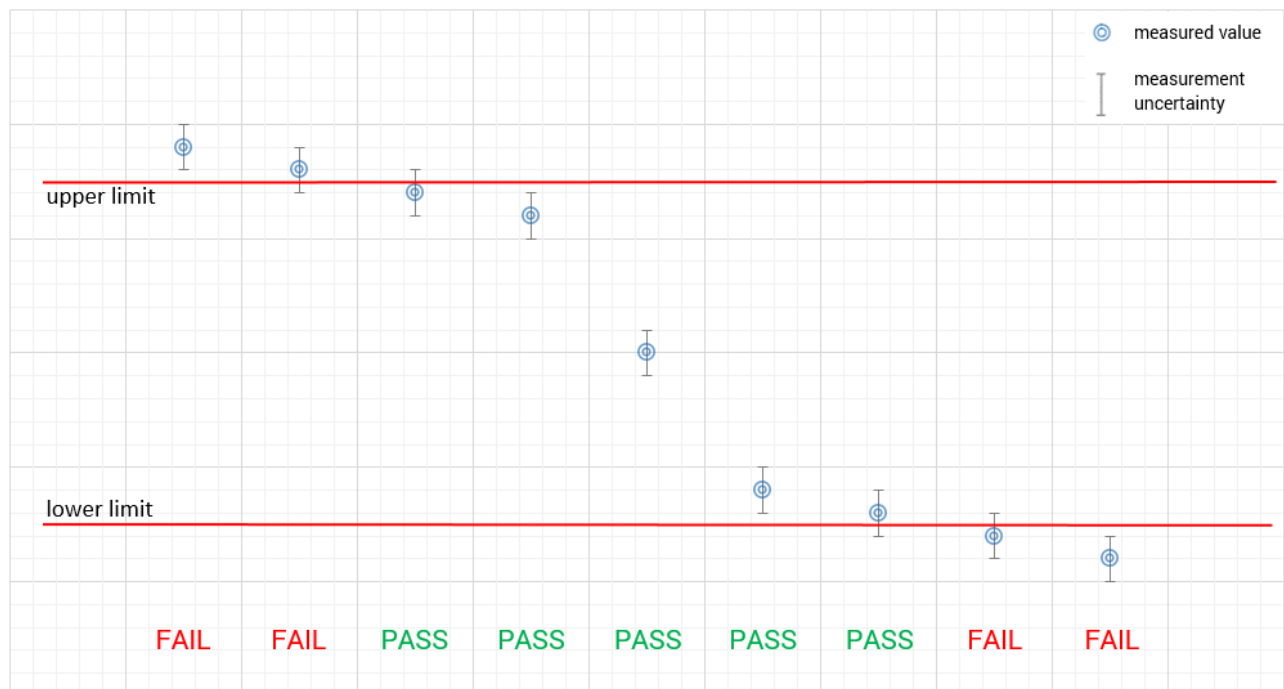
Test standard	Date	Description
FCC - Title 47 CFR Part 15		FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 210 Issue 11	25.06.2024	Spectrum Management and Telecommunications Radio Standards Specification - Licence-Exempt Radio Apparatus: Category I Equipment
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
KDB 174176 D01	V01r02	AC POWER LINE CONDUCTED EMISSIONS FREQUENTLY ASKED QUESTIONS
ANSI C63.4a-2017	-/-	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10-2020	-/-	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

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} T_{max} T_{min}	+22 °C during room temperature tests +60 °C during high temperature tests -20 °C during low temperature tests
Relative humidity content	:		55 %
Barometric pressure	:		1021 hpa
Power supply	:	V_{nom} V_{max} V_{min}	24 V DC, by external power supply 30 V DC 18 V DC

6 Test item

6.1 General description

Kind of test item	:	RFID read/write head HF
Model name	:	DTI135
HMN	:	N/A
PMN	:	RFID read/write HF
HVIN	:	DTI135
FVIN	:	N/A
EUT ID:	:	rad: 154837-99 cond: 154837-113
Hardware status	:	AA
Software status	:	V1.18
Firmware status	:	-/-
Frequency band	:	13.56 MHz
Type of radio transmission	:	modulated carrier
Use of frequency spectrum	:	
Type of modulation	:	ASK
Number of channels	:	1
Antenna	:	Integrated antenna
Power supply	:	18 V to 30 V DC, by external power supply
Temperature range	:	-20°C to +60°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:

1-1247-25-01-01_TR1-A101-R02
1-1247-25-01-01_TR1-A102-R01
1-1247-25-01-01_TR1-A104-R01

7 Description of the test setup

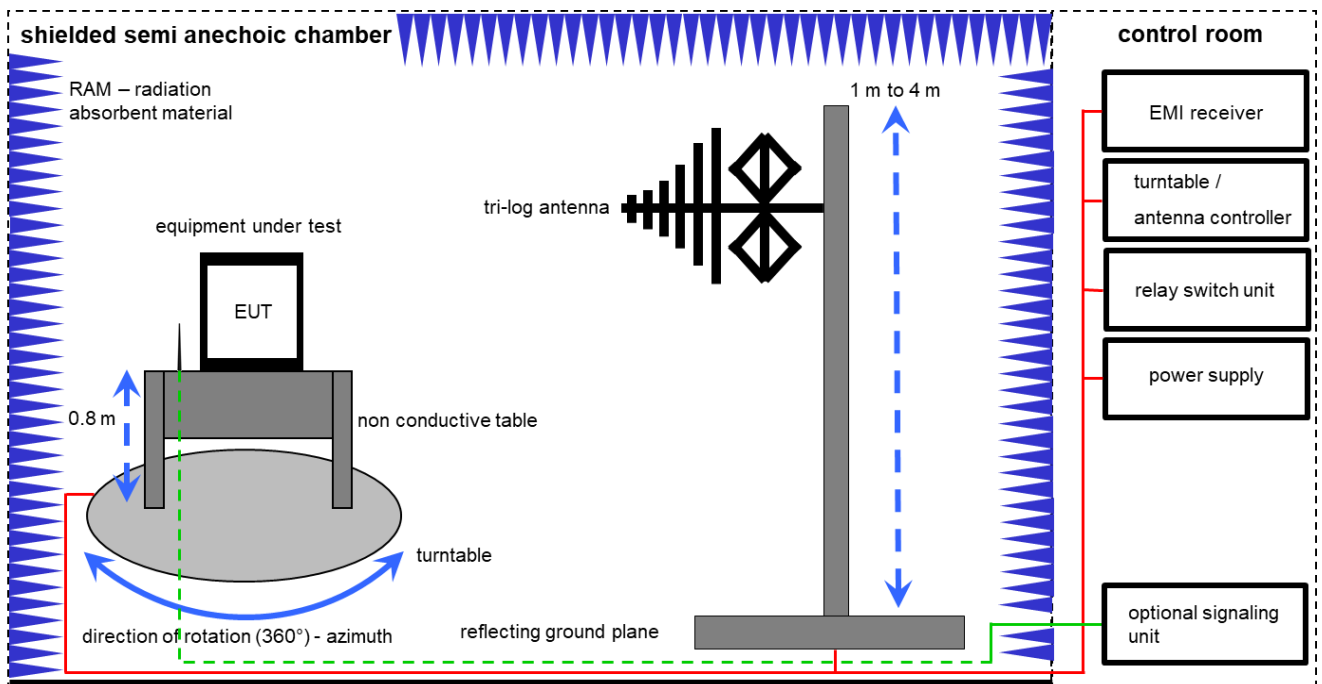
Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements 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 semi anechoic chamber

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 30 MHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are conform to specifications ANSI C63. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analyzers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.



Measurement distance: tri-log antenna 10 meter
EMC32 software version: 10.59.00

$$FS = UR + CL + AF$$

(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

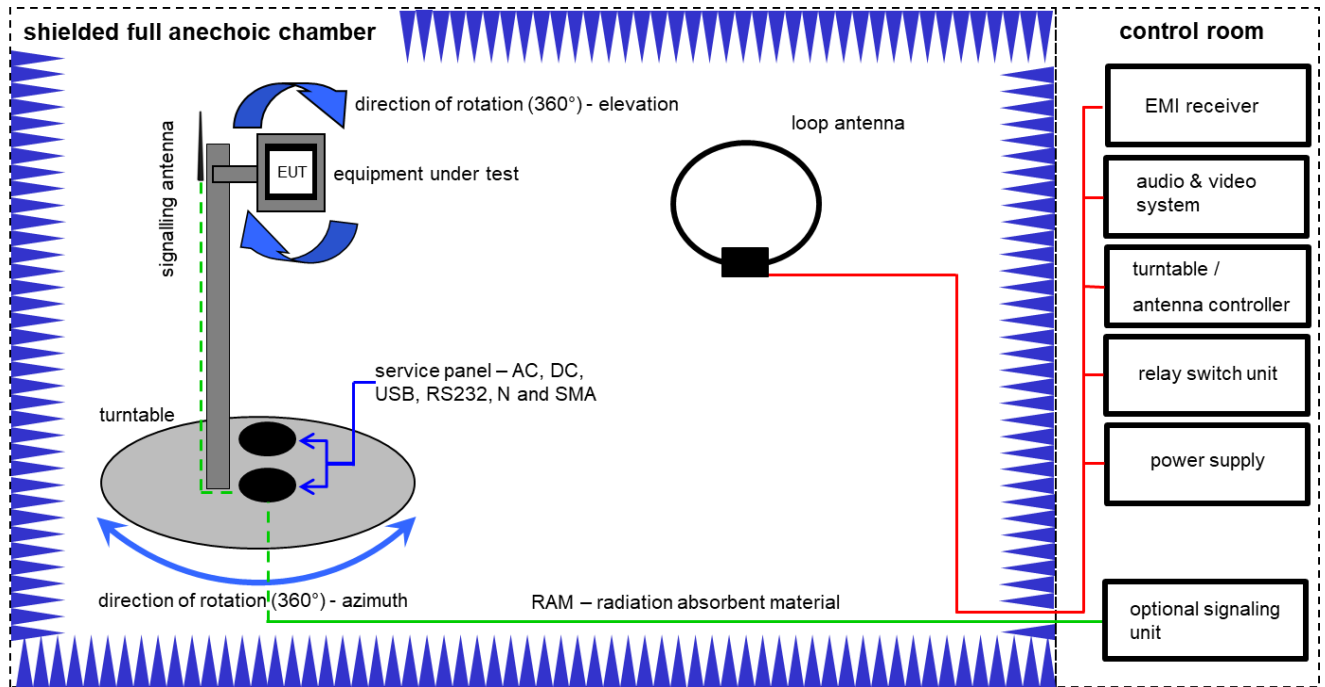
Example calculation:

$$FS [dB\mu V/m] = 12.35 [dB\mu V] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dB\mu V/m] \quad (35.69 \mu V/m) @ \text{distance}$$

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Switch-Unit	3488A	HP	2719A14505	300000368	ev	-/-	-/-
2	A	Semi anechoic chamber	3000023	MWB AG	-/-	300000551	ne	-/-	-/-
3	A	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw	-/-	-/-
4	A	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw	-/-	-/-
5	A	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw	-/-	-/-
6	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck Mess - Elektronik	318	300003696	vKII	31.01.2024	30.01.2026
7	A	Turntable	2089-4.0	EMCO	-/-	300004394	ne	-/-	-/-
8	A	PC	TecLine	F+W	-/-	300004388	ne	-/-	-/-
9	A	EMI Test Receiver	ESR3	Rohde & Schwarz	102587	300005771	k	06.12.2024	31.12.2025
10	A	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2920A04466	300000580	ne	-/-	-/-

7.2 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)

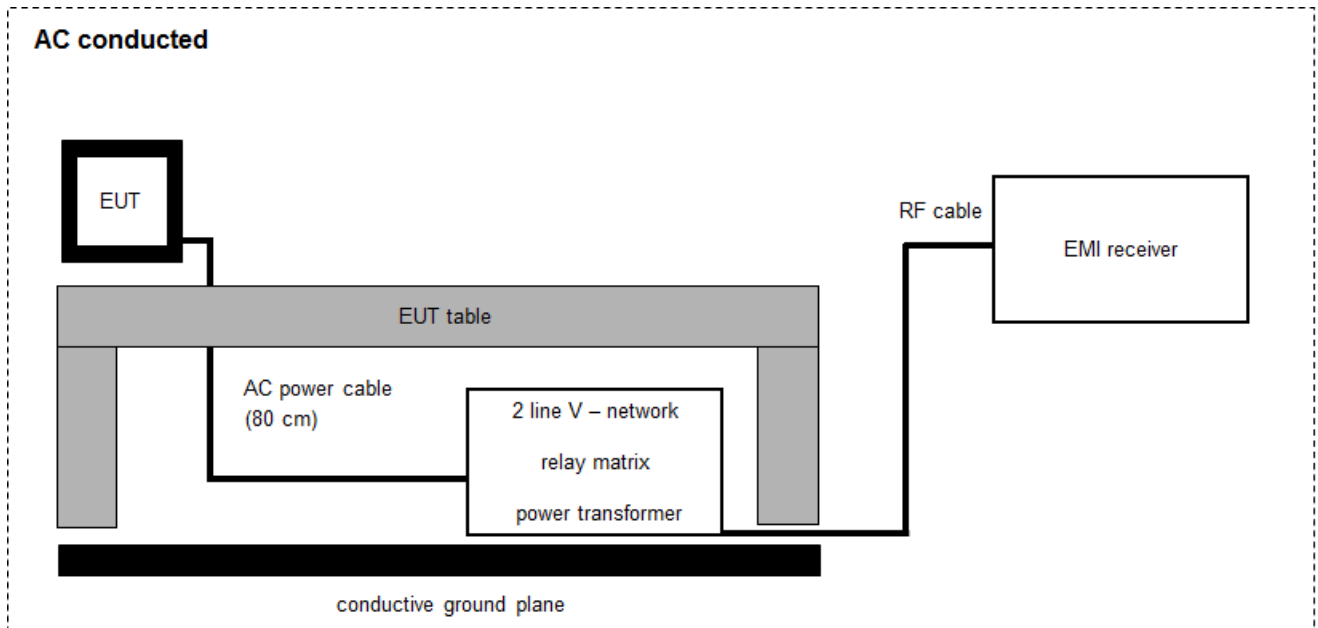
Example calculation:

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

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	11.12.2024	31.12.2025
2	A	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
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	Power Supply	Power Supply HMP2020	Rohde & Schwarz Messgerätebau GmbH / Memmingen	120626	300006408-0000	cal	02.05.2023	31.05.2026
6	A	Active Loop Antenna	Active Loop Antenna 6502	EMCO Elektronik GmbH / Gilching	2210	300001015	cal	07.07.2025	07.07.2027

7.3 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:

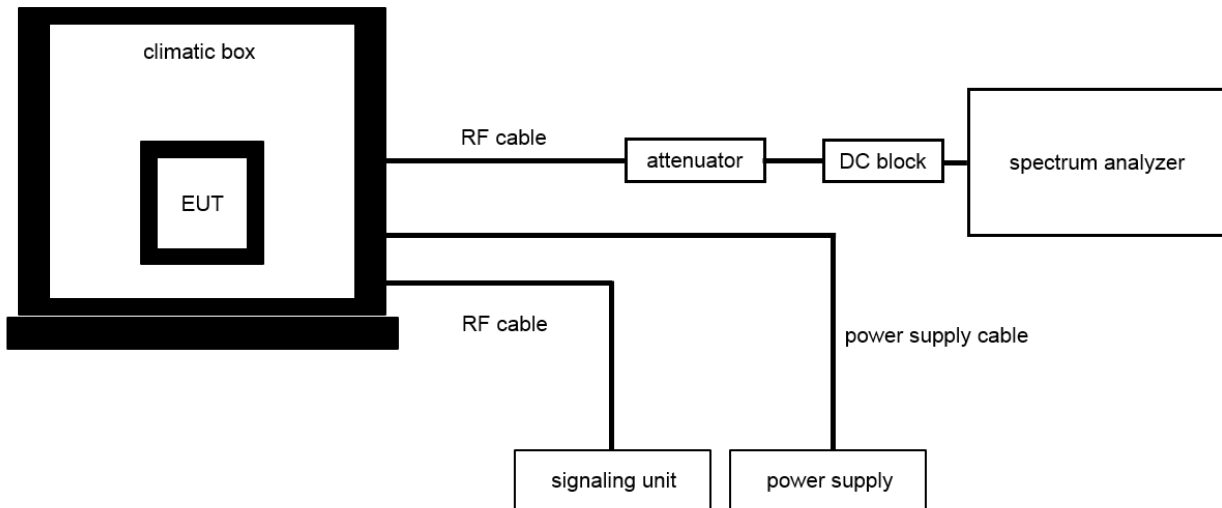
$$FS [dB\mu V/m] = 37.62 [dB\mu V] + 9.90 [dB] + 0.23 [dB] = 47.75 [dB\mu V/m] (244.06 \mu V/m) @ distance$$

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	Netzwerksimulation 1600/2000 A	ACS-1600-PS	HBS Electronic	2002-001247-0	300006074	ev	-/-	-/-
6	A	EMI Test Receiver 3.6 GHz	ESR3	Rohde & Schwarz	102981	300006318	k	03.12.2024	31.12.2025

7.4 Conducted measurements normal and extreme conditions

Conducted measurements normal & extreme 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 mW)

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A,B	Signal analyzer	FSV30	Rohde & Schwarz	104365	300005923	k	10.12.2024	31.12.2025
2	A,B	Loop Antenna	Loop Antenna	MEC Import: ZEG TS Steinfurt		400001208 -0000	cpu	-/-	-/-
3	A,B	Power Supply	Power Supply HMP2020	Rohde & Schwarz Messgerätebau GmbH / Memmingen	101961	300006102 -0000	cal	05.12.2024	05.12.2026
4	B	Temperature Test Chamber	VT 4002	Heraeus Voetsch	521/83761	300002326	ev	18.09.2024	30.09.2026

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.

Premeasurement*

- 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.

8.2 Sequence of testing radiated spurious 30 MHz to 1 GHz

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, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- 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 10 m or 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 m to 3 m.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximize the peaks by changing turntable position $\pm 45^\circ$ and antenna height between 1 and 4 m.
- The final measurement is done with quasi-peak detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

9 Measurement uncertainty

Measurement uncertainty	
Test case	Uncertainty
Occupied bandwidth	$\pm$ 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

☒	No deviations from the technical specifications were ascertained
☐	There were deviations from the technical specifications ascertained
☐	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 210 Issue 11 RSS Gen Issue 5	See table!	2025-12-05	-/-

Test specification clause	Test case	Temperature conditions	Power source conditions	C	NC	NA	NP	Remark
RSS Gen Issue 5	Occupied bandwidth	Nominal	Nominal	☒	☐	☐	☐	-/-
§ 15.225 (a) RSS 210 Issue 11	Field strength of the fundamental	Nominal	Nominal	☒	☐	☐	☐	-/-
§ 15.209 § 15.225 (b-d) RSS Gen Issue 5	Field strength of the harmonics and spurious	Nominal	Nominal	☒	☐	☐	☐	-/-
§15.107 §15.207	Conducted limits	Nominal	Nominal	☒	☐	☐	☐	-/-
§ 15.225 (a) RSS 210 Issue 11	Frequency tolerance	Normal & extreme conditions	Normal & extreme conditions	☒	☐	☐	☐	-/-

Note:

C Compliant
 NC Not compliant
 NA Not applicable
 NP Not performed

11 Additional comments

Reference documents: None

Special test descriptions: 20250415_Test operation guide

Configuration descriptions: AC conducted emission tests have been performed according KDB 174176, see chapter 12.4 for detailed test description

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 performed according to ANSI C63.10, chapter 6.9.3, "Occupied bandwidth—power bandwidth (99%) measurement procedure"

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 equipment:	See chapter 7.4 A
Measurement uncertainty:	See chapter 9

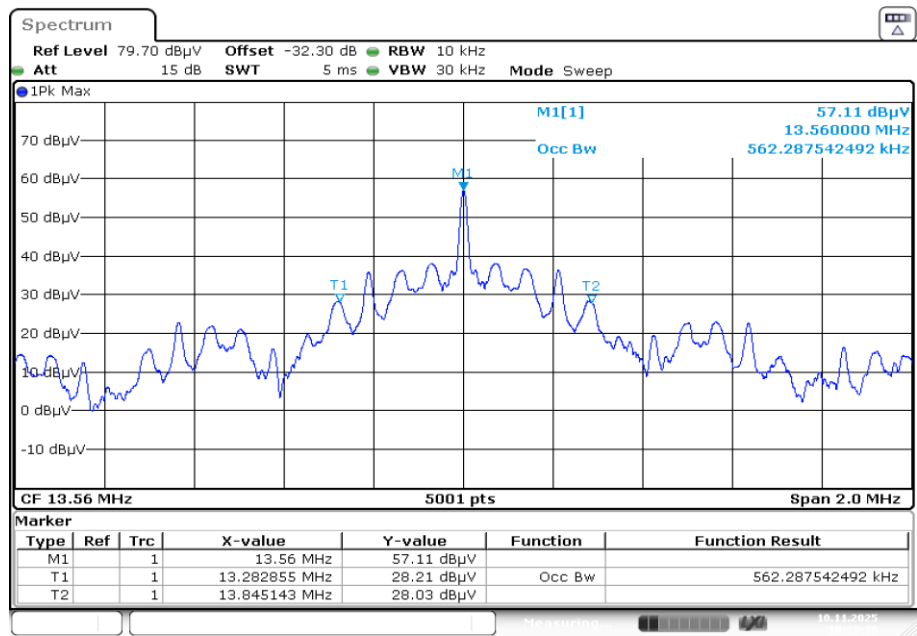
Limit:

ISED
for RSP-100 test report coversheet only

Result:

99% emission bandwidth
562.28 kHz

Plot: 99 % emission bandwidth



12.2 Field strength of the fundamental

Measurement:

The maximum detected field strength for the carrier signal. Measurement performed according to ANSI C63.10 chapter 6.4

Measurement parameters	
Detector:	Quasi Peak
Resolution bandwidth:	9 kHz
Video bandwidth:	$\geq 3 \times \text{RBW}$
Trace mode:	Max hold
Used equipment:	See chapter 7.2 A
Measurement uncertainty:	See chapter 9

Limit:

FCC & ISED		
Frequency / MHz	Field strength / ($\mu\text{V}/\text{m}$)	Measurement distance / m
13.553 to 13.567	15,848 (84 dB $\mu\text{V}/\text{m}$)	30

Recalculation:

According to ANSI C63.10		
Frequency	Formula	Correction value
13.56 MHz	$\text{FS}_{\text{limit}} = \text{FS}_{\text{max}} - 40 \log \left(\frac{d_{\text{near field}}}{d_{\text{measure}}} \right) - 20 \log \left(\frac{d_{\text{limit}}}{d_{\text{near field}}} \right)$ FS_{limit} is the calculation of field strength at the limit distance, expressed in dB$\mu\text{V}/\text{m}$ FS_{max} is the measured field strength, expressed in dB$\mu\text{V}/\text{m}$ $d_{\text{near field}}$ is the $\lambda/2\pi$ distance d_{measure} is the distance of the measurement point from EUT d_{limit} is the reference limit distance	-21.4 dB from 3m to 30m

Result:

Field strength of the fundamental		
Frequency	13.56 MHz	
Distance	@ 3 m	@ 30 m
Measured / calculated value	57.51 dB $\mu\text{V}/\text{m}$	36.11 dB $\mu\text{V}/\text{m}$

12.3 Field strength of the harmonics and spurious

Measurement:

The maximum detected field strength for the harmonics and spurious. Measurement performed according to ANSI C63.10, chapter 6.4 and 6.5

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 equipment:	See chapter 7.1 A & 7.2 A & 7.3 A
Measurement uncertainty:	See chapter 9

Limit:

FCC		
Frequency (MHz)	Field strength (μV/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 dBμV/m)	30
30 – 88	100 (40 dBμV/m)	3
88 – 216	150 (43.5 dBμV/m)	3
216 – 960	200 (46 dBμV/m)	3

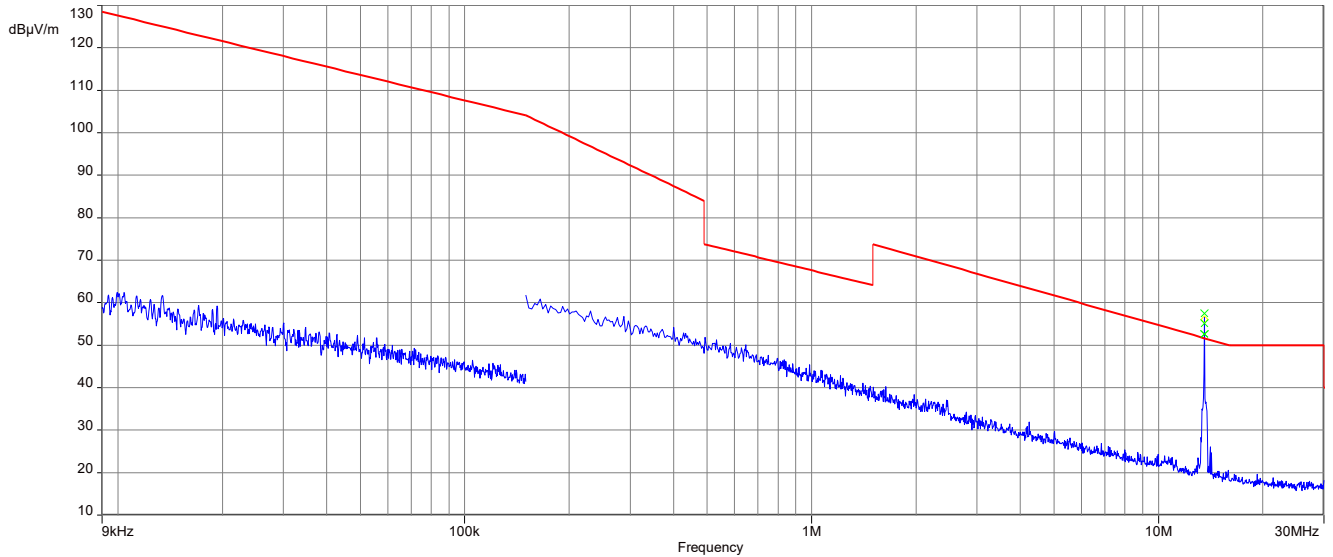
ISED		
Frequency (MHz)	Field strength (μA/m)	Measurement distance (m)
0.009 – 0.490	6.37/F (F in kHz)	300
0.490 – 1.705	63.7/F (F in kHz)	30
1.705 – 30	0.08 (-22 dBμA/m)	30

Result:

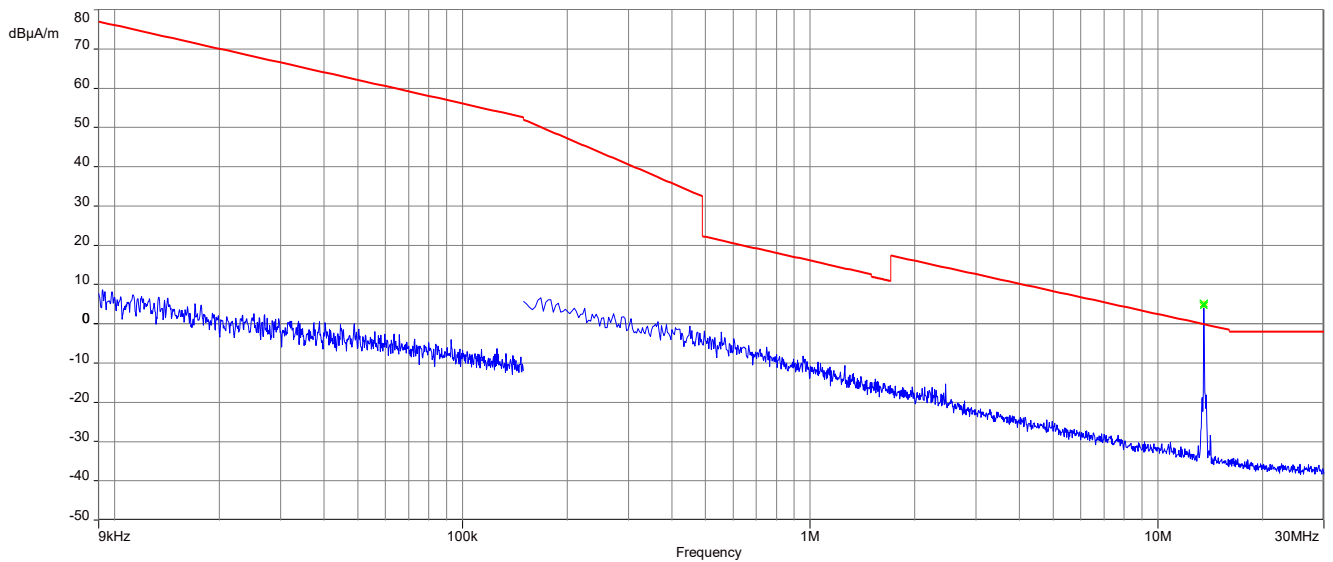
Detected emissions			
Frequency	Detector	Resolution bandwidth	Detected value (@ 3m)
no peaks detected			

Plots:

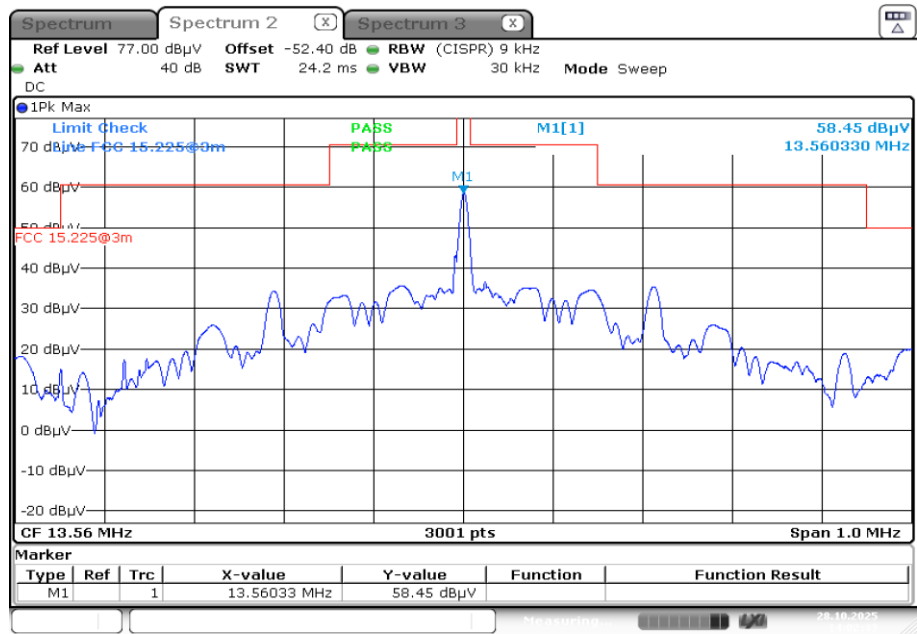
Plot 1: 9 kHz – 30 MHz, magnetic emissions FCC



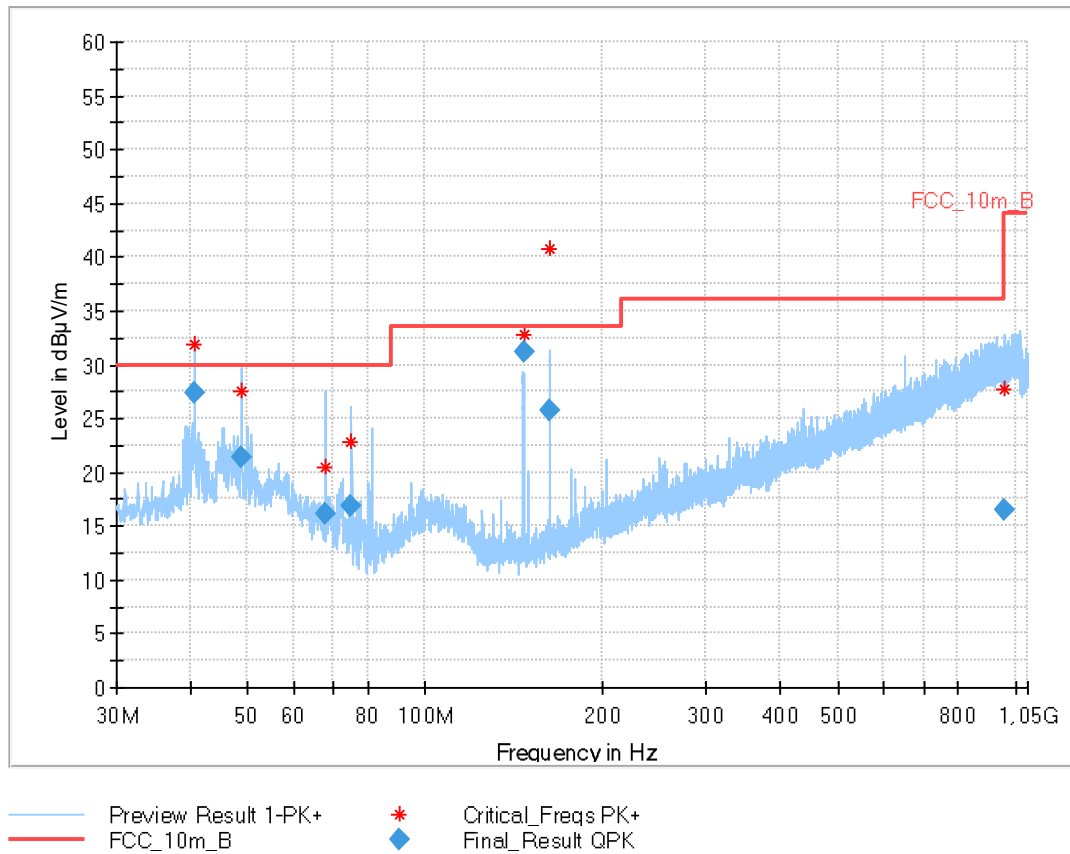
Plot 2: 9 kHz – 30 MHz, magnetic emissions ISCED



Plot 3: Spectrum mask (the limits are recalculated according to the ANSI C63.10-2020 sub clause 6.4)



Date: 28.OCT.2025 14:02:33

Plot 4: 30 MHz – 1 GHz, vertical and horizontal polarisation**Final_Result**

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
40.679	27.45	30.0	2.6	1000	120.0	188.0	V	16	14
48.776	21.30	30.0	8.7	1000	120.0	124.0	V	-43	15
67.792	16.17	30.0	13.8	1000	120.0	200.0	V	219	11
75.030	16.83	30.0	13.2	1000	120.0	185.0	V	35	9
146.857	31.11	33.5	2.4	1000	120.0	207.0	V	-32	10
162.734	25.70	33.5	7.8	1000	120.0	165.0	V	300	10
958.055	16.55	36.0	19.5	1000	120.0	203.0	H	107	25

12.4 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 7.3 A
Measurement uncertainty:	See chapter 9

Limits:

FCC		
Frequency (MHz)	Field strength (μV/m)	Measurement distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30

ISED		
Frequency (MHz)	Field strength (μA/m)	Measurement distance (m)
0.009 – 0.490	6.37/F (F in kHz)	300
0.490 – 1.705	63.7/F (F in kHz)	30
1.705 – 30	0.08 (-22 dBμA/m)	30

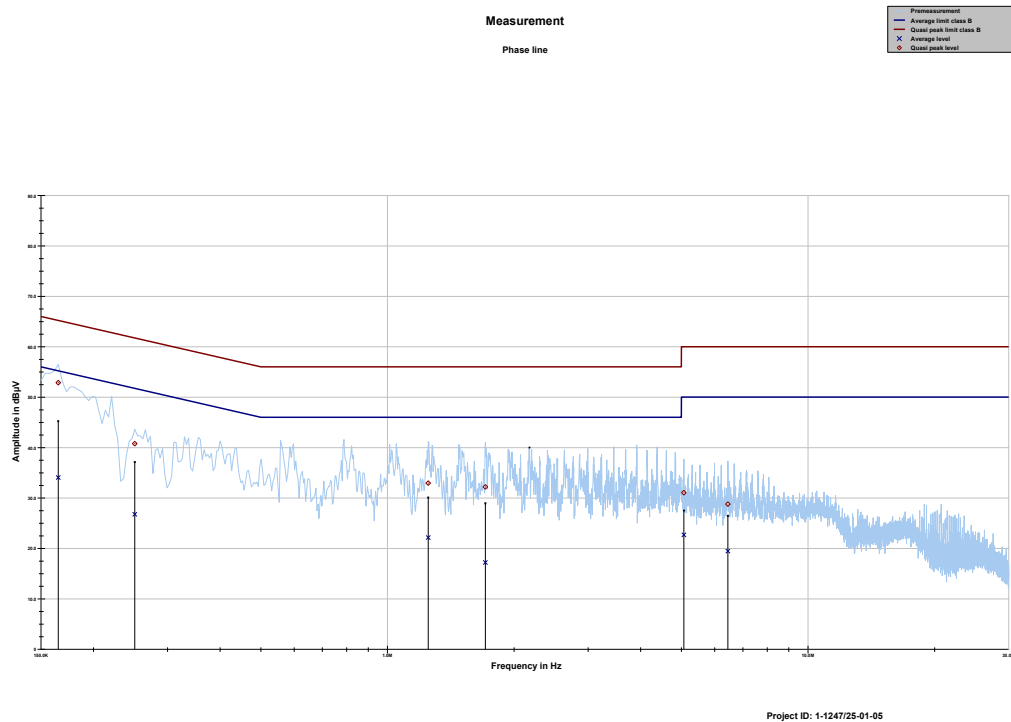
Result:

see table below plots

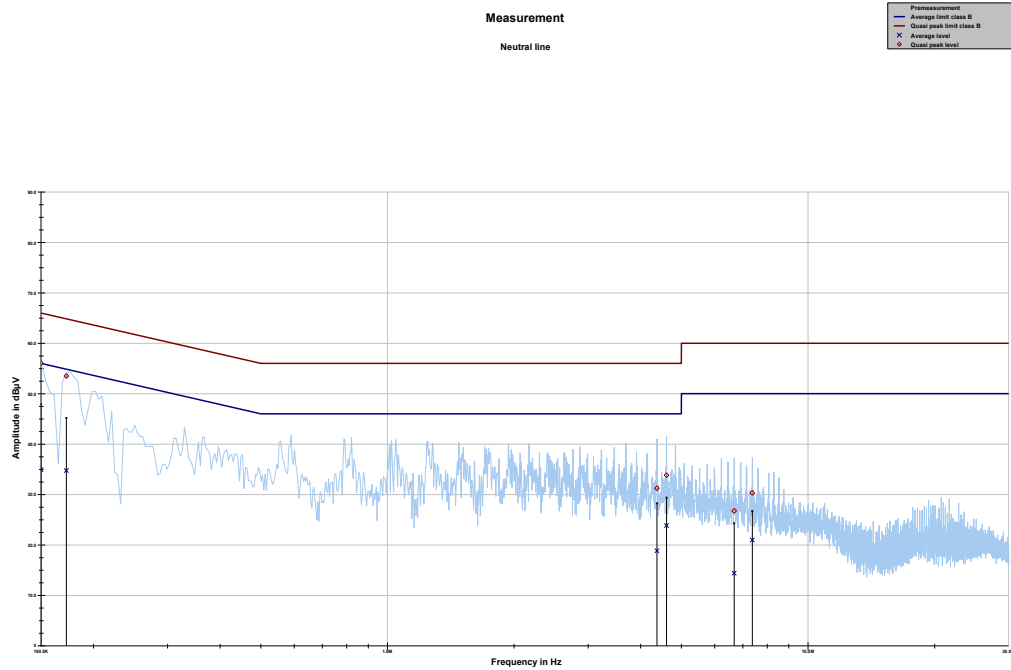
12.4.1 Plots with dummy load

Plots AC 120V/60Hz:

Plot 1: 150 kHz to 30 MHz, phase line



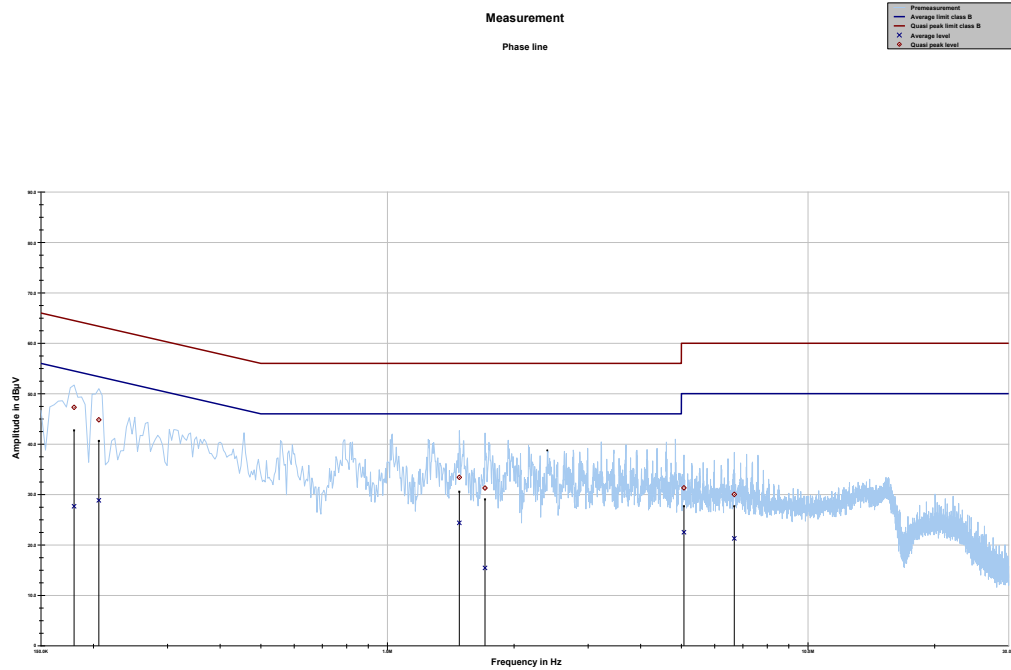
Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBμV	dB	dBμV	dBμV	dB	dBμV
0.164925	52.87	12.34	65.212	34.05	21.52	55.574
0.250744	40.77	20.96	61.732	26.77	26.35	53.122
1.250719	32.95	23.05	56.000	22.14	23.86	46.000
1.709663	32.19	23.81	56.000	17.21	28.79	46.000
5.067787	31.04	28.96	60.000	22.68	27.32	50.000
6.448350	28.78	31.22	60.000	19.45	30.55	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	dBµV	dB	dBµV	dBµV	dB	dBµV
0.150000	56.03	9.97	66.000	34.93	21.07	56.000
0.172387	53.50	11.34	64.845	34.75	20.61	55.360
4.373775	31.23	24.77	56.000	18.85	27.15	46.000
4.608844	33.83	22.17	56.000	23.84	22.16	46.000
6.675956	26.76	33.24	60.000	14.39	35.61	50.000
7.373700	30.31	29.69	60.000	20.95	29.05	50.000

Plots AC 240V/60Hz:

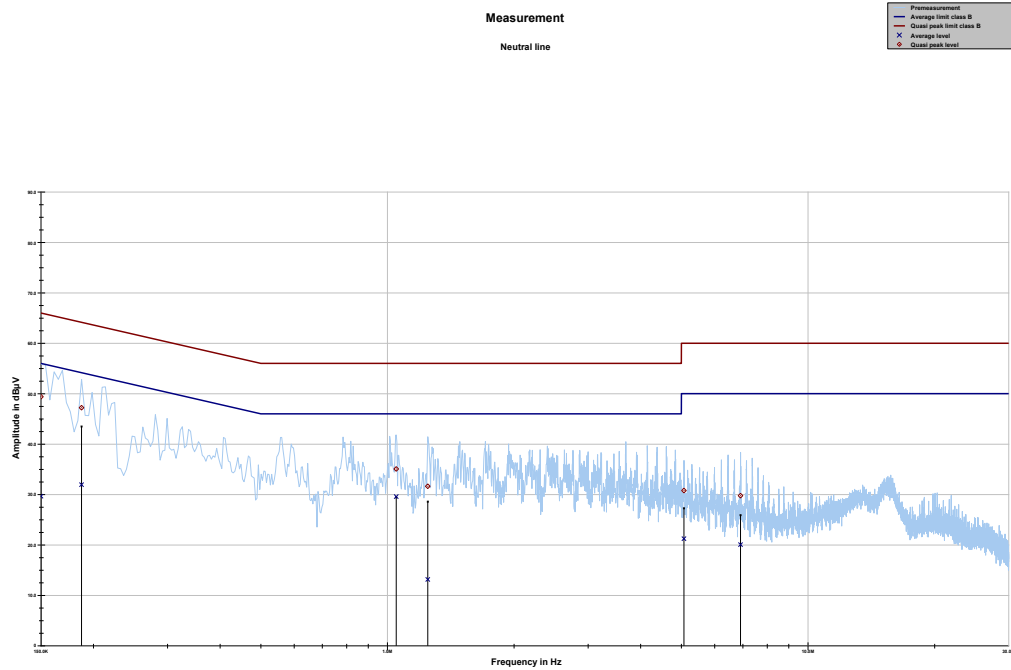
Plot 1: 150 kHz to 30 MHz, phase line



Project ID: 1-1247/25-01-05

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.179850	47.28	17.21	64.493	27.66	27.49	55.147
0.205969	44.81	18.56	63.366	28.86	25.55	54.401
1.482056	33.41	22.59	56.000	24.38	21.62	46.000
1.705931	31.28	24.72	56.000	15.45	30.55	46.000
5.071519	31.32	28.68	60.000	22.52	27.48	50.000
6.679688	30.03	29.97	60.000	21.29	28.71	50.000

Plot 2: 150 kHz to 30 MHz, neutral line



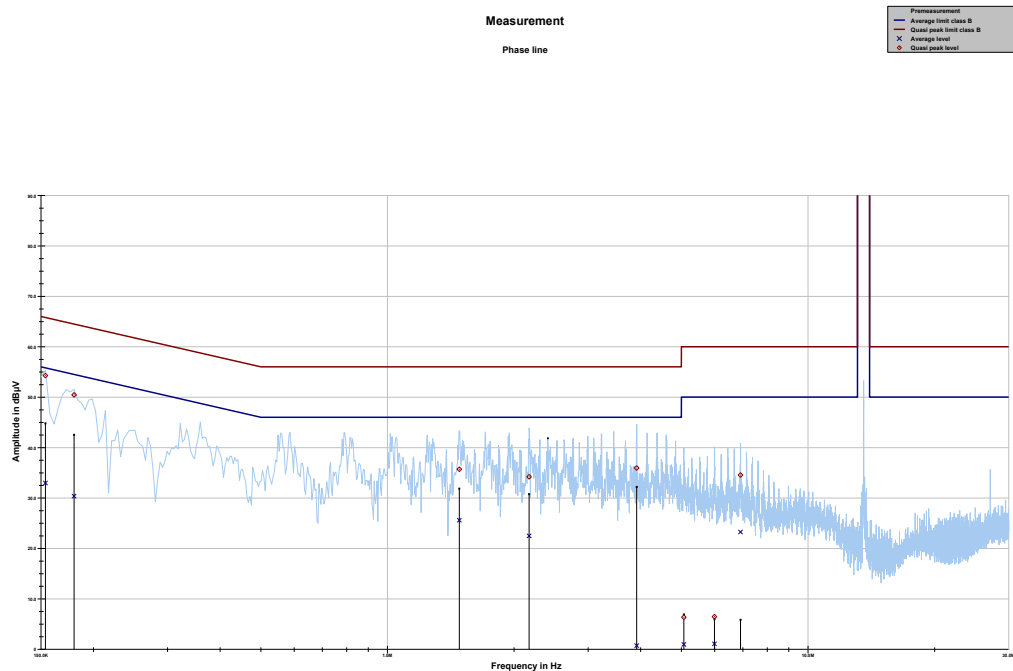
Project ID: 1-1247/25-01-05

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin Average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.150000	49.39	16.61	66.000	29.66	26.34	56.000
0.187312	47.22	16.94	64.155	31.96	22.98	54.934
1.049231	35.07	20.93	56.000	29.59	16.41	46.000
1.246987	31.64	24.36	56.000	13.15	32.85	46.000
5.071519	30.78	29.22	60.000	21.23	28.77	50.000
6.911025	29.76	30.24	60.000	20.05	29.95	50.000

12.4.2 Plots with build in antenna

Plots AC 120V/60Hz:

Plot 1: 150 kHz to 30 MHz, phase line

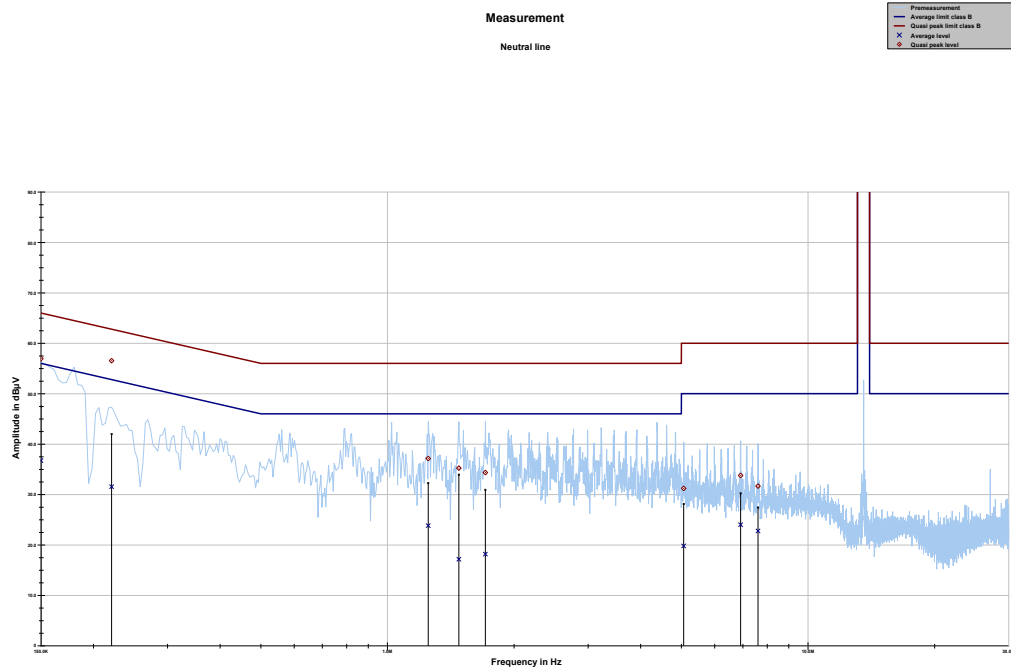


Project ID: 1-1247/25-01-05

*carrier frequency range (13.110 MHz – 14.010 MHz) not rated

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.153731	54.27	11.53	65.796	32.96	22.93	55.893
0.179850	50.44	14.05	64.493	30.36	24.79	55.147
1.482056	35.70	20.30	56.000	25.58	20.42	46.000
2.172337	34.21	21.79	56.000	22.48	23.52	46.000
3.914831	35.94	20.06	56.000	0.71	45.29	46.000
5.067787	6.35	53.65	60.000	0.95	49.05	50.000
5.993137	6.46	53.54	60.000	1.07	48.93	50.000
6.911025	34.56	25.44	60.000	23.25	26.75	50.000

Plot 2: 150 kHz to 30 MHz, neutral line



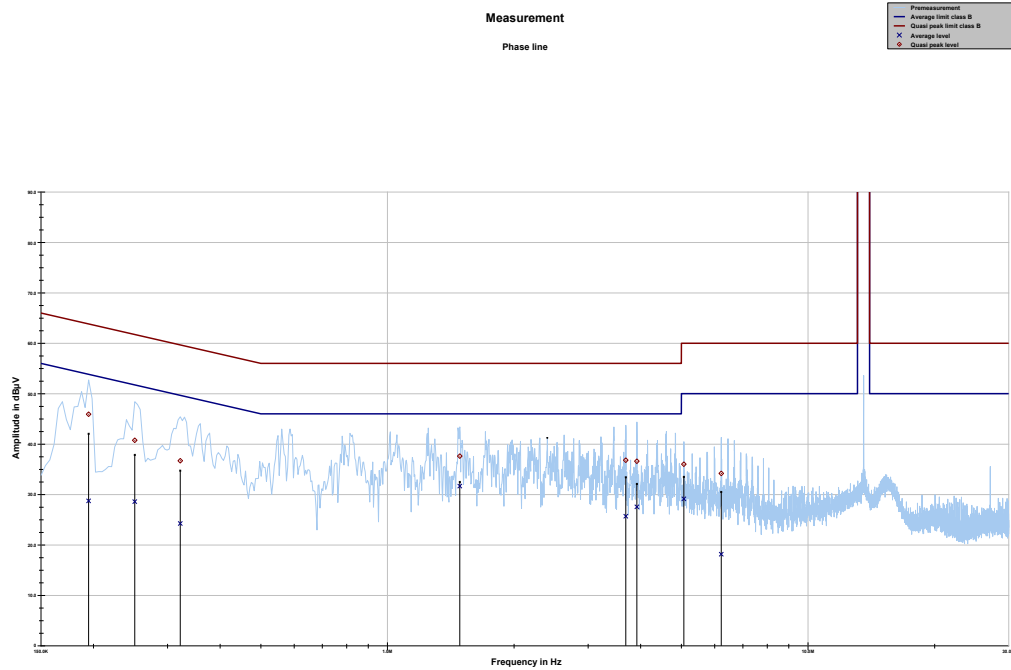
Project ID: 1-1247/25-01-05

*carrier frequency range (13.110 MHz – 14.010 MHz) not rated

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin Average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.150000	56.94	9.06	66.000	36.74	19.26	56.000
0.220894	56.53	6.25	62.785	31.53	22.44	53.974
1.250719	37.13	18.87	56.000	23.82	22.18	46.000
1.478325	35.23	20.77	56.000	17.16	28.84	46.000
1.709663	34.34	21.66	56.000	18.18	27.82	46.000
5.064056	31.21	28.79	60.000	19.81	30.19	50.000
6.914756	33.78	26.22	60.000	24.00	26.00	50.000
7.605037	31.68	28.32	60.000	22.78	27.22	50.000

Plots AC 240V/60Hz:

Plot 1: 150 kHz to 30 MHz, phase line

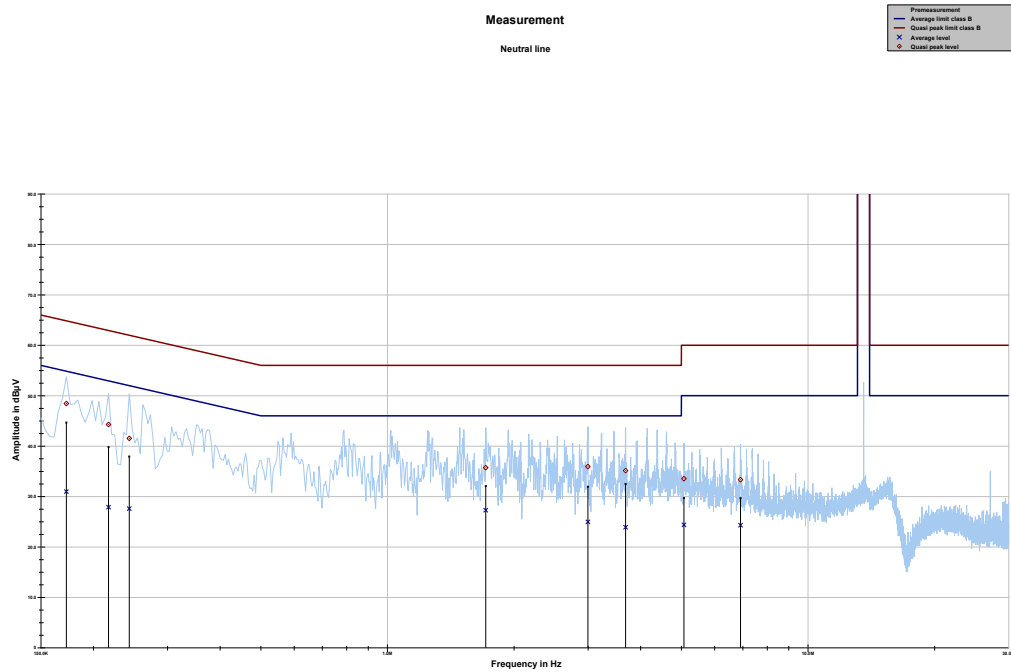


Project ID: 1-1247/25-01-05

*carrier frequency range (13.110 MHz – 14.010 MHz) not rated

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.194775	45.92	17.91	63.830	28.73	25.99	54.721
0.250744	40.75	20.99	61.732	28.60	24.53	53.122
0.321638	36.70	22.97	59.664	24.25	26.85	51.096
1.485788	37.62	18.38	56.000	31.68	14.32	46.000
3.687225	36.81	19.19	56.000	25.69	20.31	46.000
3.918563	36.61	19.39	56.000	27.55	18.45	46.000
5.067787	36.01	23.99	60.000	29.14	20.86	50.000
6.220744	34.17	25.83	60.000	18.17	31.83	50.000

Plot 2: 150 kHz to 30 MHz, neutral line



*carrier frequency range (13.110 MHz – 14.010 MHz) not rated

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin Average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.172387	48.44	16.40	64.845	30.97	24.39	55.360
0.217163	44.28	18.65	62.927	27.88	26.20	54.081
0.243281	41.52	20.46	61.983	27.59	25.74	53.335
1.713394	35.72	20.28	56.000	27.28	18.72	46.000
2.996944	35.94	20.06	56.000	24.96	21.04	46.000
3.683494	35.14	20.86	56.000	23.91	22.09	46.000
5.071519	33.54	26.46	60.000	24.38	25.62	50.000
6.911025	33.33	26.67	60.000	24.30	25.70	50.000

12.5 Frequency error

Measurement:

The maximum detected field strength for the spurious. Measurement performed according to ANSI C63.10, chapter 6.8

Measurement parameters	
Detector:	Peak detector
Resolution bandwidth:	10 Hz / 100 Hz
Video bandwidth:	> RBW
Trace mode:	Max hold
Used equipment:	See chapter 7.4 B
Measurement uncertainty:	See chapter 9

Limit:

FCC & ISED
The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. (± 1.356 kHz)
Carrier frequency stability shall be maintained to $\pm 0.01\%$ (± 100 ppm)

Result: Temperature variation

Frequency tolerance			
Measured frequency	Frequency error	Conditions	Result
13.560644 MHz	47.5 ppm	-20 °C & 100% voltage	compliant
13.560653 MHz	48.1 ppm	-10 °C & 100% voltage	compliant
13.560641 MHz	47.3 ppm	0 °C & 100% voltage	compliant
13.560619 MHz	45.6 ppm	+10 °C & 100% voltage	compliant
13.560568 MHz	41.8 ppm	+30 °C & 100% voltage	compliant
13.560550 MHz	40.5 ppm	+40 °C & 100% voltage	compliant
13.560542 MHz	40.0 ppm	+50 °C & 100% voltage	compliant

Result: Voltage variation

Frequency tolerance			
Measured frequency	Frequency error	Conditions	Result
13.560576 MHz	42.5 ppm	+20 °C & 85% voltage	compliant
13.560579 MHz	42.6 ppm	+20 °C & 100% voltage	compliant
13.560574 MHz	42.3 ppm	+20 °C & 115% voltage	compliant

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	Combination of Grantee Code and Equipment Product Code
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
ISED	Innovation, Science and Economic Development 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	2025-11-10
R02	PMN corrected	2025-12-05

END OF TEST REPORT