

Test Report

Product	Smart Brick
Name and address of the applicant	LEGO System A/S Aastvej 1 Billund 7190, Denmark
Name and address of the manufacturer	LEGO System A/S Aastvej 1 Billund 7190, Denmark
Model	PEL-1
Rating	3.7V _{DC} (Li-Ion Battery)
Trademark	LEGO
Additional information	BLE, 13.56MHz, 8.25MHz
Tested according to	FCC Part 15.225 Low Power Device Transmitter Industry Canada RSS-210, Issue 11 Low Power Licence-Exempt Radio Apparatus, Category I Equipment
Order number	PRJ0078073
Tested in period	2025-07-02 to 2025-07-04 and 2025-12-03
Issue date	2025-12-03
Name and address of the testing laboratory	 Instituttveien 6 Kjeller, Norway www.nemko.com CAB Number: FCC: NO0001 ISED: NO0470   An accredited technical test executed under the Norwegian accreditation scheme
 Digitally signed by Frode Sveinsen DN: cn=Frode Sveinsen, c=NO, o=Nemko Scandinavia AS, ou=ETM, email=frode.sveinsen@nemko.com Date: 2025.12.03 15:39:22 +01'00'  Jan G Eriksen CN=Jan G Eriksen, OU=Senior Engineer, O=Nemko Scandinavia AS, E=jangunnar.eriksen@nemko.com, C=NO 2025.12.04 06:45:01 +01'00' Prepared by [Frode Sveinsen] Approved by [Jan G. Eriksen]	
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Revision history

Revision	Date	Comment	Sign
A	2025-09-12	First edition	FS
B	2025-10-20	Corrected model name	FS
C	2025-11-12	Added RSS-210 references	FS
D	2025-12-03	Added FCC 15.225 and RSS-210 B.6 results	FS

GENERAL REMARKS

This report applies only to the sample(s) tested. It is the manufacturer's responsibility to ensure the additional production units of this product are manufactured with identical electrical and mechanical components. The manufacturer is solely responsible for any modifications to the product that could result in non-compliance with the relevant regulations.

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Opinions expressed within this report regarding general assessments and qualifications for PASS or FAIL to the standards limits and requirements are not part of the current accreditation. Neither are opinions expressed regarding model variants covered by the testing of this report.

CALIBRATION

All instruments used in the tests given in this test report are calibrated and traceable to national or international standards. Between calibrations all test set-ups are controlled and verified on a regular basis by periodic checks to ensure, with 95% confidence, that the instruments remain within the calibrated levels.

MEASUREMENT UNCERTAINTY

Measurement uncertainties are calculated or considered for all instruments and instrument set-ups used during these tests. Uncertainty figures are found in a separate clause in this report.

1 INFORMATION

1.1 Test Item

Product	Smart Brick
Manufacturer	LEGO System A/S
Model	PEL-1
FCC ID	NPI106929
ISED Canada ID	3072A-106929
Serial number	Radiated: 0017F5, 0017FV, 0017G2 Conducted: Sample 5 Frequency and Spectrum Mask: 000V6K
Hardware version	AB1.1-STD
Software version	V2.29.0-27
Frequency Range	13.56 MHz
Operating frequency	13.56 MHz
Type of Modulation	FSK
User Frequency Adjustment	None
Type of Power Supply	Secondary Battery (3.7V Li-Ion)
Antenna Type	Internal Antenna

1.2 Description of Tested Device

The EUT is a Smart Brick with Bluetooth Low Energy (BLE) as well as 13.56 MHz and 8.25 MHz transmitters. The Smart Brick is charged by an inductive charger. The charging frequency is 27.12 MHz and there is no communication between the charger and the brick when charging.

1.3 Test Environment

Temperature:	20 - 23 °C
Relative humidity:	40 - 70 %
Normal test voltage:	3.7V _{DC} (Nominal Battery Voltage)

The values are the limit registered during the test period.

1.4 Test Engineers

Frode Sveinsen

1.5 EUT Operating Modes

Description of operating modes	All tests were performed with the EUT set to transmit continuously in test-mode.
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1.6 Comments

All measurements were performed with the EUT powered by a fully charged battery.

2 TEST REPORT SUMMARY

2.1 General

The tests were conducted on a sample of the equipment for demonstrating compliance with one or more of the following standards:

Standard	Description
FCC CFR 47 Part 15C	Unlicensed transmitters
ISED RSS-210, Issue 10	Licence-Exempt Radio Apparatus: Category I Equipment
ISED RSS-GEN Issue 5	General Requirements for Compliance of Radio Apparatus

The following standards and documents were used for one or more measurements:

Standard	Description
ANSI C63.4-2014	Unintentional Radiators
ANSI C63.10-2020 (FCC)	Procedures for Compliance Testing of Unlicensed Wireless Devices
ANSI C63.10-2020 (ISED Canada) +cor.1-2023 +ANSI C63.10a-2024 +Errata to C63.10a-2024	Procedures for Compliance Testing of Unlicensed Wireless Devices +Corrigendum 1 +Amendment 1 +Errata to Amendment 1

All measurements are traceable to national standards.

A description of the test facility is on file with FCC and ISED Canada.

☒ New Submission	☐ Production Unit
☐ Class II Permissive Change	☒ Pre-production Unit
DXX Equipment Class	☐ Family Listing

2.2 Test Summary

Name of test	FCC Part 15 reference	RSS-210 Issue 11 RSS-GEN Issue 5 reference	ANSI C63.10-2020 reference	Verdict
Supply Voltage Variations	15.31(e)	6.11 (RSS-GEN)	5.13	N/A
Number of Frequencies	15.31(m)	6.9 (RSS-GEN)	5.6	N/A
Antenna Requirement	15.203	6.8 (RSS-GEN)	5.8	N/A
Power Line Conducted Emission	15.207(a)	7.2 / 8.8 (RSS-GEN)	6.2	N/A
Field Strength of Fundamental	15.225	B.6 (RSS-210)	6.3, 6.4	Complies
Spectrum Mask	15.225(a)(b)(c)(d)	B.6 (RSS-210)	6.3, 6.4	Complies
Frequency Tolerance	15.225(e)	B.6 (RSS-210) 6.11 (RSS-GEN)	6.8	Complies
Occupied Bandwidth (99% BW)	N/A	6.7 (RSS-GEN)	6.9	Complies
Spurious Emissions (Radiated)	15.209(a)	7.3 (RSS-GEN) 8.9 (RSS-GEN)	6.3, 6.4, 6.5	Complies

3 TEST RESULTS

3.1 Field Strength of Fundamental

FCC Part 15.225 (a)

ISED Canada RSS-210 Issue 11, Clause B.6

Measurement procedure: ANSI C63.10-2020 Clause 6.4

Test Results: Complies

Measurement Data:

Frequency (MHz)	Measuring Distance	Measured Field Strength @3m	Extrapolated Value @30m	Detector	Limit	Margin
13.56	3m	55.3 dBμV/m	13.3 dBμV/m	Peak	84.0 dBμV/m	70.7 dB

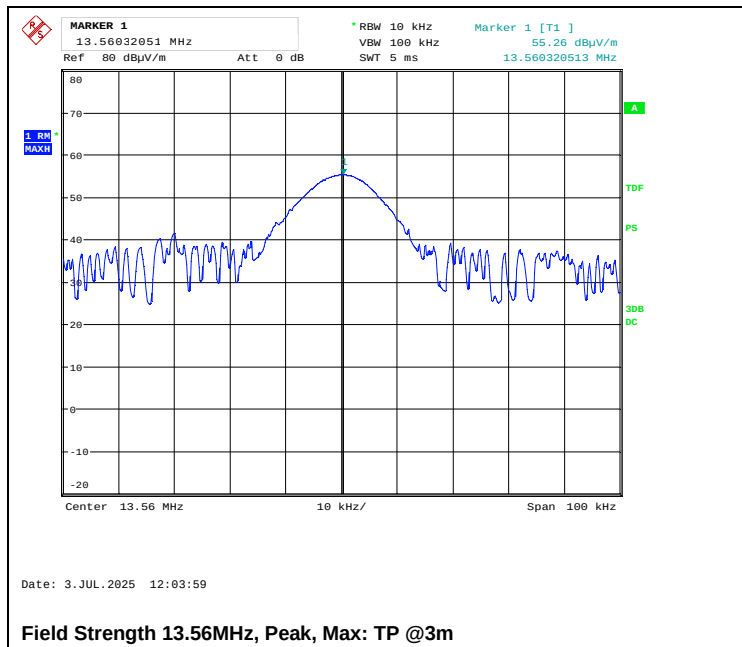
Field Strength was measured at 3m, and the value was extrapolated to 30m using an extrapolation factor of 40dB/decade, as specified in RSS-GEN Clause 6.5 and FCC Part 15.31(f)(2).

Antenna factor, amplifier-gain and cable loss are included in Spectrum Analyzer "Transducer factor".

See attached graphs.

Limit

FCC	Part 15.225	
ISED	RSS-210 Issue 11, Clause B.6	
Frequency	Radiated emission limit @30 meters	
13.56 MHz	15848 μV/m	84.0 dBμV/m
Limits above are with Quasi Peak Detector		



3.2 Spectrum Mask

FCC Part 15.225 (a)(b)(c)(d)

ISED Canada RSS-210 Issue 11, Clause B.6.a

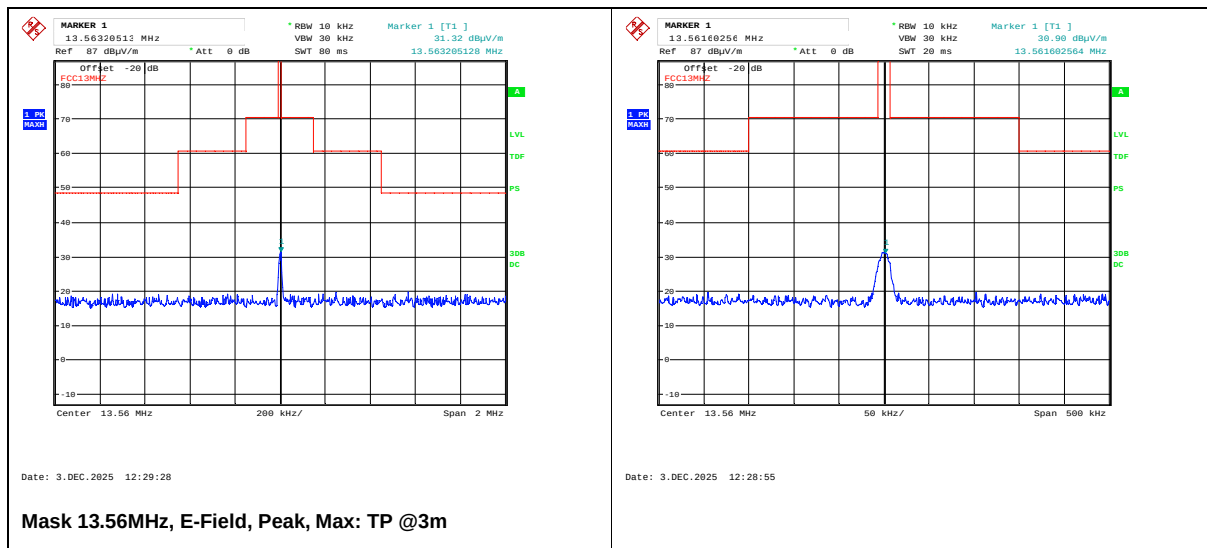
Measurement procedure: ANSI C63.10-2020 Clause 6.4

Test Results: Complies

Measurement Data:

Frequency (MHz)	Measured Value @30m	Limit @30m
13.553 – 13.567	< 40 dB μ V/m	84.0 dB μ V/m
13.410-13.553 and 13.567-13.710	< 30 dB μ V/m	50.5 dB μ V/m
13.110-13.410 and 13.710-14.010	< 30 dB μ V/m	40.5 dB μ V/m
Outside the band 13.110-14.010	< 20 dB μ V/m	29.5 dB μ V/m

The measurement was extrapolated from 3m to 30m using an extrapolation factor of 20dB/decade.



3.3 99% Occupied Bandwidth

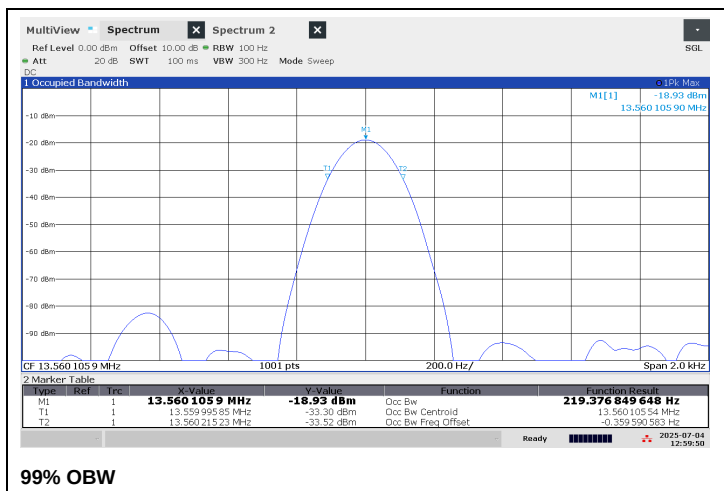
ISED Canada RSS-GEN Issue 5, Clause 6.7

Measurement procedure: ANSI C63.10-2020 Clause 6.9

Measurement Data:

Occupied Bandwidth (99%)	
Operating Frequency	13.56 MHz
Measured OBW (99%)	219 Hz

Requirements: No requirement for 99% BW, reported for information only.



3.4 Frequency Stability

FCC Part 15.225(e)

ISED Canada RSS-210 Issue 11, B.6.b

ISED Canada RSS-GEN Issue 5, Clause 6.11

ANSI C63.10-2020 Clause 6.8

Test Results: Complies

Measurement Data:

Temperature	Measured Frequency (MHz)	Deviation (kHz)	Deviation (ppm)
+50 °C	13.560004	-0.028	-2.1
+20 °C	13.560032	Reference	Reference
-20 °C	13.560024	-0.008	-0.5

Voltage	Measured Frequency (MHz)	Deviation (kHz)	Deviation (ppm)
85 % of Nominal Voltage	N/A	N/A	N/A
Nominal Voltage	N/A	Reference	Reference
115% of Nominal Voltage	N/A	N/A	N/A

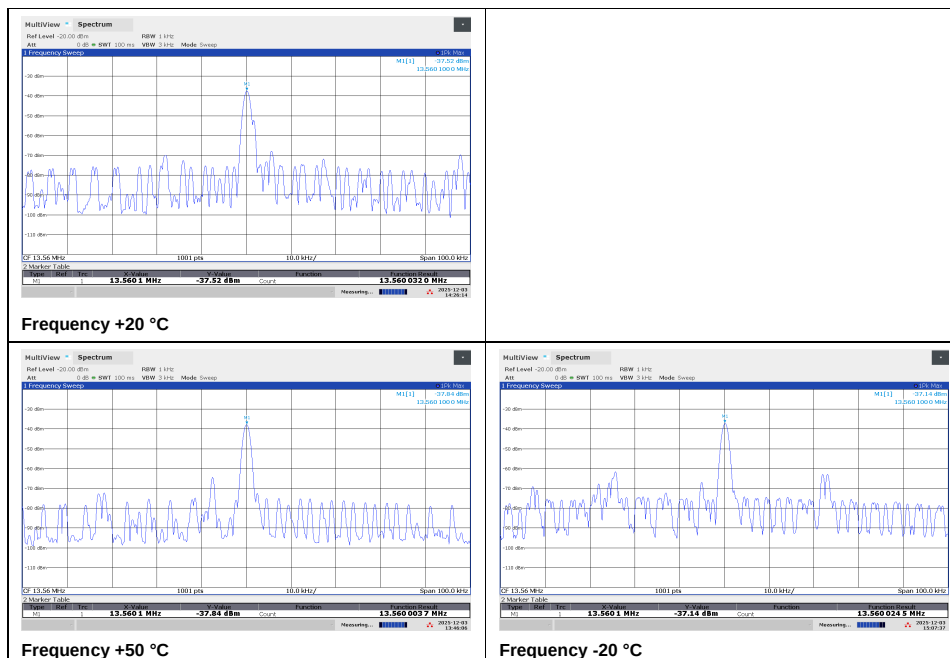
The test was performed with new batteries. Voltage variation is not applicable for battery-operated equipment.

Frequency Stability was measured using the counter function on the spectrum analyzer.

Limit:

FCC 15.225(e):	±0.01 % of operating frequency
ISED Canada RSS-210 B6.e:	±100 ppm

0.01% is identical to 100ppm



3.5 Spurious Emissions (Radiated)

FCC Part 15.209(a)

ISED Canada RSS-210 Issue 11, Clause 8.3

ISED Canada RSS-GEN Issue 5, Clause 7.3/8.9

Measurement procedure: ANSI C63.10-2020 Clause 6.4, 6.5

Test Results: Complies

Measuring Distance: 9 kHz- 30 MHz: 10m
30 – 1000 MHz: 3m

Frequency (MHz)	Tx Freq (MHz)	Measuring Distance	Field Strength (dBμV/m)	Detector	Limit (dBμV/m)	Margin (dB)
0.009-30	13.56	10m	See plots	Peak	See Plots	>10
40.6	13.56	3m	18.3	QP	40	21.7
67.7	13.56	3m	28.4	QP	40	11.6
94.9	13.56	3m	27.3	QP	43.5	16.2
122.0	13.56	3m	21.0	QP	43.5	22.5
935.6	13.56	3m	36.7	QP	46	9.3

Measurements below 30 MHz were extrapolated from 10m to the specified measurement distance using an extrapolation factor of 40dB/decade, as specified in RSS-GEN Clause 6.5 and FCC Part 15.31(f)(2).

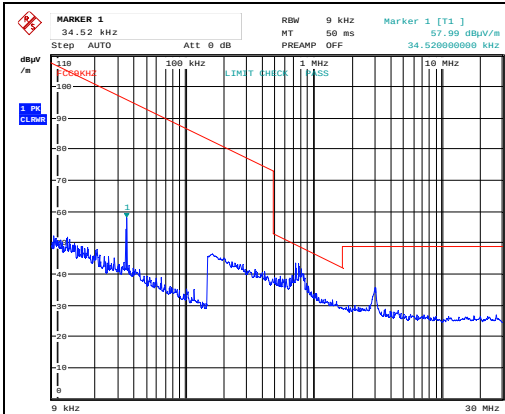
Spurious Emissions were measured from 9 kHz to 1000 MHz.

Antenna factor, amplifier-gain and cable loss are included in Spectrum Analyzer "Transducer factor".

See attached graphs.

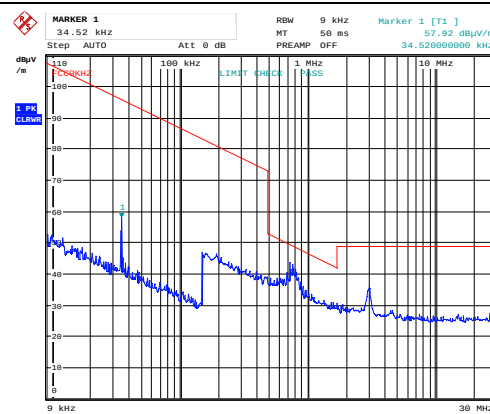
Requirements/Limit

FCC	Part 15.209		
ISED	RSS-GEN Issue 5, Clause 8.9		
	Radiated emission limit		
Frequency	FCC (μV/m)	ISED (μA/m)	Distance
0.009 – 0.490 MHz	2400 / F (kHz)	6.37 / F (kHz)	300 m
0.490 – 1.705 MHz	24000 / F (kHz)	63.7 / F (kHz)	30 m
1.705 – 30 MHz	30	0.08	30 m
	Radiated emission limit		
Frequency	FCC and ISED		Distance
30 – 88 MHz	100 μV/m	40 dBμV/m	3 m
88 – 216 MHz	150 μV/m	43.5 dBμV/m	3 m
216 – 960 MHz	200 μV/m	46 dBμV/m	3 m
Above 960 MHz	500 μV/m	54 dBμV/m	3 m
Limits are with Quasi Peak Detector, except: Limit in the bands 9-90kHz, 110-490kHz and above 1000MHz are with Average Detector			



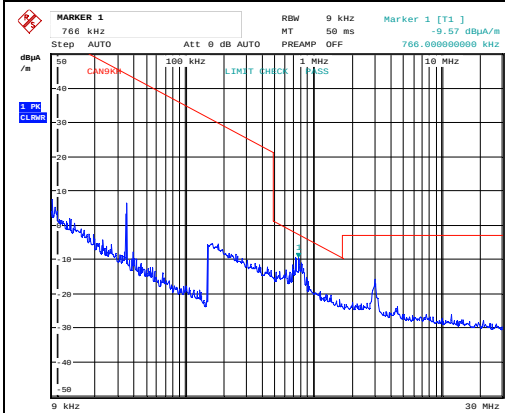
Date: 3.JUL.2025 15:04:58

Radiated Emissions, 0.09 - 30MHz, Peak, LP @10m
(The signal at 34.5 kHz is inherent noise)



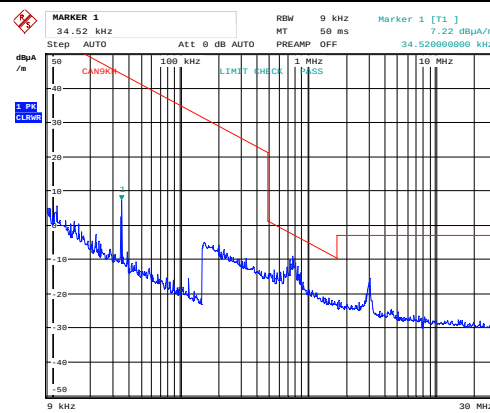
Date: 3.JUL.2025 15:17:10

TP @10m



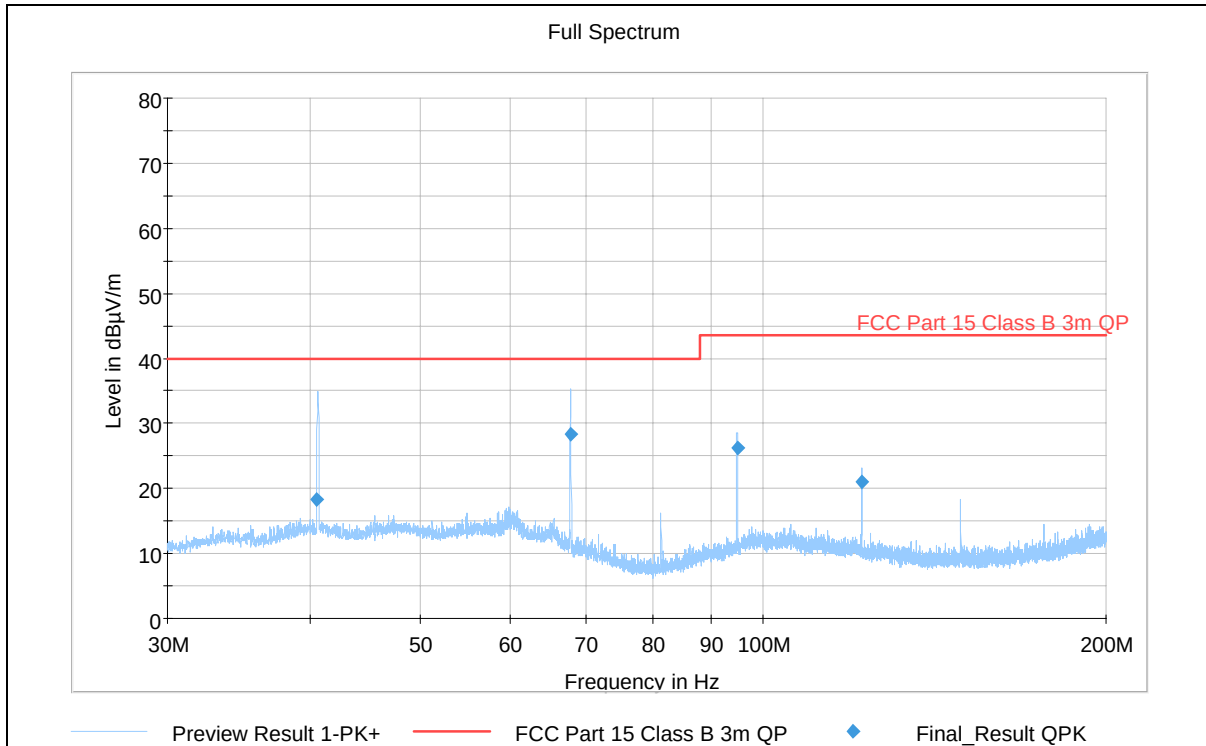
Date: 3.JUL.2025 14:51:54

Radiated Emissions, 0.09 - 30MHz, Peak, LP @10m
(The signal at 34.5 kHz is inherent noise)

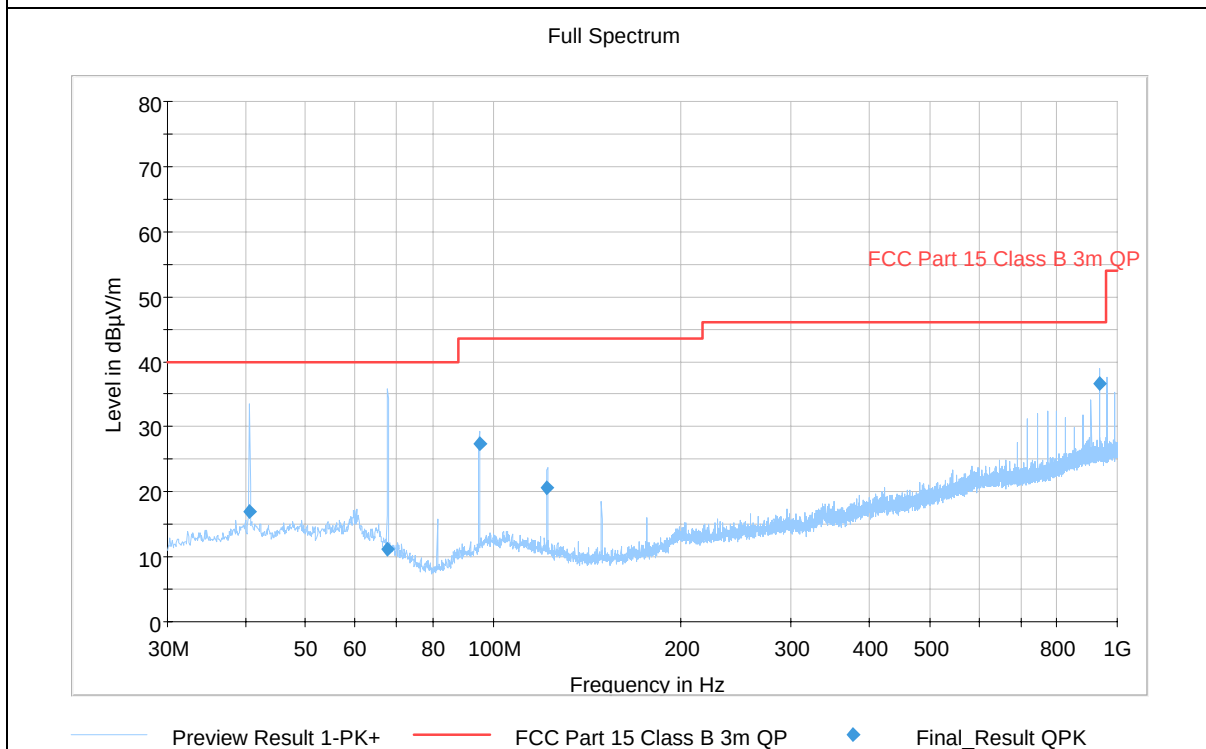


Date: 3.JUL.2025 15:26:29

TP @10m



Radiated Emissions, 30 – 200 MHz, @3m, Brick:



Radiated Emissions, 30 – 1000 MHz, @3m, Brick:

4 Measurement Uncertainty

Measurement Uncertainty Values		
Test Item		Uncertainty
Output Power		±0.5 dB
Spurious Emissions, Radiated	< 1 GHz	±2.5 dB
	> 1 GHz	±2.2 dB
Emission Bandwidth		±4 %
Power Line Conducted Emissions		+2.9 / -4.1 dB
Temperature Uncertainty		±1 °C

All uncertainty values are expanded standard uncertainty to give a confidence level of 95%, based on coverage factor k=2

5 LIST OF TEST EQUIPMENT

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the test laboratory.

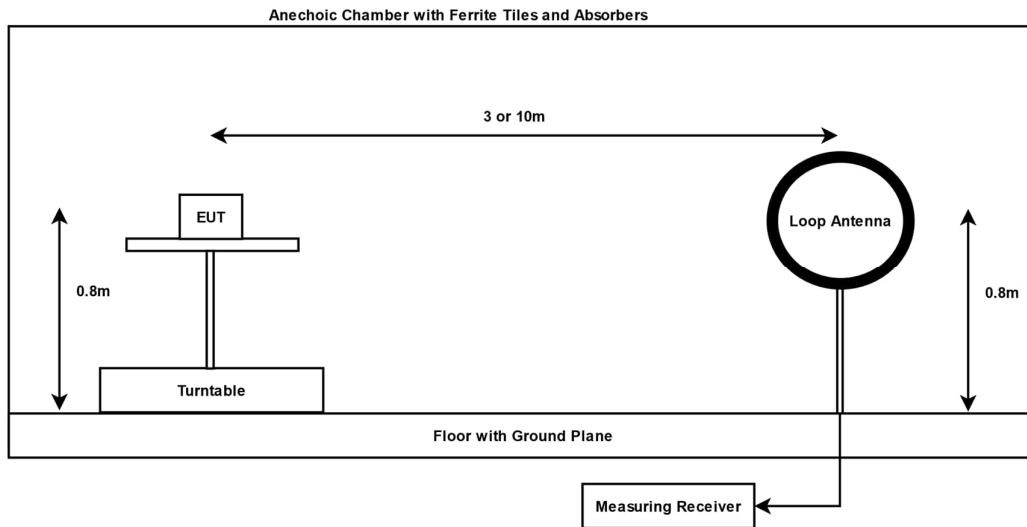
No.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2024-01	2025-01
2	HFH2-Z2	Loop Antenna	Rohde & Schwarz	LR 1660	2022-01	2025-01
3	JB3	BiLog Antenna	Sunol	N-4525	2023-04	2026-04
4	310	Preamplifier	Sonoma Inst.	LR 1686	2024-09	2025-09
5	FSW43	Spectrum Analyzer	Rohde & Schwarz	LR 1690	2025-01	2026-01
6	VT 4034	Climatic Chamber	Vötsch	N-5048	2025-04	2026-04

The software listed below has been used for one or more tests in this report.

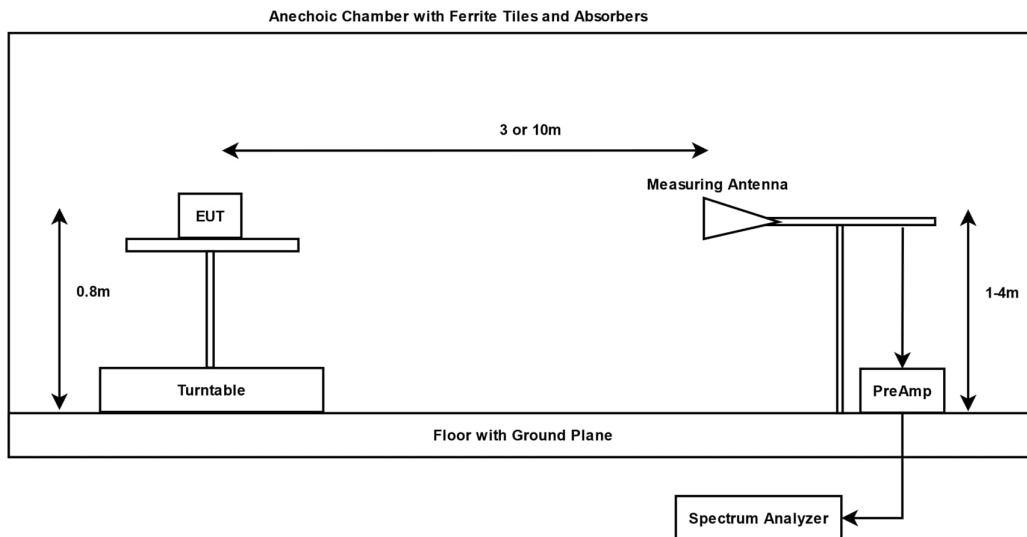
No.	Manufacturer	Name	Version	Comment
1	Rohde & Schwarz	EMC32	10.60.20	Power Line Conducted test software
3	Nemko	RSPlot	1.0.8.0	Screenshots from R&S Spectrum Analyzers

6 BLOCK DIAGRAM

6.1 Radiated Emissions Test

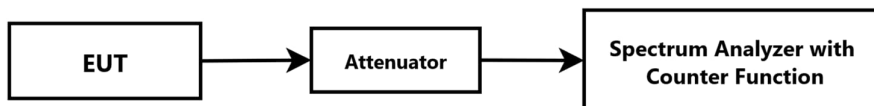


10m Chamber, below 30 MHz



10m Chamber, 30-1000 MHz

6.2 Frequency Stability



Frequency Stability

The EUT was placed inside the Climatic Chamber, and the measurement was performed radiated with a loop antenna inside the chamber. The attenuator was not used for this test.