Test report for

47 CFR Part 15 Subpart B

ICES-Gen, ICES-003

Product name	: PSV-Box sample
Applicant	: Advantest Europe GmbH
FCC ID	: 2BDQ2-EK810PS1
IC	: Not applicable

Test report No. : P000380782 001 Ver 1.0

Laboratory information

Accreditation

Kiwa Nederland B.V. complies with the accreditation criteria for test laboratories as laid down in ISO/IEC 17025:2017. The accreditation covers the quality system of the laboratory as well as the specific activities as described in the authorized annex bearing the accreditation number L248 and is granted by the Dutch Council For Accreditation (RvA: Raad voor Accreditatie).

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Kiwa Nederland B.V. is a Wireless Device Testing laboratory recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements.
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Documentation

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Testing Location

Test Site	Kiwa Nederland B.V.
Test Site location	Wilmersdorf 50 7327 AC Apeldoorn The Netherlands Tel. +31 88998 3393
Test Site FCC	NL0001
CABID	NL0001

Revision History

Version	Date	Remarks	By
v0.5	09-09-2024	First draft	PvW
v1.0	17-09-2024	Final release	PvW

Table of Contents

Summary of Test results

FCC	ISED	Description	Section in report	Verdict
15.109 (a)	ICES-003 Table 2	Radiated spurious emissions < 1GHz	3.1	Pass
15.109 (a)	ICES-003 Table 4	Radiated spurious emissions > 1GHz	3.1	Pass
15.107 (c)	ICES-003 Table 1	AC power-line conducted emissions	3.2	Pass

Decision rule: Pass/Fail decisions are based on measurement results without taking into account measurement uncertainty.

1 General Description

1.1 Applicant

Client name:	Advantest Europe GmbH
Address:	Herrenberger Str. 130, Böblingen
Zip code:	71034
Telephone:	+49 70314 357000
E-mail:	None
Contact name:	None

1.2 Manufacturer

Manufacturer name:	Salland Engineering (Europe) B.V.
Address:	Boerendanserdijk 39, Zwolle
Zip code:	8024 AE
Telephone:	+31 384547702
E-mail:	erik.kloekke@salland.com
Contact name:	Erik Kloekke

1.3 Tested Equipment Under Test (EUT)

Product name:	PSV-Box sample
Brand name:	Advantest Europe GmbH
FCC ID:	2BDQ2-EK810PS1
IC:	Not Applicable
Product type:	Benchtop post silicon validation instrument
Model(s):	EK810-65200
Batch and/or serial No.	000018
Software version:	--
Hardware version:	V2 PP first release
Date of receipt	01-08-2024
Tests started:	05-08-2024
Testing ended:	05-08-2024

Auxiliary items

AUX1

Product name:	PSV-Box
Brand name:	Advantest
Product type:	--
Model(s):	--
Batch and/or serial No.	--
Remarks:	Connects to EUT with various interface cables

AUX2

Product name:	Notebook
Brand name:	--
Product type:	--
Model(s):	--
Batch and/or serial No.	--
Remarks:	Connects to EUT 10Gbps Ethernet port and runs test software

1.4 Product specifications of Equipment under test

Transmitter	None
Receiver	None

Disclaimer: above info is declared by the applicant

The EUT is considered as a Class A device.

1.5 Environmental conditions

Test date	05-08-2024
Ambient temperature	23.1°C
Humidity	56.7%

1.6 Measurement standards

- ANSI C63.4:2014

1.7 Applicable standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart B
- ICES-003 Issue 7
- ICES-Gen Issue 2

1.8 Observation and remarks

EUT was placed table top on its legs. As there is no use case for the EUT in any other position, this is the only orientation in which the EUT was tested. The auxiliary equipment was placed next to it leaving about 5 cm of space, this deviates from the required 10 cm because the cables connecting the EUT and it's auxiliary equipment were not long enough to reach 10 cm distance between them. An ethernet cable had to be drawn from the EUT to a laptop outside the anechoic room. A direct link had to be used because the ethernet required 10 Gbit transfer speed, this speed is not supported by the ethernet to fibreoptic converters available in the test lab. Care was taken to limit potential disruptions entering the anechoic room through this cable.

1.9 Conclusions

The sample of the product showed **NO NON-COMPLIANCES** to the specifications stated in paragraph 1.8 of this report.

The results of the test as stated in this report, are exclusively applicable to the product items as identified in this report. Kiwa Nederland B.V. accepts no responsibility for any properties of product items in this test report, which are not supported by the tests as specified in paragraph 1.8 *"Applicable standards".*

All tests are performed by:

Name : Paul van Wanrooij, BASc

Review of test methods and report by:

Name : ing. R. van Barneveld

The above conclusions have been verified by the following signatory:

Date : 02-10-2024

Name : ing. R. van Barneveld

Function : Test Engineer

Signature :

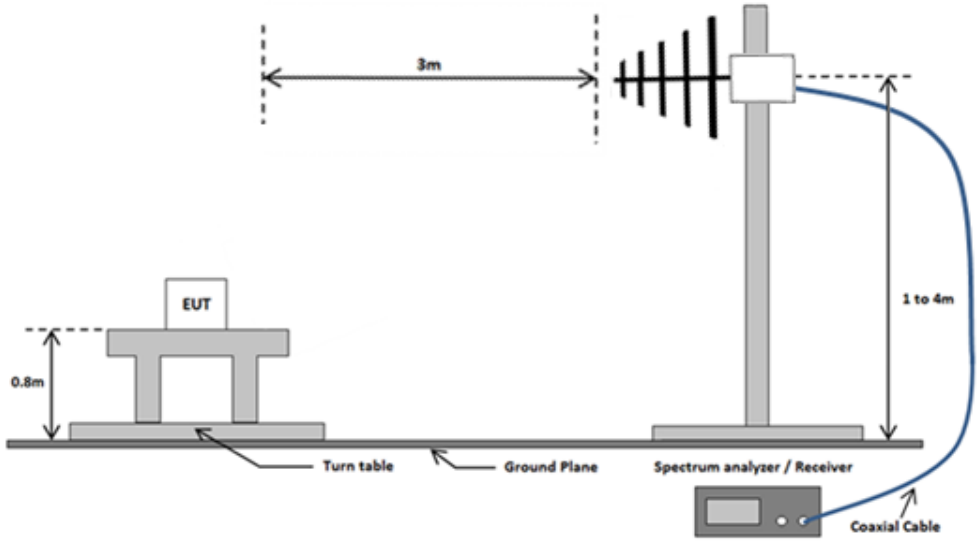
2 Test configuration of the Equipment Under Test

2.1 Test mode

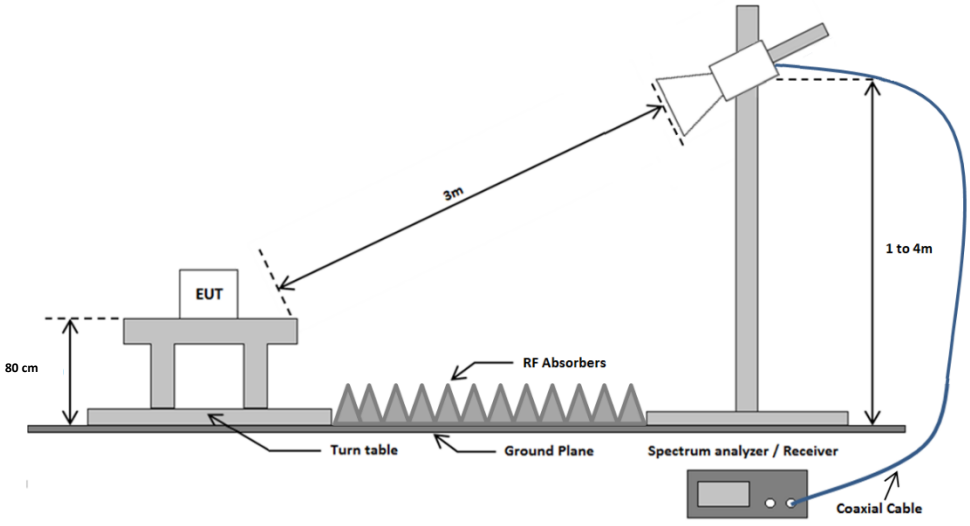
The manufacturer provided a test software with test mode. The test mode simulated normal use of the EUT.

2.2 Test setups

2.2.1 Radiated emissions test setup 30 MHz - 1 GHz

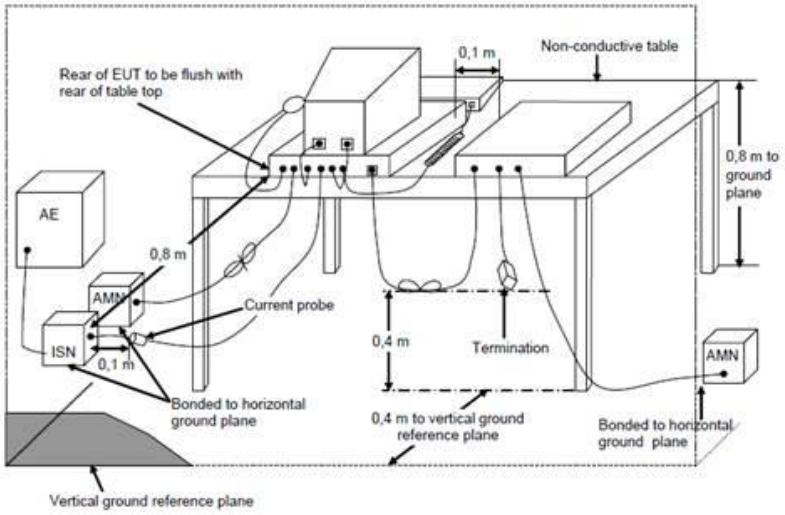


2.2.2 Radiated emissions test setup above 1 GHz



2.2.3 AC Power line conducted emissions test setup

Emissions test at AC mains



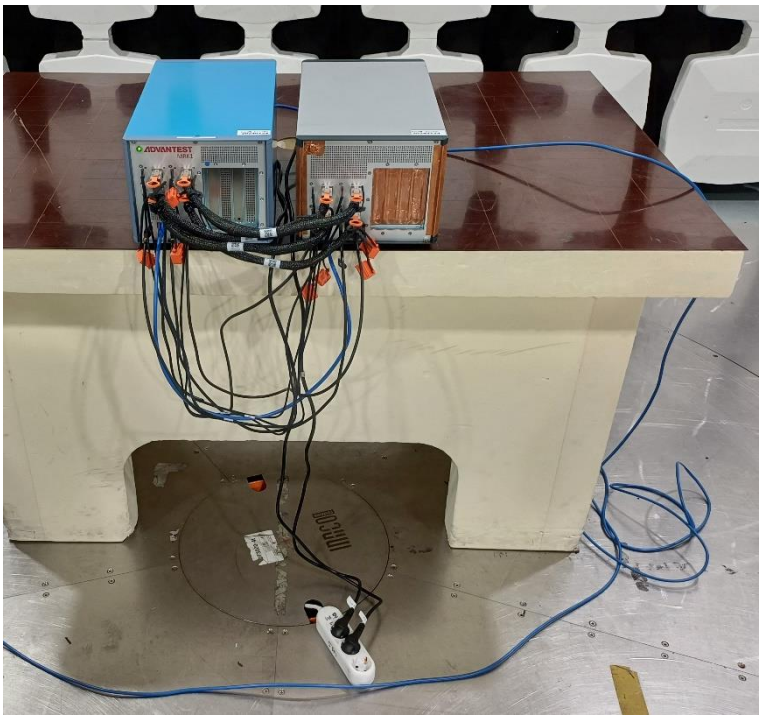


Figure 1. EUT and auxiliary setup

List of used cables					
Number	**Function**	**From**	**To**	**Length**	**Remarks**
1	AC Power	mains 110Vac 60 Hz	EUT1 and AUX1	< 3m	-
2	Ethernet	EUT	AUX2	<3m	-
3	PCIe cable	EUT	AUX1	0.5m	4 times
4	GPIO	EUT	AUX1	1.0	4 times
5	USB-C	EUT	AUX1	1.0	2 times
6	Ethernet	EUT	AUX1	1.0	-
7	Relay	EUT	AUX1	1.0	-

2.3 Test methodology.

The test methodology used is based on the requirements of 47 CFR Part 15, sections 15.31, 15.107 and 15.109, ICES-003 and ICES-Gen. The test methods, which have been used, are based on ANSI C63.4-2014.

2.4 Equipment modifications.

No modifications have been made to the equipment.

2.5 Equipment used in the test configuration

Description	Manufacturer	Model	ID	Cal. Done date	Cal. due date	Used at Par.
EMI Receiver	Rohde & Schwarz	ESR7	114870	09-2022	09-2024	3.1; 3.2
Spectrum Analyzer	Rohde & Schwarz	FSV3044	114923	10-2023	10-2025	3.2
Biconical antenna + 6dB attenuator	Schwarzbeck + HP	VHA9103 + 8491A	114435 114945	01-2023	01-2026	3.1
Logperiodic antenna	EMCO	3147	114385	02-2021	02-2026	3.1
Horn antenna	EMCO	3115	114607	01-2021	12-2024	3.2
Horn antenna	FLANN-MICROWAVE	20240-25	114518	NA*	NA*	3.2
Horn antenna	Scientific atlanta	12A-26	114487	NA*	NA*	3.2
Preamplifier 1-18 GHz	µComp Nordic	MCNA-40-0010800-25-10P	114771	08-2024	08-2025	3.2
Preamplifier 18-40 GHz	Schwarzbeck	BBV-9721	115026	06-2024	06-2025	3.2
Semi-Anechoic Chamber	ETS Lindgren	SAR	114624	03-2023	03-2026	3.1, 3.2
Test software	Raditeq	Radimation Version 2023.2.3	--	--	--	3.1, 3.2, 3.3
LISN /Two line V-network	Rohde & Schwarz	ENV 216	114379	11-2023	11-2025	3.3

*Note: Standard gain horn antennas do not need calibration
Conformance of the used measurement and test equipment with the requirements of ISO/IEC 17025:2017 has been confirmed before testing.
NA= Not Applicable

2.6 Sample calculations

All formulas for data conversions and conversion factors are reported in chapter 4 of this test report.

3 Test results

3.1 Radiated spurious emissions

3.1.1 Limit

For Class A digital devices, the field strength of radiated emissions from an unintentional radiator shall not exceed the field strength levels specified in the following tables.
On any frequency or frequencies below or equal to 1000 MHz, the limits shown are based on measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths, unless otherwise specified.
Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function.
When average radiated emission measurements are specified in this part, there is also a limit on the peak level of the emissions. Unless otherwise specified, the limit on peak emissions is 20 dB above the average limit.
The product under test shall comply with both the average and the peak limits.

ICES-003 Issue 7 section 3.2.2
The quasi-peak limits for the electric component of the radiated field strength emitted from ITE or digital apparatus, within 30 MHz to 1 GHz, for a measurement distance of 3m are presented in table below.
At and above 1 GHz, except for outdoor units of home satellite receiving systems, the ITE or digital apparatus shall comply with the limits specified in table below up to the frequency F_M, which shall be determined. The product under test shall comply with both the average and the peak limits.

FCC 15.109(b)

Frequency (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Measurement distance (m)
30-88	90	39	10
88-216	150	43.5	10
216-960	210	46.4	10
Above 960	300	49.5	10

ICES-003 tables 2, 4

Frequency (MHz)	Field strength (dBµV/m)	Measurement distance (m)
30-88	40.0	10
88-216	43.5	10
216-230	46.4	10
230 -960	47.0	10
960-1000	49.5	10
Above 1000	80.0	3

3.1.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

3.1.3 Test setup

The test setup is as shown in chapter 2.2.1 and 2.2.2 of this report.

3.1.4 Test procedure

30 MHz to 26.5 GHz: According to ANSI C63.4-2014, section 8.3

30 MHz to 1 GHz: IRN 441 – Method 1
1 GHz to 18 GHz: IRN 441 – Method 2
18 to 26.5 GHz: IRN 441– Method 3

In case of handheld and/or body-worn equipment, the EUT's orientation (X, Y, Z) was varied in order to ensure that maximum emission amplitudes were attained. In all other cases the associated cabling and the EUT orientation was varied for maximum emissions.

The spectrum was examined from 30MHz to the highest measurement frequency according to the table below. Final radiated emission measurements were made at 3m distance.

Highest internal frequency (F_X) [i]	Highest measurement frequency (F_M)
$F_X \leq 108$ MHz	1 GHz
108 MHz < $F_X \leq 500$ MHz	2 GHz
500 MHz < $F_X \leq 1$ GHz	5 GHz
$F_X > 1$ GHz	5 x F_X up to a maximum of 40 GHz
i. F_X is the highest fundamental frequency generated and/or used in the ITE or digital apparatus under test.	

The 6 highest emission amplitudes relative to the appropriate limit were recorded in this report. Field strength values of radiated emissions at frequencies not listed in the tables are more than 20 dB below the applicable limit.

3.1.5 Measurement Uncertainty

Frequency range	Polarization	Uncertainty
30 – 200 MHz	Horizontal	±4.5 dB
	Vertical	±5.4 dB
200 -1000 MHz	Horizontal	±3.6 dB
	Vertical	±4.6 dB
1 – 18 GHz	Horizontal	±5.7 dB
	Vertical	±5.7 dB
18 – 26.5 GHz	Horizontal	±4.9 dB
	Vertical	±4.9 dB

3.1.6 Test results

Note: Emissions are measured at 3m distance, the measured values are converted to 10m distance by subtracting 10.46 dB

Peaks < 1 GHz

Peak Number	Frequency	Peak	Quasi-Peak	Quasi-Peak Limit	Status	Height	Polarization
1	41.909 MHz	26.8 dBµV/m	19 dBµV/m	39.1 dBµV/m	Pass	1 m	Vertical
2	103.798 MHz	28.1 dBµV/m	20.4 dBµV/m	43.5 dBµV/m	Pass	1 m	Vertical
3	111.934 MHz	30.1 dBµV/m	23.3 dBµV/m	43.5 dBµV/m	Pass	1 m	Vertical
4	391.819 MHz	27.4 dBµV/m	18.2 dBµV/m	46.4 dBµV/m	Pass	1.7 m	Horizontal

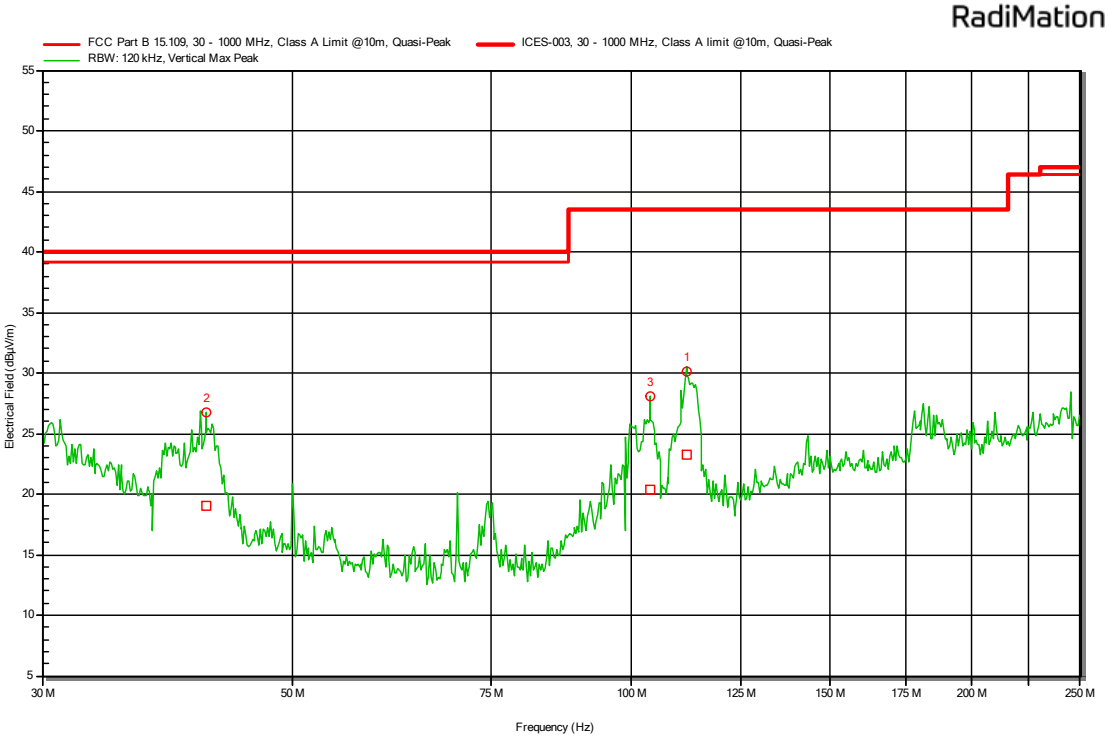
Peaks > 1 GHz

Peak Number	Frequency	Peak	Peak Limit	Average	Average Limit	Status	Height	Polarization
1	1.152 GHz	33.7 dBµV/m	69.5 dBµV/m	20.6 dBµV/m	49.5 dBµV/m	Pass	1.7 m	Horizontal
2	1.6 GHz	32.1 dBµV/m	69.5 dBµV/m	26.2 dBµV/m	49.5 dBµV/m	Pass	3 m	Horizontal
3	1.8 GHz	34.4 dBµV/m	69.5 dBµV/m	21.6 dBµV/m	49.5 dBµV/m	Pass	4 m	Vertical
4	21.661 GHz	42.2 dBµV/m	69.5 dBµV/m	30.3 dBµV/m	49.5 dBµV/m	Pass	4 m	Vertical

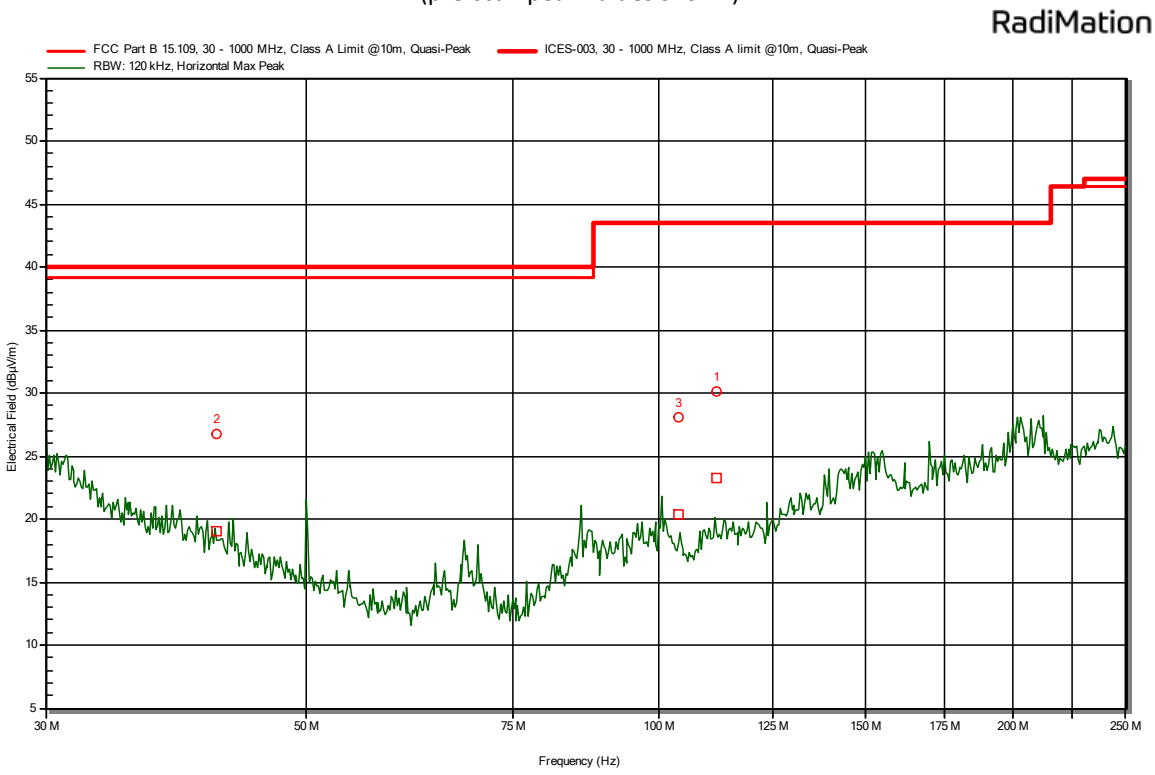
The results of the radiated emission tests are depicted in the table above. A selection of plots is provided on the next pages.

3.1.7 Plots of the Radiated Spurious Emissions Measurement

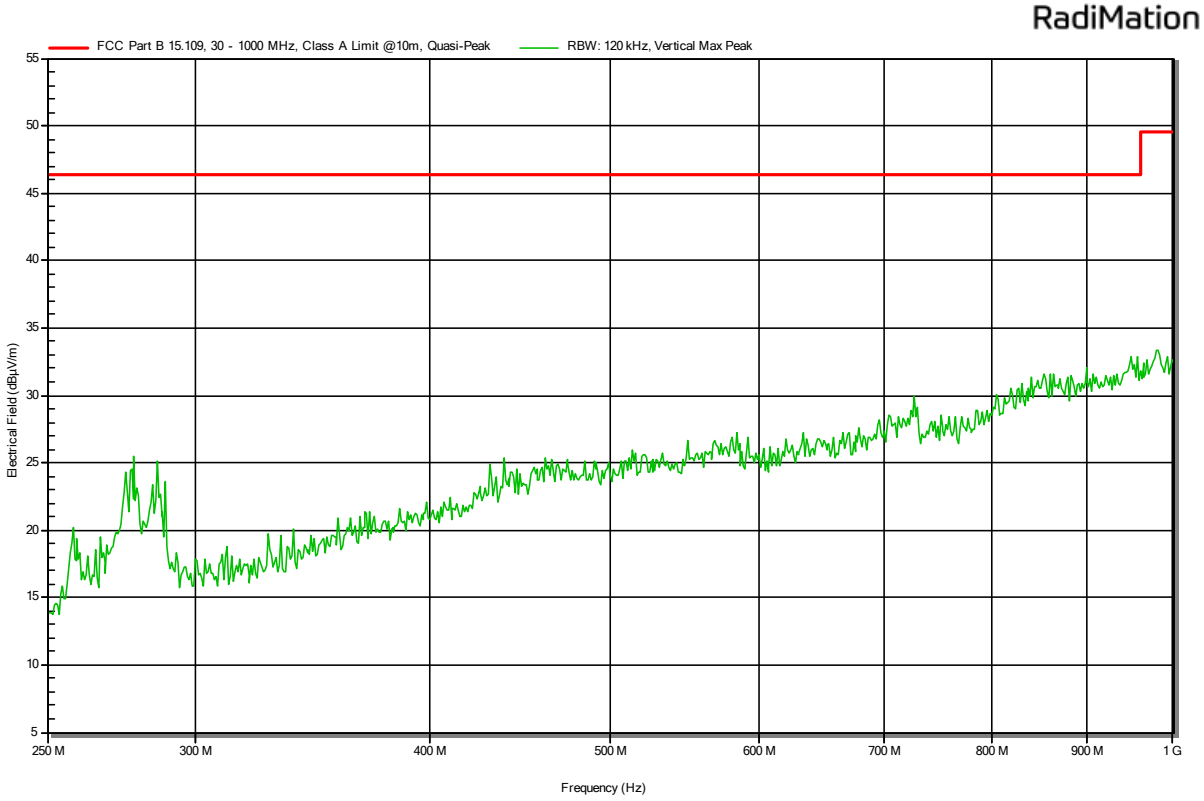
Plot 1a: radiated emissions of the EUT, Antenna vertical, in the range 30 – 250 MHz
(pre-scan peak values shown)



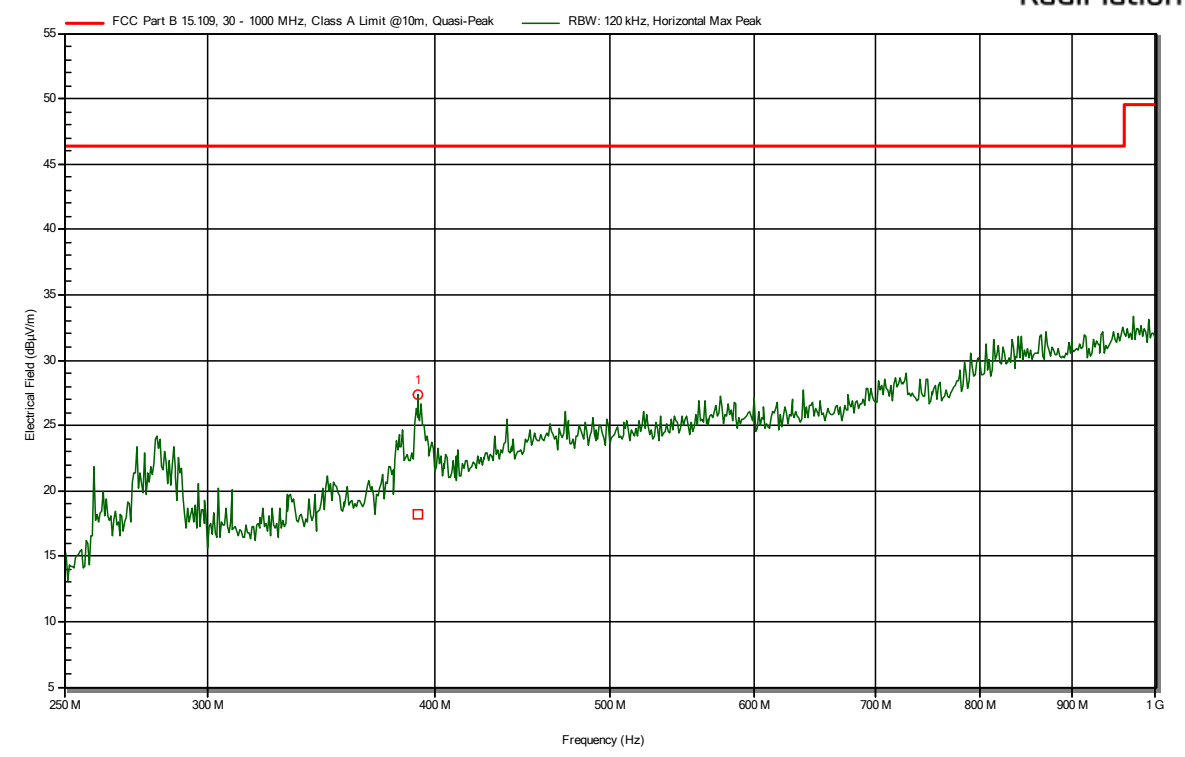
Plot 1b: radiated emissions of the EUT, Antenna horizontal, in the range 30 – 250 MHz
(pre-scan peak values shown)



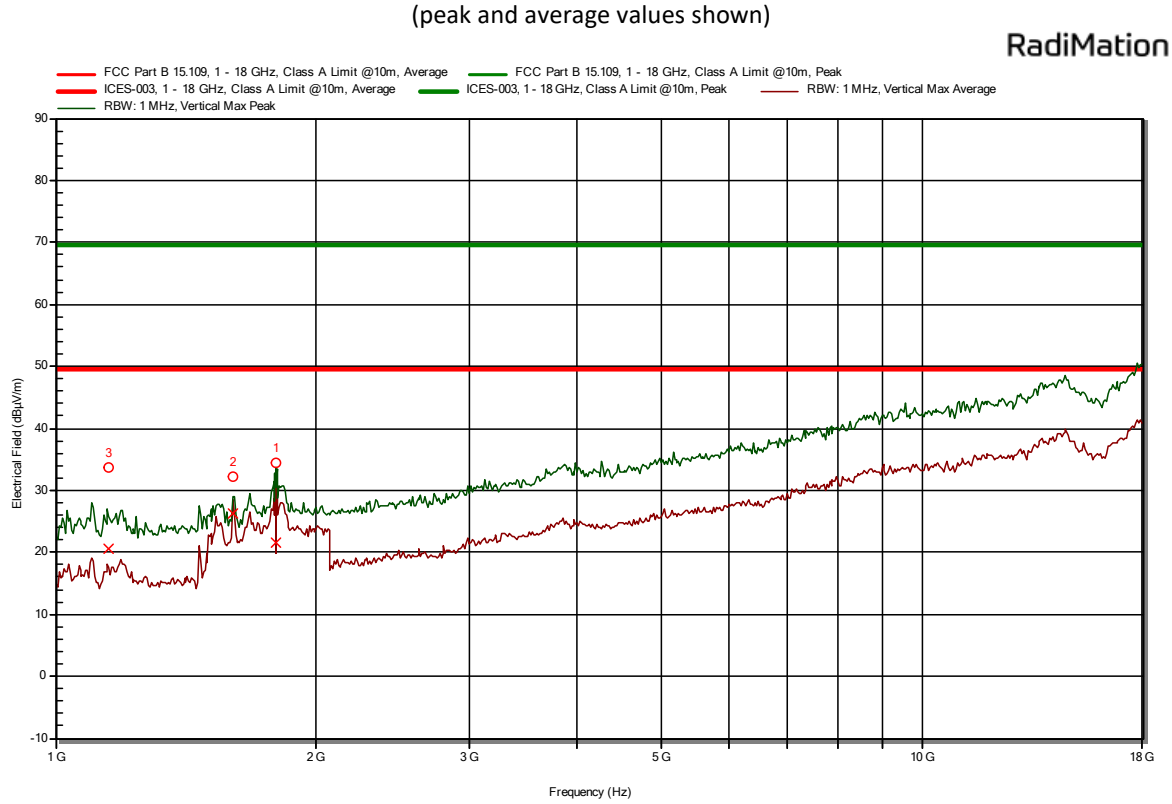
Plot 2a: radiated emissions of the EUT, Antenna vertical, in the range 250-1000 MHz
(pre-scan peak values shown)



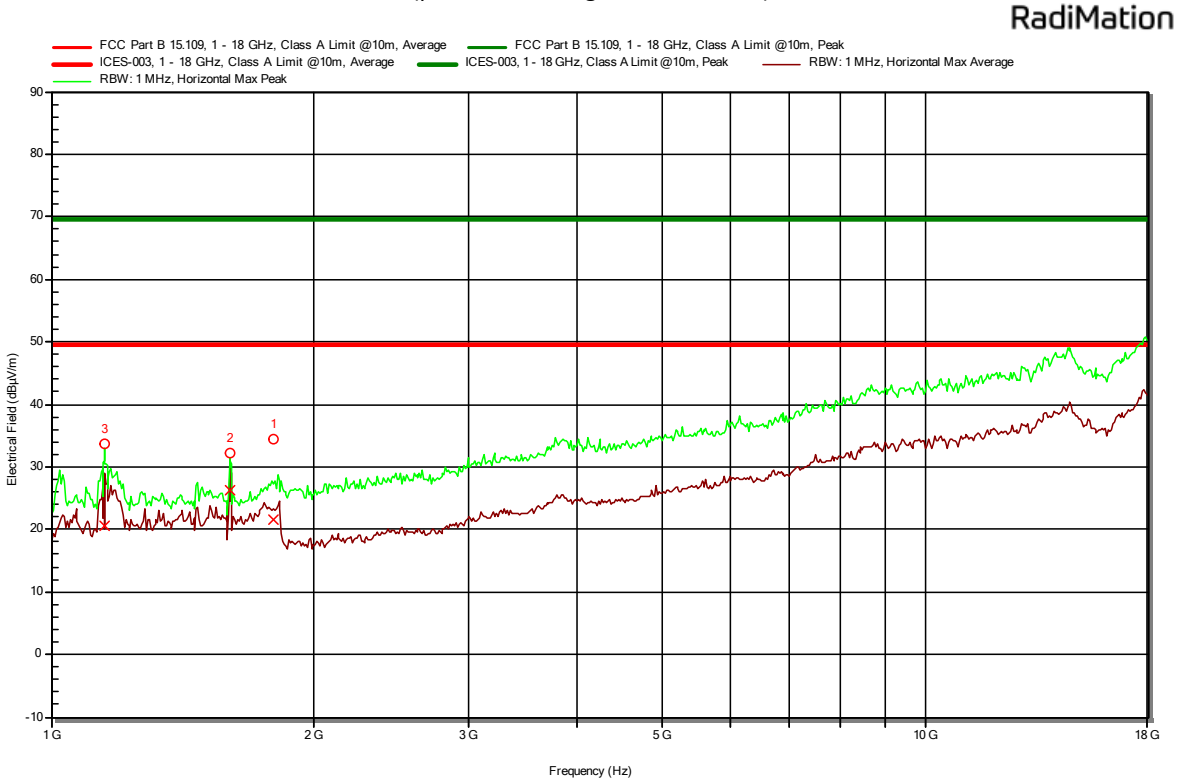
Plot 2b: radiated emissions of the EUT, Antenna horizontal, in the range 250-1000 MHz
(pre-scan peak values shown)



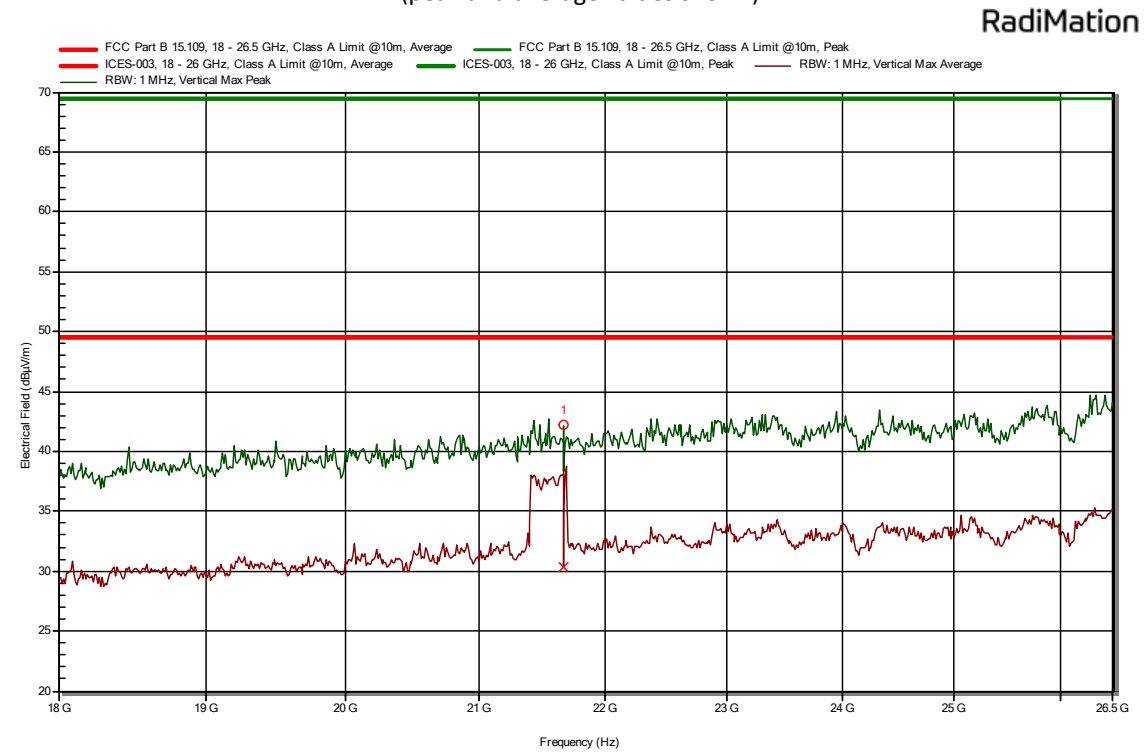
Plot 3a: radiated emissions of the EUT, Antenna vertical, in the range 1-18 GHz
(peak and average values shown)



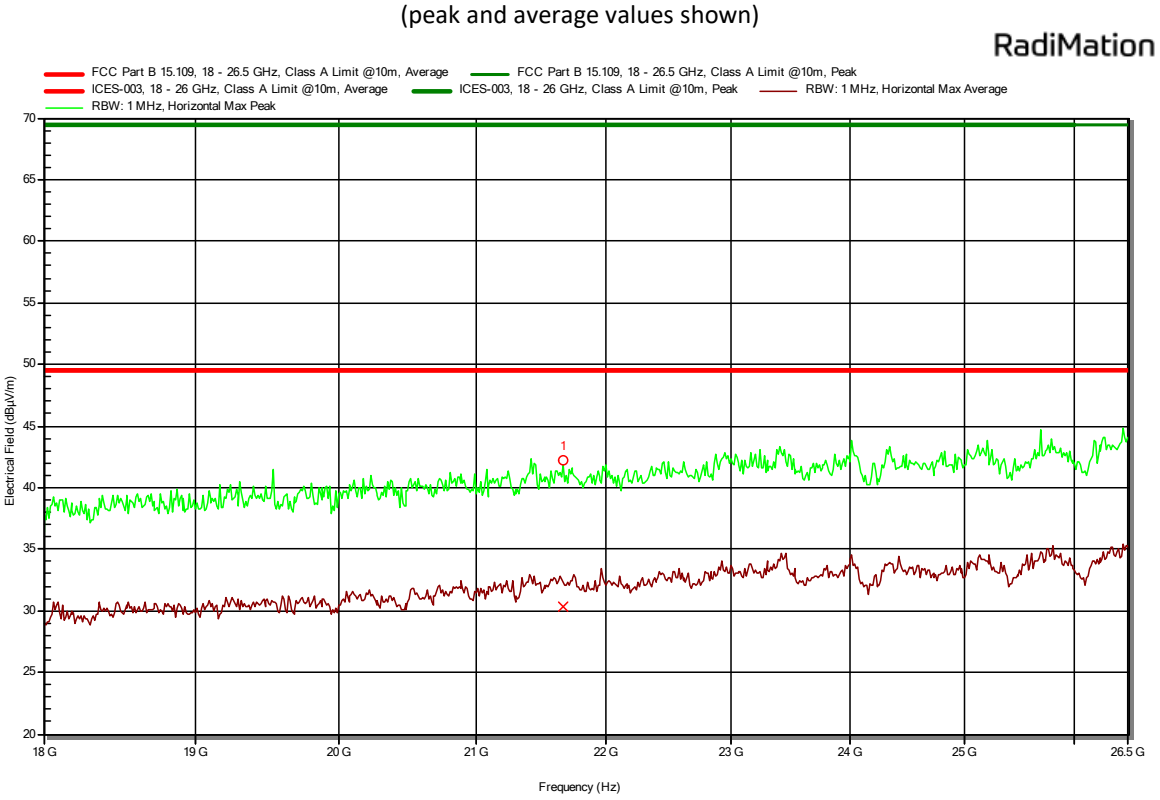
Plot 3b: radiated emissions of the EUT, Antenna horizontal, in the range 1-18 GHz
(peak and average values shown)



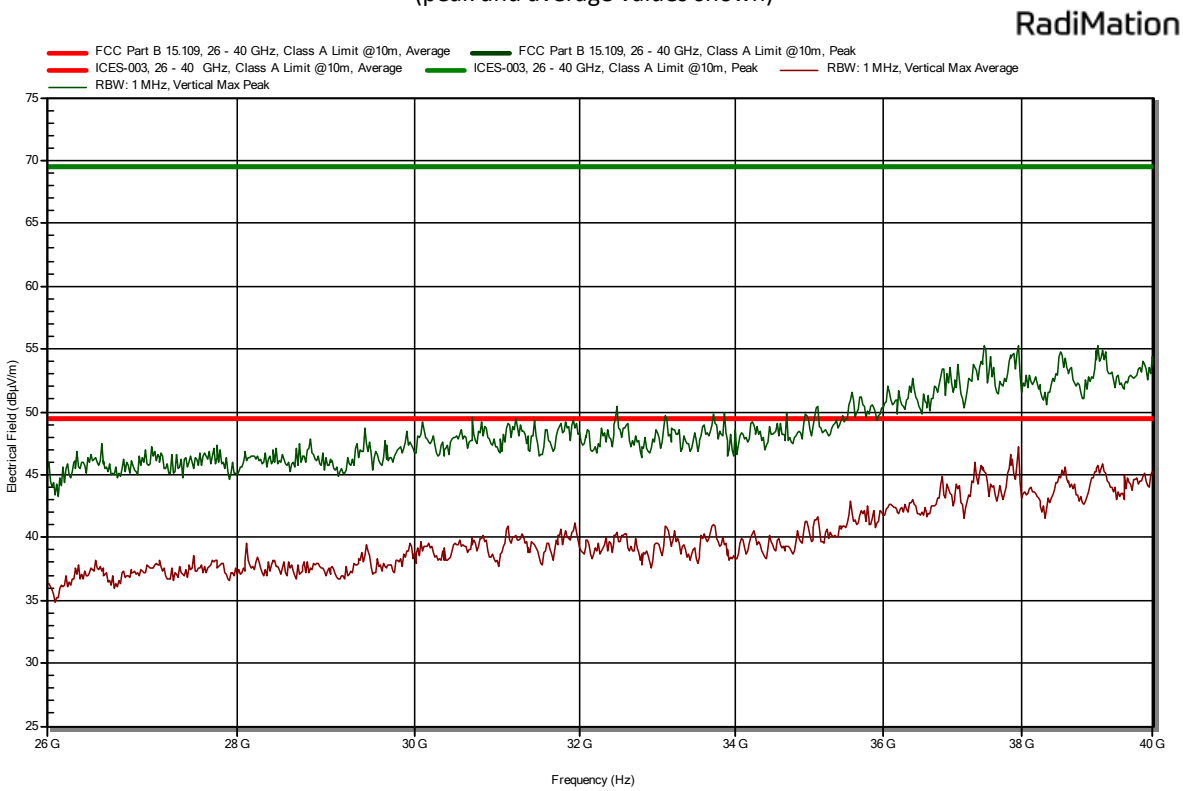
Plot 4a: radiated emissions of the EUT, Antenna vertical, in the range 18-26 GHz
(peak and average values shown)



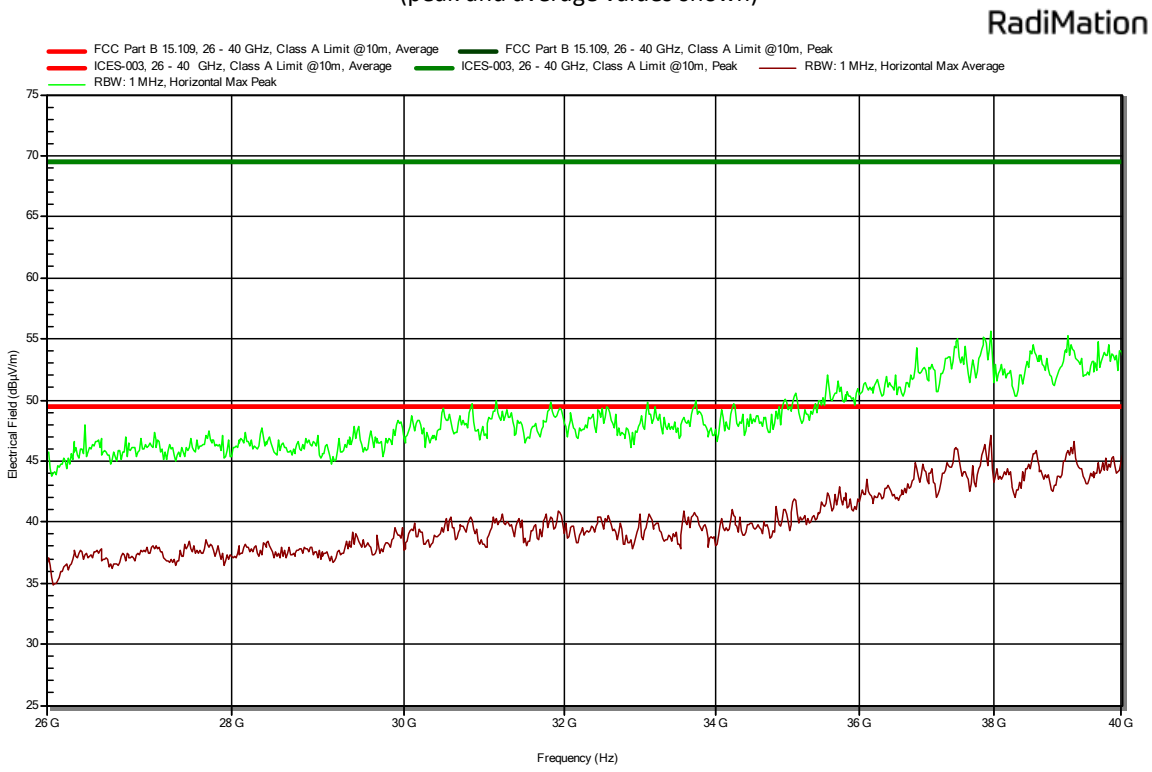
Plot 4b: radiated emissions of the EUT, Antenna horizontal, in the range 18-26 GHz
(peak and average values shown)



Plot 4a: radiated emissions of the EUT, Antenna vertical, in the range 26-40 GHz
(peak and average values shown)



Plot 4b: radiated emissions of the EUT, Antenna horizontal, in the range 26-40 GHz
(peak and average values shown)



3.2 AC Power-line conducted emissions

3.2.1 Limit

§ 15.107 (a)
For a Class A digital device that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms LISN. Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

ICES-003 Issue 7 section 3.2.1

The ITE or digital apparatus shall comply with the conducted emission limits specified in the table below at its AC mains power terminals. The product under test shall comply with both the quasi-peak and the average limits.

Where the product under test is powered through an external device (for example, through an external power supply, or by means of a device providing power over Ethernet to the product under test), the conducted emission limits apply at the AC mains power terminals of the external device, while this is powering the product under test: see ICES-Gen.

Frequency of Emission (MHz)	Conducted Limit (dBµV) Quasi-Peak	Conducted Limit (dBµV) Average
0.15 – 0.5	79	66
0.5 – 5	73	60
5 - 30	73	60

*Decreases with the logarithm of the frequency.

3.2.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

3.2.3 Test setup

The test setup is as shown in chapter 2.2.3 of this report.

3.2.4 Test procedure

According to ANSI C63.4: 2014, section 13.3

IRN 439 – Method 1

3.2.5 Measurement uncertainty

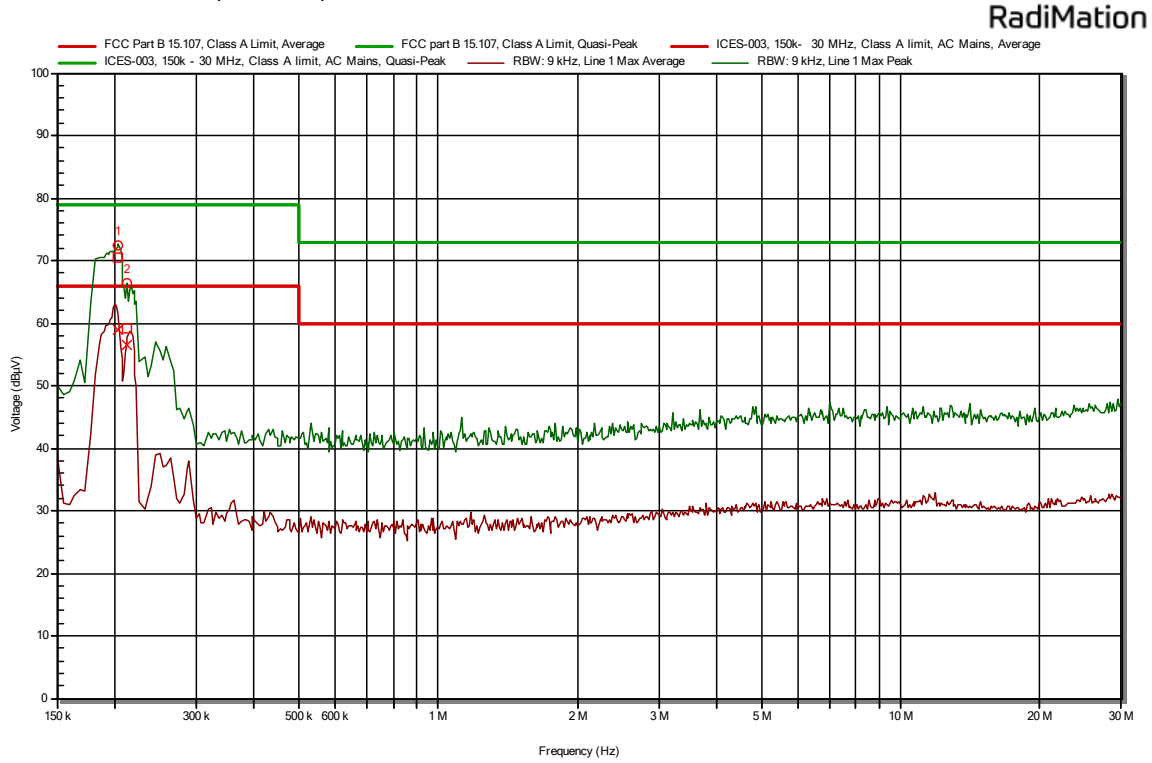
+/- 3.6 dB

3.2.6 AC Power Line Conducted emission data of the EUT, results

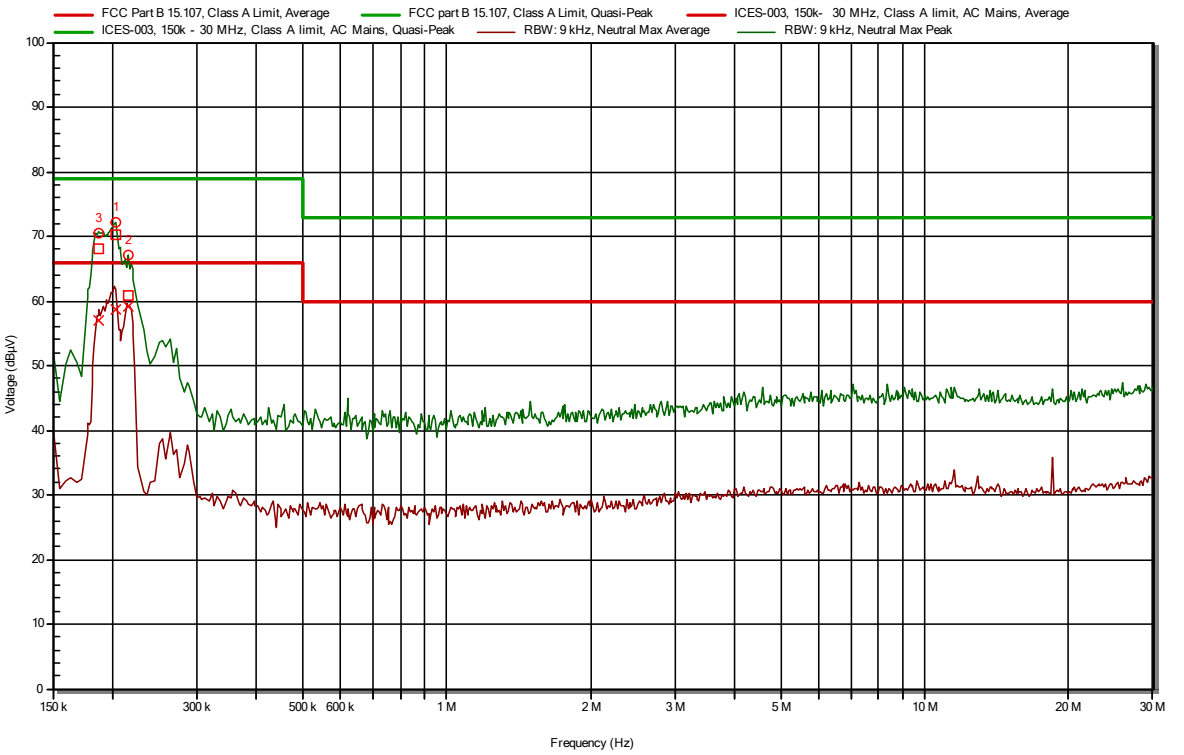
Peak Number	Frequency	Peak	Average	Average Limit	Quasi-Peak	Quasi-Peak Limit	Status	LISN
1	187.8 kHz	70.6 dBµV	56.9 dBµV	66 dBµV	68.1 dBµV	79 dBµV	Pass	Neutral
2	204 kHz	72.3 dBµV	58.7 dBµV	66 dBµV	70.2 dBµV	79 dBµV	Pass	Neutral
3	215.25 kHz	67.2 dBµV	59.1 dBµV	66 dBµV	60.7 dBµV	79 dBµV	Pass	Neutral
4	204 kHz	72.5 dBµV	59 dBµV	66 dBµV	70.5 dBµV	79 dBµV	Pass	Line 1
5	212.55 kHz	66.3 dBµV	56.5 dBµV	66 dBµV	59.2 dBµV	79 dBµV	Pass	Line 1

3.2.7 Plots of the AC mains conducted spurious measurement

Pre-scan plot with peak detector of the AC Power-line Conducted emissions on **Phase**



Pre-scan plot with peak detector of the AC Power-line Conducted emissions on **Neutral**



4 Sample calculations

All formulas for data conversions and conversion factors are reported in this chapter.

Conducted emission Measurement:

U_{lisn} (dBµV) = U (dBµV) + Corr. (dB)

Where:
U = Measuring receiver voltage
LISN insertion loss = Voltage division factor of LISN
Corr. = sum of single correction factors of used LISN, cables and pulse limiter.
Linear interpolation will be used for frequencies in between the values in the table.

Frequency (MHz)	**Voltage division LISN (db)**	**Cable loss (dB)**	**Corr. (dB)**
	114379 SN: 230000813 Rohde & Schwarz ENV 216	**TE 11134**	
0,15	9.7	0.02	9.72
0,2	9.68	0.03	9.71
0,3	9.68	0.03	9.71
0,5	9.69	0.08	9.77
0,7	9.69	0.25	9.94
0,8	9.69	0.25	9.94
1	9.68	0.11	9.79
2	9.7	0.15	9.85
3	9.71	0.21	9.92
5	9.72	0.21	9.93
7	9.76	0.25	10.01
8	9.77	0.25	10.02
10	9.77	0.29	10.06
15	9.84	0.34	10.18
20	9.88	0.37	10.25
25	9.97	0.43	10.4
30	10.08	0.45	10.53

Field Strength Measurement:

E (dBµV/m) = U(dBµV) + AF (dB/m) + Corr. (dB)

Where:
E = Electric field strength
U = Measuring receiver voltage
AF = Antenna factor
CL = Cable loss

Corr. = sum of single correction factors of used cable and amplifier (if applicable).
Linear interpolation will be used for frequencies in between the values in the table.
Tables shows an extract of the values.

Frequency (MHz)	**AF (dB/m)** **ID: 114436** **VHA 9103 + BBA 9106** **SN: 9856**	**Cable loss (dB)** **Id: SAR cable**	**Corr. (dB)**
30	18.6	0.68	19.28
100	10.4	1.15	11.55
150	14.8	1.41	16.21
200	16.0	1.63	17.63
250	16.9	1.93	18.83

Frequency (MHz)	**Gain (dBi)** **ID: 114385** **EMCO LPDA** **SN: 9856**	**Cable loss (dB)** **Id: SAR cable**	**Corr. (dB)**
250	11.8	1.93	13.73
300	13	2.12	15.12
350	15.6	2.2	17.8
400	17.1	2.29	19.39
450	17.3	2.53	19.83
500	17.7	2.67	20.37
550	18.4	2.9	21.3
600	19.2	3.02	22.22
650	19.7	3.09	22.79
700	20.3	3.22	23.52
750	21.4	3.56	24.96
800	22	3.69	25.69
900	22.1	3.81	25.91
950	22.6	3.91	26.51
1000	22.5	4.3	26.8

Frequency (MHz)	AF (dB/m) TE 00531 Emco 3115 SN: 9412-4377	Gain (dB) TE 11132 Miteq JS4-18004000-30-8P-A1	Cable loss (dB) TE 01315	Corr. (dB)
1000	23,6	40,4	2,0	66
1500	25,1	40,5	2,4	68
2000	27,1	40,5	2,7	70,3
2500	28,6	40,7	3,2	72,5
3000	30,5	40,7	3,2	74,4
3500	31,2	40,7	3,4	75,3
4000	32,7	40,9	4,9	78,5
4500	32,4	40,9	4,4	77,7
5000	33,2	40,7	4,6	78,5
5500	34,0	40,5	4,5	79
6000	34,6	40,0	5,2	79,8
6500	34,3	39,4	5,9	79,6
7000	35,2	38,6	5,7	79,5
7500	36,4	39,2	5,9	81,5
8000	37,0	38,9	6,3	82,2
8500	37,5	38,4	6,4	82,3
9000	38,1	37,4	6,5	82
9500	37,8	37,0	7,1	81,9
10000	38,2	36,5	7,3	82
10500	38,1	36,7	7,6	82,4
11000	38,3	36,9	8,3	83,5
11500	38,5	37,6	8,1	84,2
12000	39,1	38,3	8,4	85,8
12500	38,7	38,5	8,3	85,5
13000	39,2	38,9	9,2	87,3
13500	40,5	40,2	8,3	89
14000	41,1	40,0	8,2	89,3
14500	41,4	40,1	8,2	89,7
15000	40,2	41,4	8,3	89,9
15500	37,9	41,4	8,6	87,9
16000	37,5	42,8	9,2	89,5
16500	38,6	42,3	8,8	89,7
17000	41,1	43,1	9,4	93,6
17500	42,7	43,2	9,4	95,3
18000	44,0	44,2	9,8	98

Frequency (MHz)	AF (dB/m) TE 00818 Flann 20240-25 SN: 163703	Gain (dB) TE 11131 Miteq JS4-18004000-30-8P-A1	Cable loss (dB) TE 01315	Corr. (dB)
18000	31,3	26,2	9,8	67,3
19000	31,5	26,1	9,6	67,2
20000	31,7	25,9	11	68,6
21000	31,9	24,3	10,7	66,9
22000	32,1	18,3	10,5	60,9
23000	32,2	18,9	10,8	61,9
24000	32,3	23,6	11,4	67,3
25000	32,4	24,5	11,6	68,5
26000	32,5	25,3	11,7	69,5

5 Photograph test setup

5.1 Photograph test setup Radiated Emissions

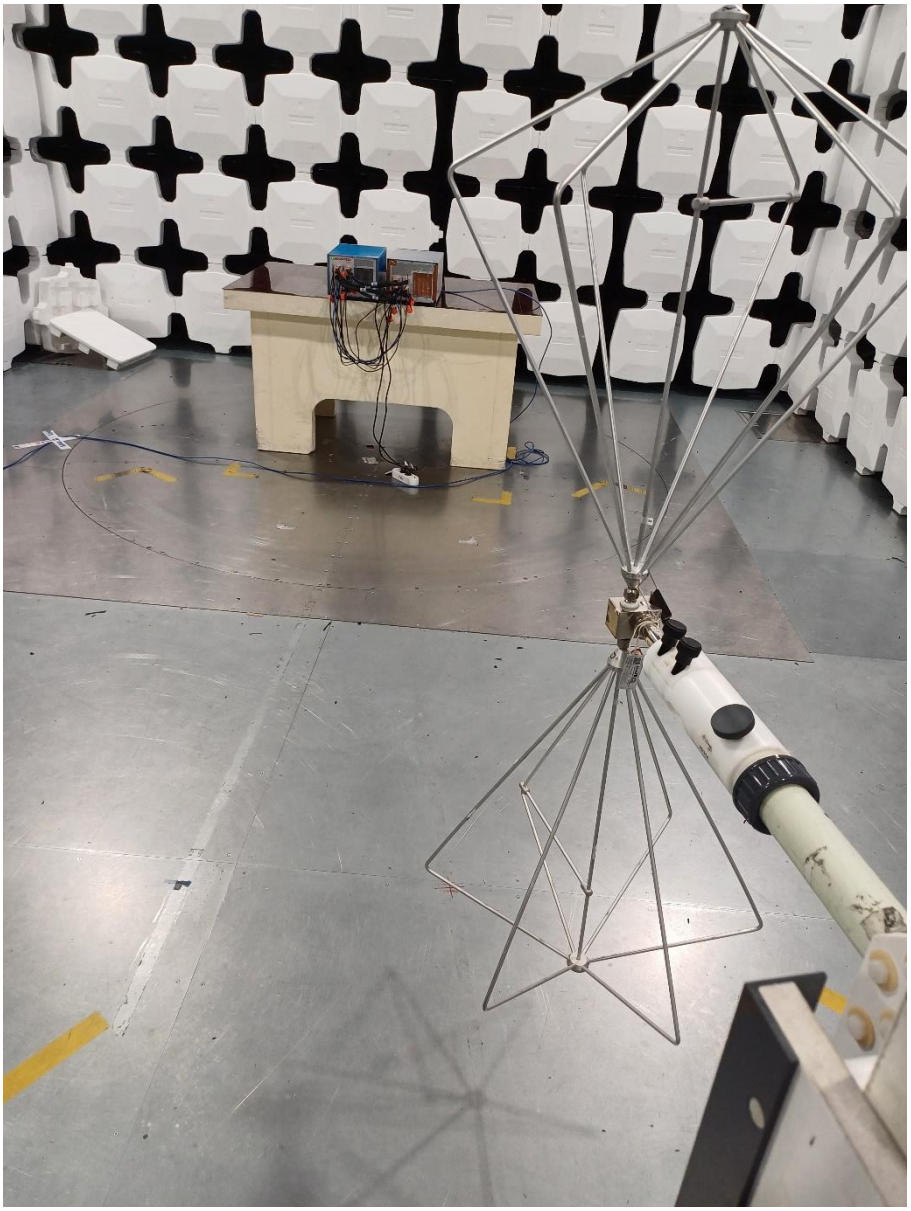


Photo 1 Photograph test setup radiated emissions 30-250 MHz, report section 3.1

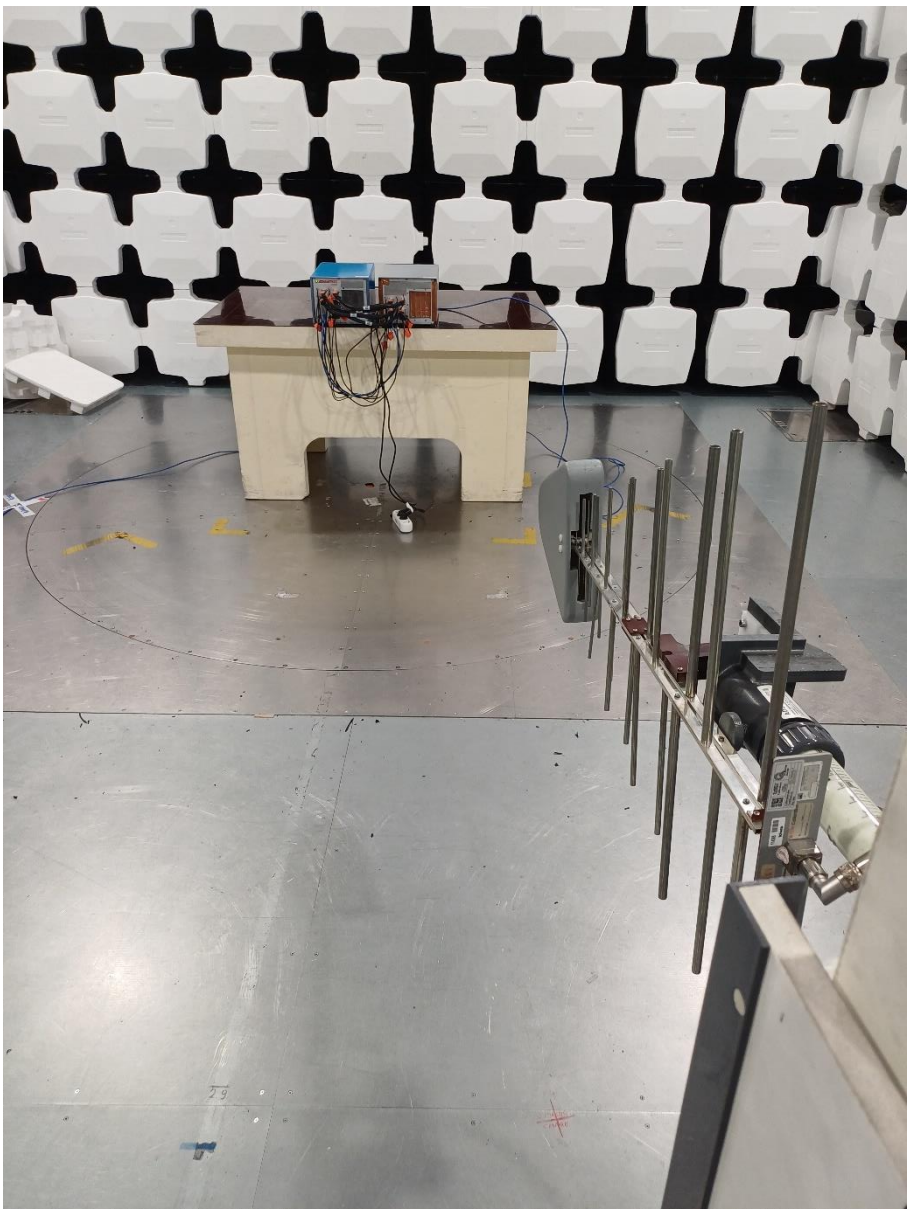


Photo 2 Photograph test setup radiated emissions 250-1000 MHz, report section 3.1

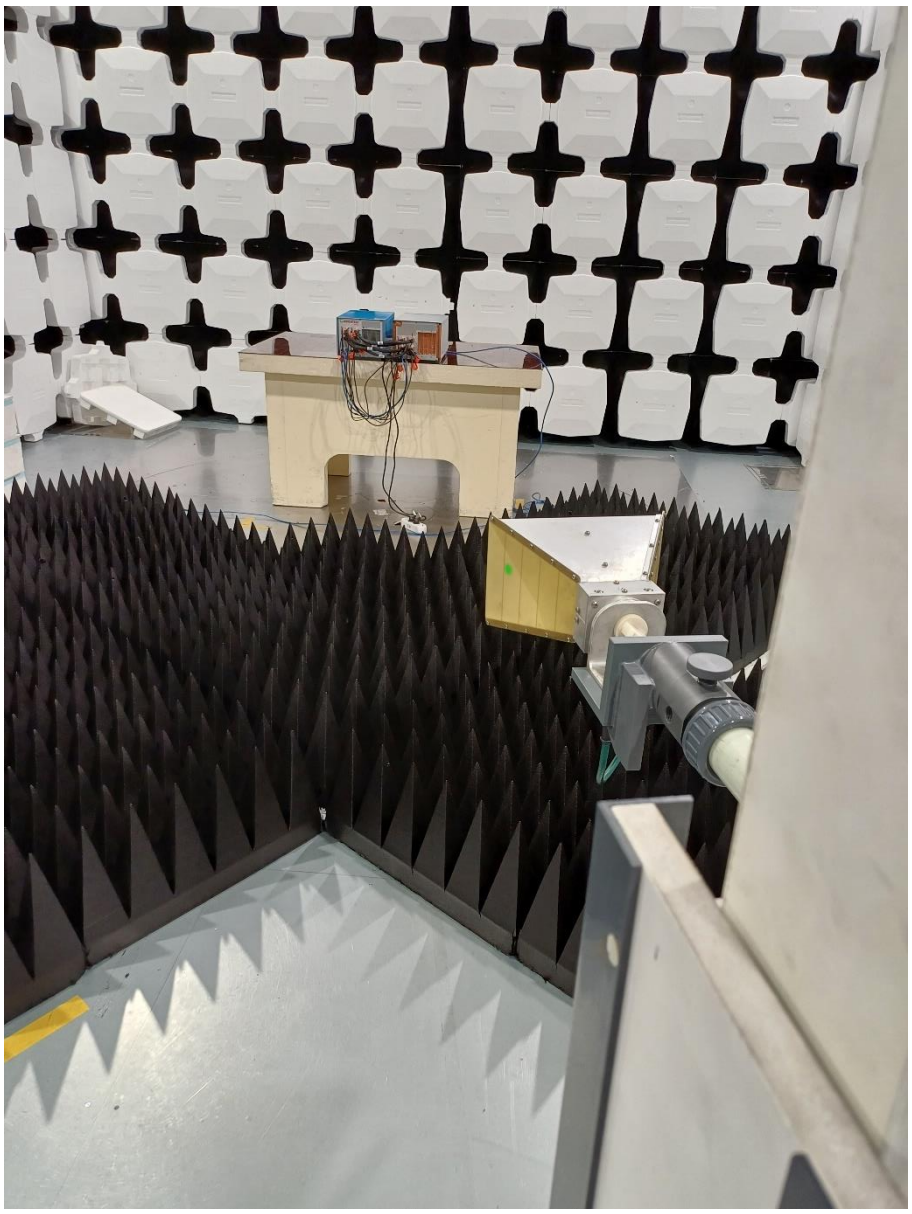


Photo 3 Photograph test setup radiated emissions 1-18 GHz, report section 3.1

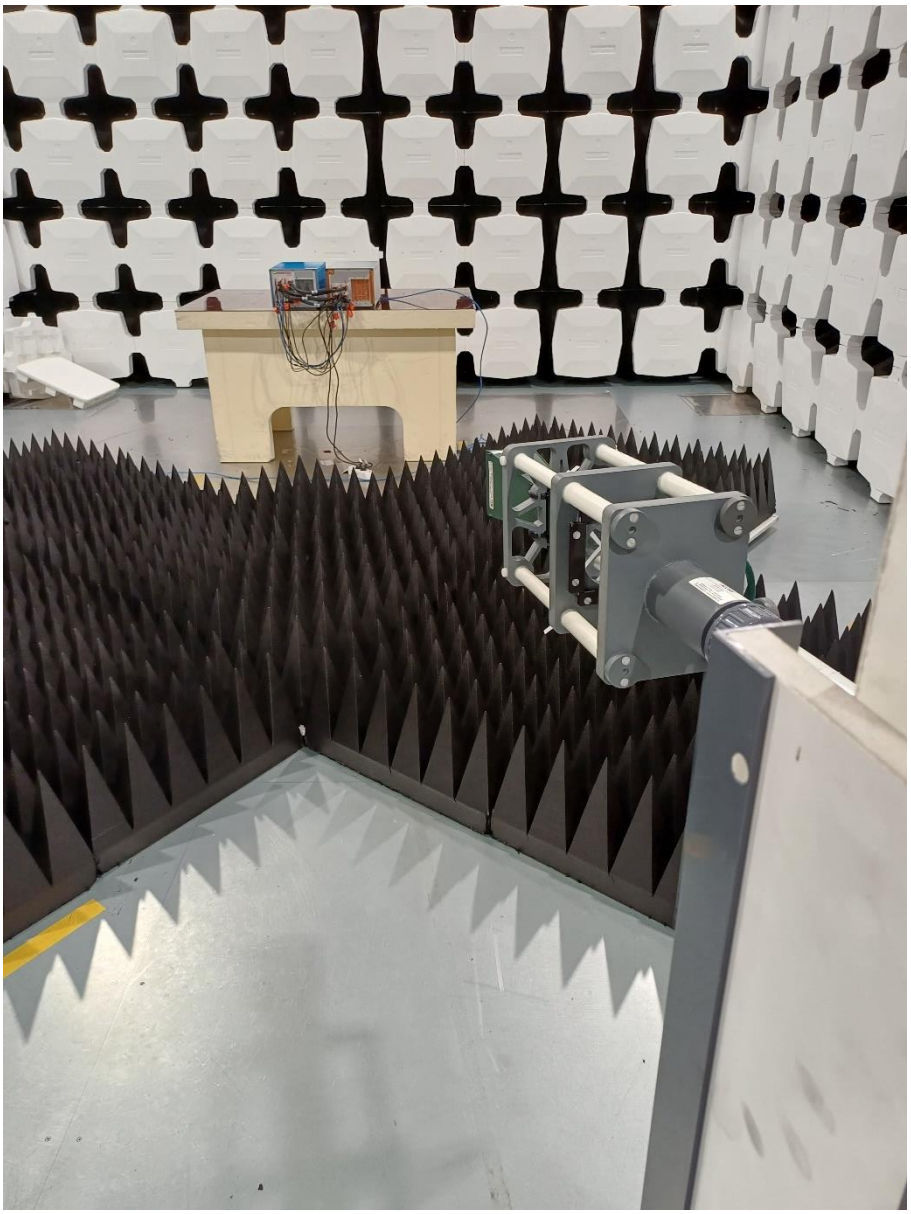


Photo 4 Photograph test setup radiated emissions 18-26.5 GHz, report section 3.1

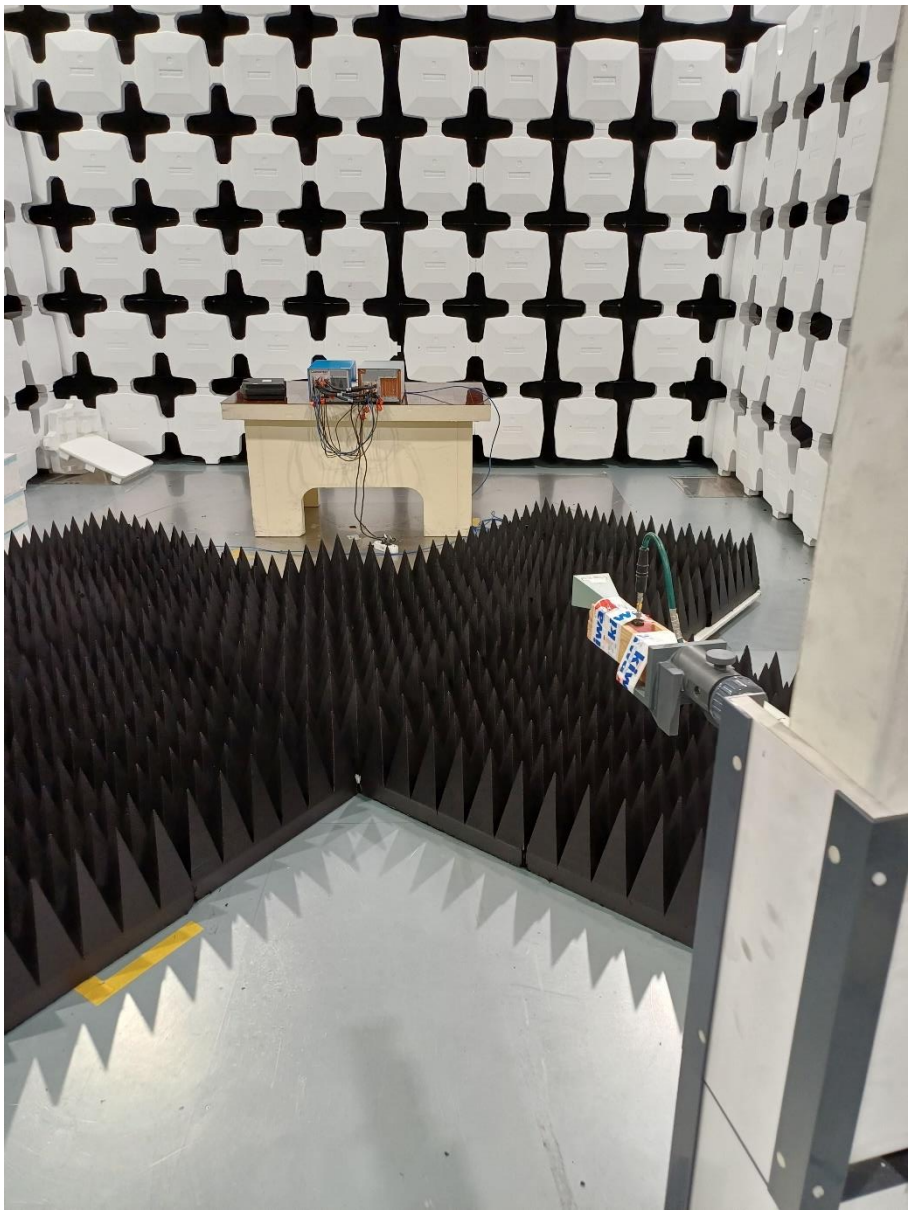


Photo 5 Photograph test setup radiated emissions 26.5-40 GHz, report section 3.1

5.2 Photograph test setup, AC Power Line Conducted emissions

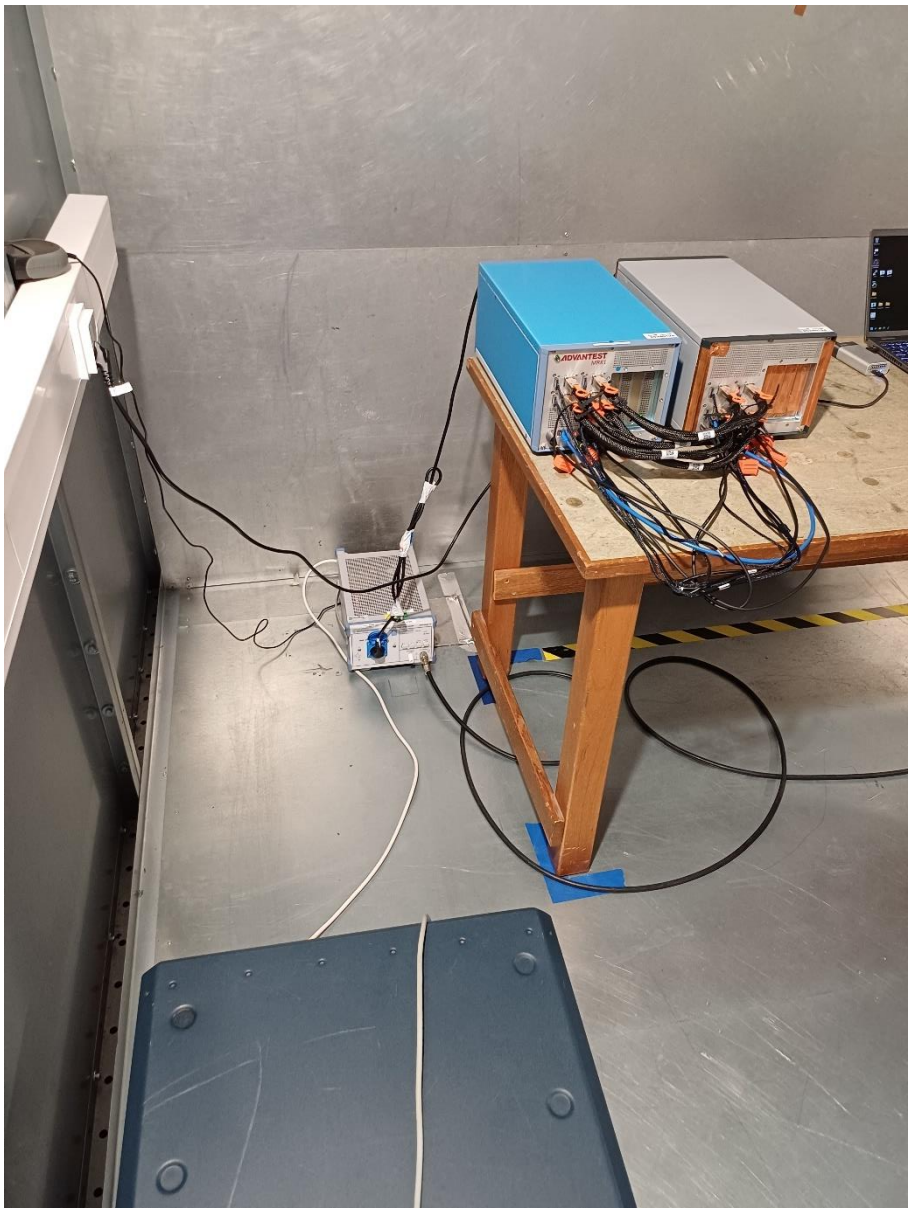


Photo 6: Photographs AC Power Line conducted emission, report section 3.3

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