Test report for

47 CFR Part 15 Subpart B

ICES-Gen, ICES-003

The RvA is signatory to ILAC - MRA

Product name	: TotaLite Sensor A2.0
Applicant	: Fugro
FCC ID	: 2BTLV-TLA20
IC	: 35704-TLA20

Test report No. : P000412022 001 Ver 5.0

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 L015 and is granted by the Dutch Council For Accreditation (RvA: Raad voor Accreditatie).

Kiwa Nederland B.V. is designated by the FCC as an Accredited Test Firm for compliance testing of equipment subject to Certification under Parts 15 & 18. The Designation number is: NL0001.

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.
The Industry Canada company number for Kiwa Nederland B.V. is: 4173A. The CABID is NL0001.

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Documentation

The test report must always be reproduced in full; reproduction of an excerpt only is subject to written approval of the testing laboratory. The documentation of the testing performed on the tested devices is archived for 10 years at Kiwa Nederland B.V.

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
v0.50	02-07-2025	First draft	PvW
v1.00	28-10-2025	Final release	PvW
V2.0	13-11-2025	Changed modification shown in clause 1.9 Changed applicant and manufacturer information	PvW
V3.0	06-01-2026	Updated FCC ID and IC	PvW
V4.0	24-06-2026	New modification of the EUT in clause 1.9 Updated EUT photos with modification	PvW IS
V5.0	23-07-2026	Updated IC	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

*Note: ICES-003 and ICES-Gen are not part of the Kiwa Netherlands L015 accreditation scope. Measurement results according ICES-003 and ICES-Gen are excluded from the accreditation scope.

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

1 General Description

1.1 Applicant

Client name:	Fugro Technology BV
Address:	Prismastraat 3, Nootdorp, the Netherlands
Zip code:	2631 RT
Telephone:	+31 (0)622137002
E-mail:	e.berger@fugro.com
Contact name:	Epco Berger

1.2 Manufacturer

Manufacturer name:	Fugro Technology BV
Address:	Prismastraat 3, Nootdorp, the Netherlands
Zip code:	2631 RT
Telephone:	+31 (0)622137002
E-mail:	e.berger@fugro.com
Contact name:	Epco Berger

1.3 Tested Equipment Under Test (EUT)

Product name:	TotaLite Sensor A2.0
Brand name:	TotaLite
FCC ID:	2BTLV-TLA20
IC:	35704-TLA20
Contains FCC ID:	LTE: 2ANPOOONRF9161
Contains IC:	LTE: 24529-NRF9161
Product type:	Optical monitoring system using optical sensors, captures images, identifies the position of retroflectors and convert sub-pixel changes into displacements.
Model(s):	A2.0
Batch and/or serial No.	--
Software version:	V1.1.1
Hardware version:	V2.0 0-Series
Date of receipt	23-06-2025
Tests started:	23-06-2025
Testing ended:	24-06-2026

1.3.1 Auxiliary items

AUX1

Product name:	Lab laptop
Brand name:	Lenovo
Product type:	Laptop
Remarks:	Connects to EUT

AUX2

Product name:	Asus router
Brand name:	Asus
Product type:	Router
Remarks:	Connects to Laptop Ethernet port, property test lab

1.4 Product specifications of Equipment under test

TX Frequencies:	BLE: 2400 – 2483.5MHz 802.11b/g/n: 2400 – 2483.5MHz LTE: B2, B4, B5, B12, B13, B25, B26, B66
RX frequencies:	BLE: 2400 – 2483.5MHz 802.11b/g/n: 2400 – 2483.5MHz LTE: B2, B4, B5, B12, B13, B25, B26, B66
Antenna type:	LTE: Dipole Wifi: Omindirectional BLE: Omnidirectional

Disclaimer: above info is declared by the applicant

The EUT is considered as a Class A device.

1.5 Environmental conditions

Test date	23-06-2025	24-06-2025	25-06-2025	26-06-2025	27-06-2025	06-08-2025
Ambient temperature	24.4°C	24.1°C	23.1°C	25.7°C	22.2°C	21.8°C
Humidity	53.6%	48.1%	62.1%	57.1%	55.0%	53.3%

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*

*Note: ICES-003 and ICES-Gen are not part of the Kiwa Netherlands L015 accreditation scope. Measurement results according ICES-003 and ICES-Gen are excluded from the accreditation scope.

1.8 Observation and remarks

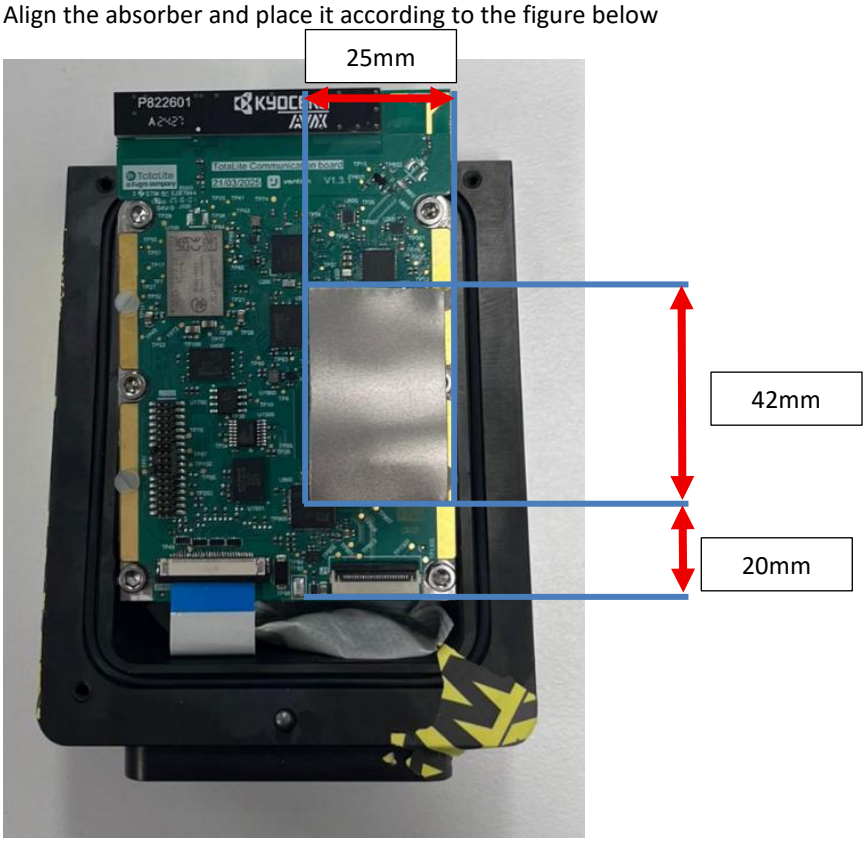
Note: for connecting the EUT to LAN and setting up a ping, the AP and laptop were inside the room in a shielded area due to limitations of the measurement setup.
The EUT contains a pre-certified LTE module, brand and model Nordic Semiconductor, nRF9161.

1.9 Modifications to the EUT

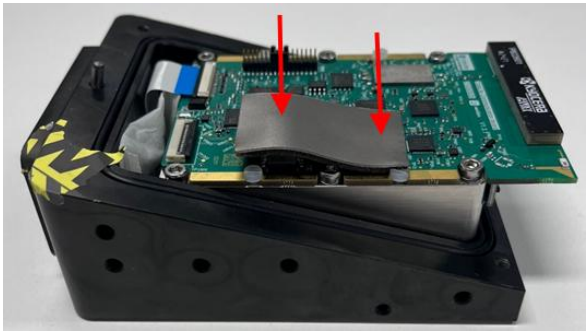
The following modifications were made to the EUT:
Modified input PCB from revision BA to DA: improved radiated immunity, swapped magnetics jack/phy side, added efuse.
The input PCB will be revised to version EA, which adds a stronger TVS diode and removes bypassed place for an efuse. The revision DA -> EA changes have been determined to not negatively impact EMC behaviour so no re-testing is required for this modification.
Lowered the EUT transmission power of WLAN from setting 20 to setting 16 (0x40 in EUT firmware)

Shielding added: Wurth Flexible Ferrite sheet (MPN 344 150 01) with Double sided foam tape 3M (VHB 5962F).
Following installation instruction below:

1. Remove the peel-off to reveal the adhesive of the Tape on the EMI Absorber
2. Align the absorber and place it according to the figure below



3. Verify that the EMI Absorber is fixed to the Communication Board at indicated locations



1.10 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 : P. van Wanrooij, BASc and C. Brinkman under supervision of P. van Wanrooij

Review of test methods and report by:

Name : dr. ir. G. Geers

The above conclusions have been verified by the following signatory:

Date 24-07-2026

Name : ing. R. van Barneveld

Function : Test Engineer

Signature :

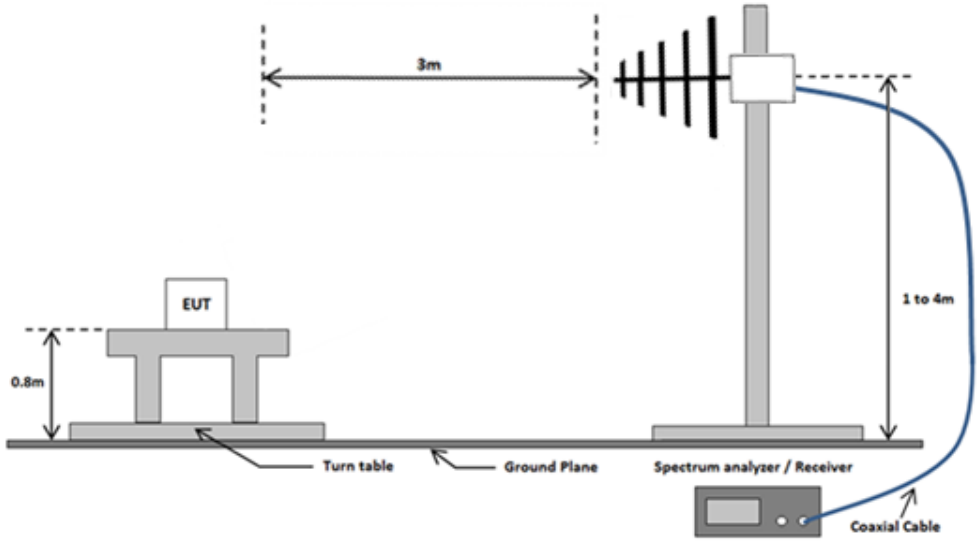
2 Test configuration of the Equipment Under Test

2.1 Test mode

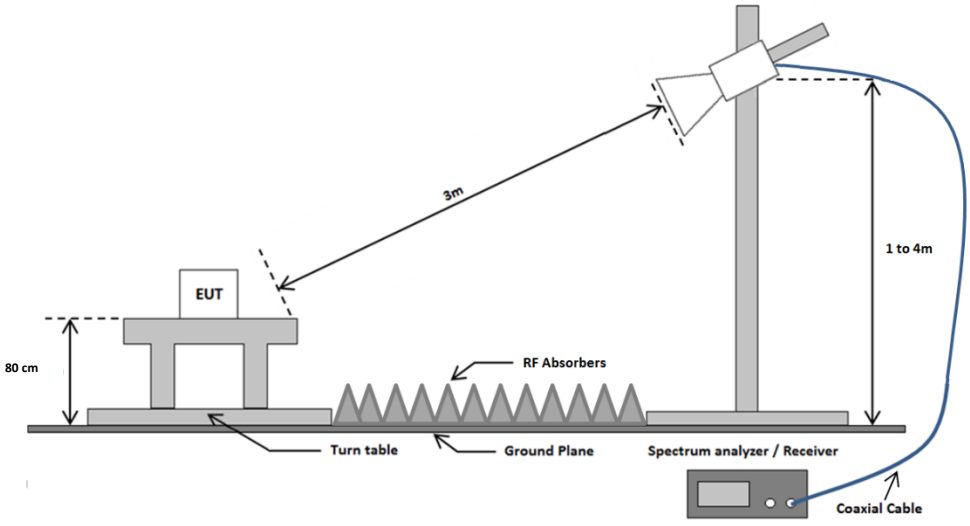
The equipment is tested in normal operating mode, with the device making photos and processing data.

2.2 Test setups

2.2.1 Radiated emissions test setup 30 MHz - 1 GHz

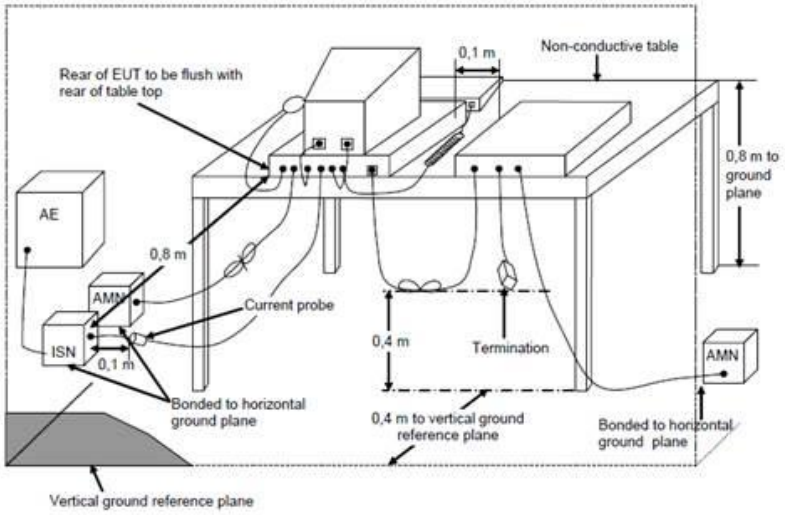


2.2.2 Radiated emissions test setup above 1 GHz



2.2.3 AC Power line conducted emissions test setup

Emissions test at AC mains



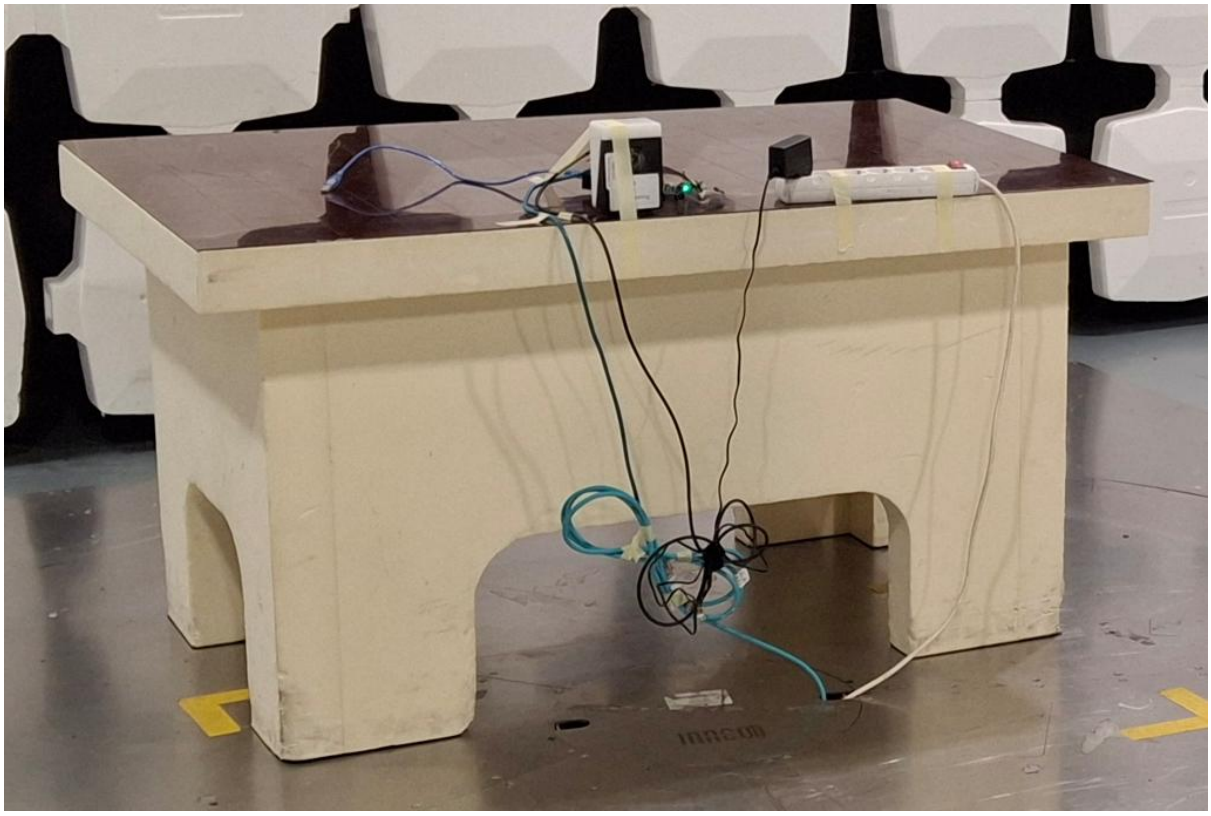


Figure 1. EUT and auxiliary setup

List of used cables					
Number	**Function**	**From**	**To**	**Length**	**Remarks**
1	AC Power	mains 120Vac 60 Hz	AUX1	< 3m	-
2	12 Vdc power	AUX1	EUT	< 3m	-
3	Ethernet	EUT	Laptop outside test chamber through fiber converter	<3m	-

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	114605	11-2024	11-2025	3.1
Spectrum Analyzer	Rohde & Schwarz	FSV3044	114923	10-2023	10-2025	3.1
Biconical antenna + 6dB attenuator	Schwarzbeck + HP	VHA9103 + 8491A	114436	07-2024	07-2027	3.1
Logperiodic antenna	Schwarzbeck	VULP 9118B	115028	11-2024	11-2027	3.1
Horn antenna	EMCO	3115	114607	01-2025	01-2028	3.1
Horn antenna	Scientific atlanta	12A-26	114487	NA*	NA*	3.1
Preamplifier 1-18 GHz	µComp Nordic	MCNA-40-0010800-25-10P	114771	08-2024	31-08-2025	3.1
Semi-Anechoic Chamber	ETS Lindgren	SAR	114624	03-2023	03-2026	3.1
Test software	Raditeq	Radimation Version 2023.2.3	--	--	--	3.1, 3.2
LISN /Two line V-network	Rohde & Schwarz	ENV 216	114379	11-2023	11-2025	3.2
EMI receiver	Rohde & Schwarz	EPL1000	115435	12-2024	12-2025	3.2

*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

The field strength of radiated emissions from a class A device, as determined at a distance of 10 meters, shall not exceed the following:
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/meter)	Field strength (dBµV/m)	Measurement distance (meters)
30-88	90	39.1	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 (µV/meter)	Field strength (dBµV/m)	Measurement distance (meters)
30-88	100	40.0	10
88-216	150	43.5	10
216-230	210	46.4	10
230 -960	224	47.0	10
Above 960	300	49.5	10

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

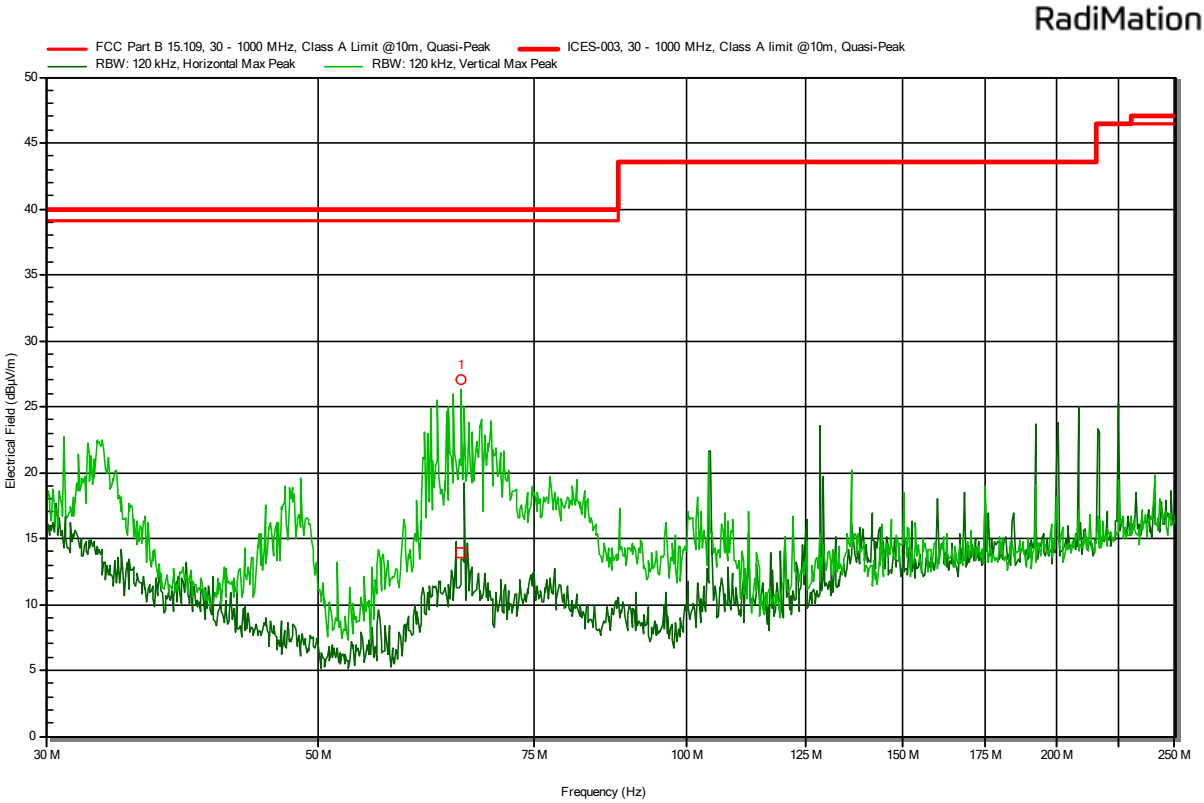
Frequency range	Polarization	Uncertainty
30 – 200 MHz	Horizontal	±4.5 dB
	Vertical	±5.4 dB
200 -1000 MHz	Horizontal	±3.6 dB
	Vertical	±4.6 dB
1 – 18 GHz	Horizontal	±5.7 dB
	Vertical	±5.7 dB
18 – 26.5 GHz	Horizontal	±4.9 dB
	Vertical	±4.9 dB

3.1.6 Test results

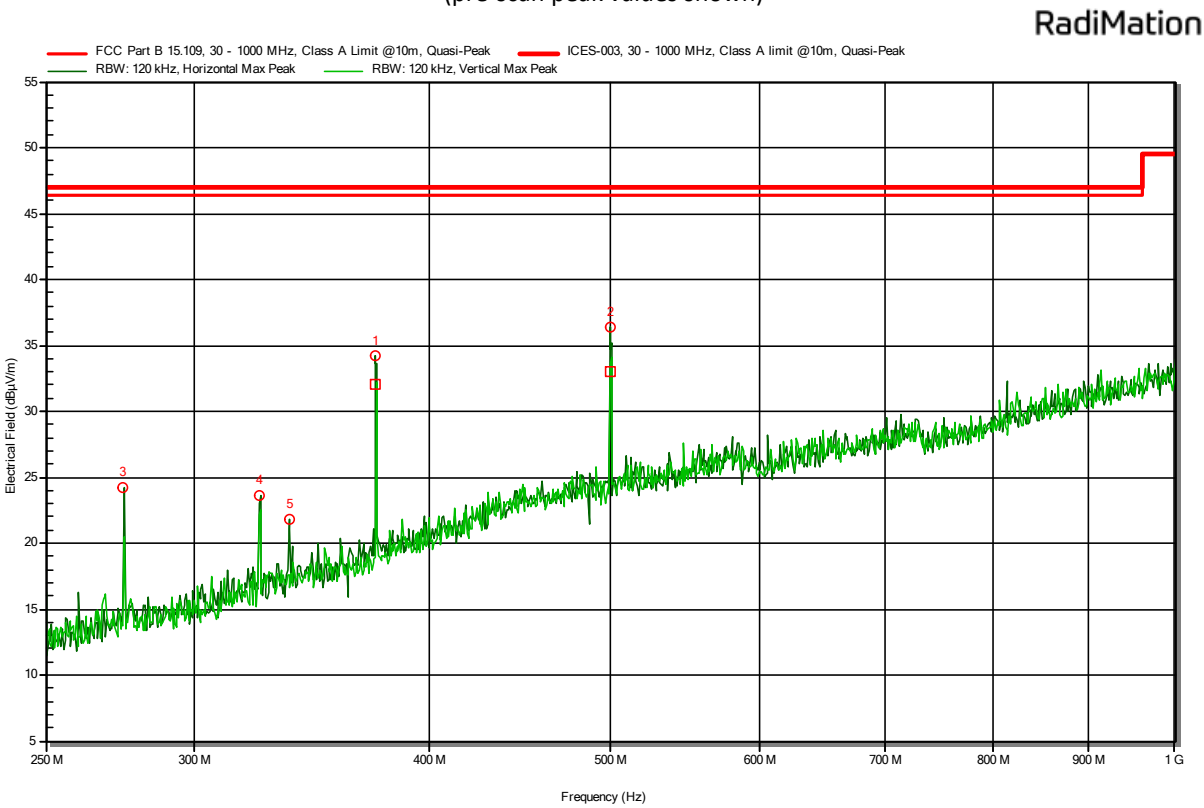
Frequency	Peak	Quasi-Peak	Quasi-Peak Limit	Height	Polarization	Status
65,393 MHz	27 dBµV/m	13,9 dBµV/m	39,1 dBµV/m	1 m	Vertical	Pass
320,148 MHz	21,3 dBµV/m	8,5 dBµV/m	46,4 dBµV/m	1 m	Vertical	Pass
325,016 MHz	27,1 dBµV/m	23,4 dBµV/m	46,4 dBµV/m	1 m	Horizontal	Pass
374,994 MHz	36,8 dBµV/m	34,8 dBµV/m	46,4 dBµV/m	1 m	Horizontal	Pass
375,001 MHz	34,3 dBµV/m	32 dBµV/m	46,4 dBµV/m	2,5 m	Horizontal	Pass
375,023 MHz	32,8 dBµV/m	29,5 dBµV/m	46,4 dBµV/m	2,3 m	Vertical	Pass
500,003 MHz	33,3 dBµV/m	28,4 dBµV/m	46,4 dBµV/m	2,3 m	Vertical	Pass
500,008 MHz	36,3 dBµV/m	33 dBµV/m	46,4 dBµV/m	1,8 m	Horizontal	Pass
500,025 MHz	35,7 dBµV/m	31,8 dBµV/m	46,4 dBµV/m	1,7 m	Horizontal	Pass

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

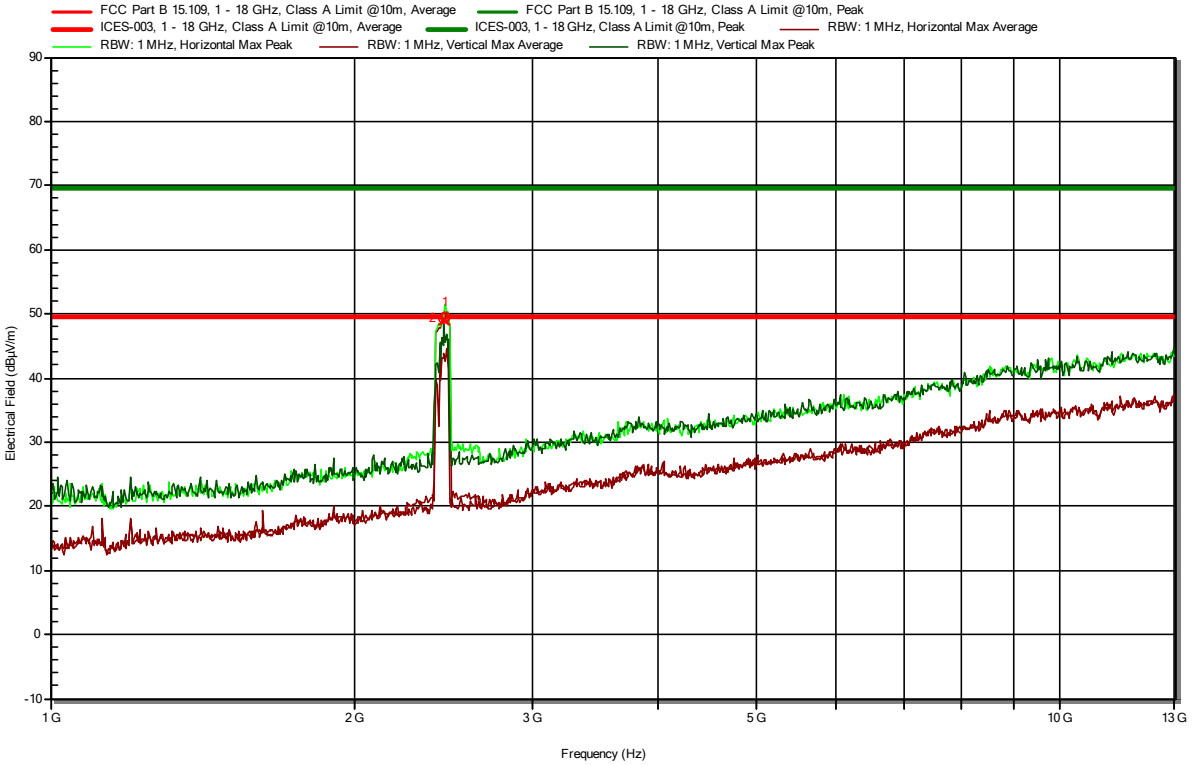


Plot 1: radiated emissions of the EUT, Antenna horizontal + vertical, in the range 30 – 250 MHz (pre-scan peak values shown)



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

RadiMation



Plot 3: radiated emissions of the EUT, Antenna horizontal + vertical, in the range 1-13 GHz (peak and average values shown)

The peaks in the 2400-2483.5 MHz range in the plot above are the BLE operating frequencies. It was not possible to disable those transmissions during normal operation. Since the peaks are intentional transmitters they are not subject to the radiated emissions limit.

3.2 AC Power-line conducted emissions

3.2.1 Limit

§ 15.107 (b)
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 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 – 30	73	60

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

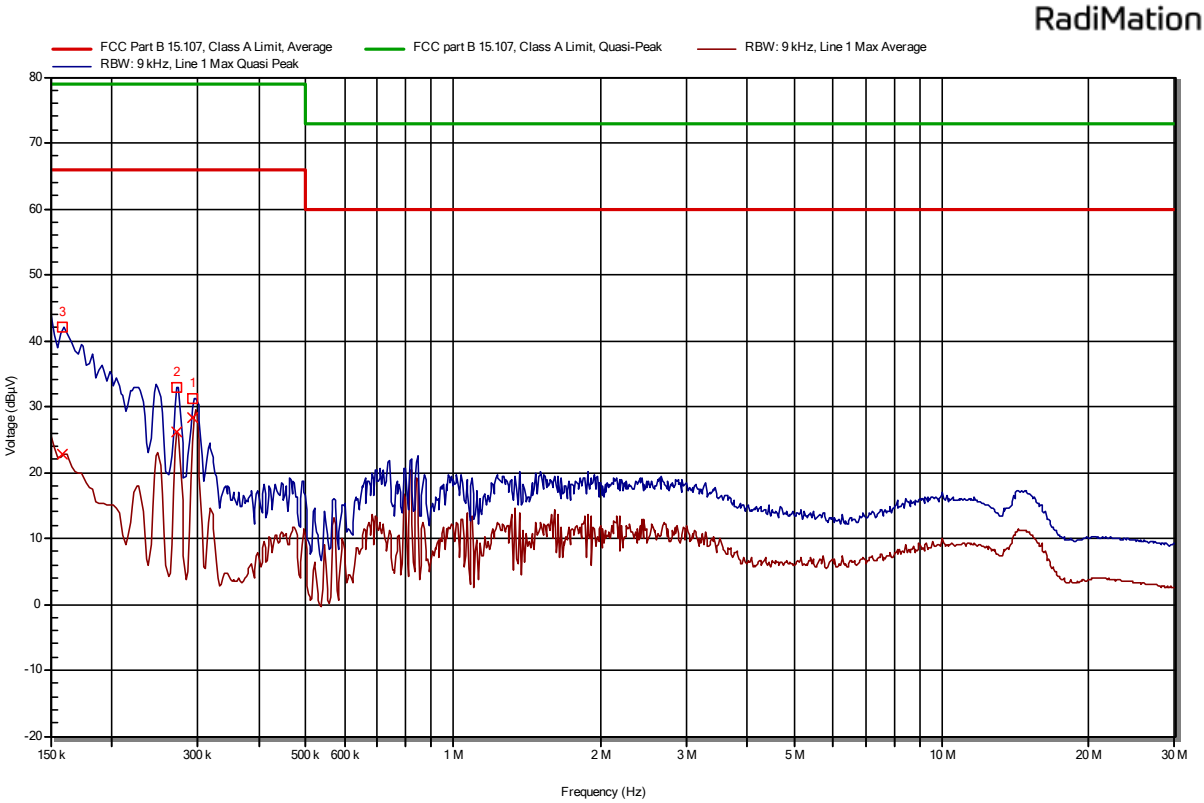
3.2.5 Measurement uncertainty

+/- 3.6 dB

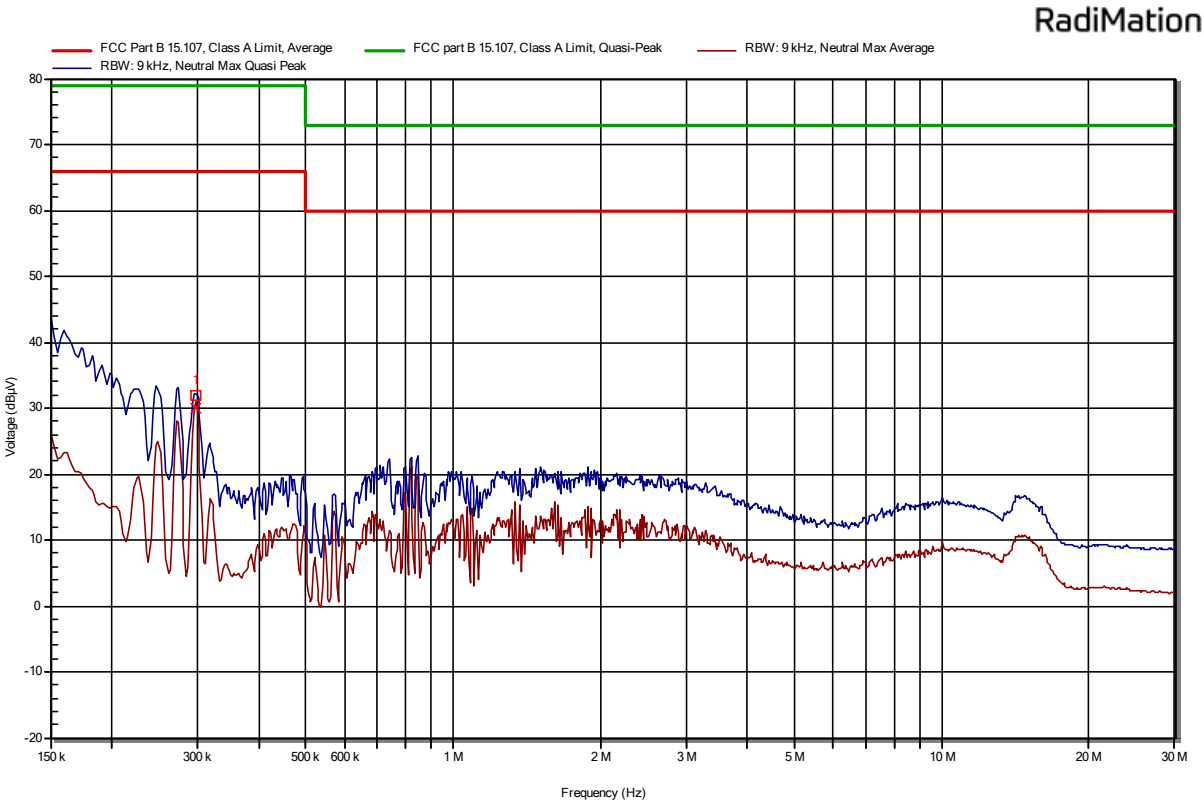
3.2.6 AC Power Line Conducted emission data of the EUT, results

Frequency	Average	Average Limit	Quasi-Peak	Quasi-Peak Limit	Status	LISN
298.5 kHz	30 dBµV	66 dBµV	31.8 dBµV	79 dBµV	Pass	Neutral
294 kHz	28.4 dBµV	66 dBµV	31.2 dBµV	79 dBµV	Pass	Line 1
271.5 kHz	26.1 dBµV	66 dBµV	32.8 dBµV	79 dBµV	Pass	Line 1
159 kHz	22.9 dBµV	66 dBµV	42 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**



Plot 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: 107818 EMCO 3109	Cable loss (dB) Id: 114928	Attenuator ID:114525 Hewlett Packet	Corr. (dB)
30	13.5	1.8	6	21.3
100	9.2	2.7	6	17.9
150	12.6	3.2	6	21.8
200	13.6	3.6	6	23.2
250	15.2	4.3	6	25.5

Frequency (MHz)	AF (dB/m) ID: 114385 EMCO LPDA	Cable loss (dB) Id: 114928	Corr. (dB)
250	11.8	4.3	16.1
300	13	5.1	18.1
350	14.2	5.8	20.0
400	15.6	7.3	22.9
450	17.1	7.9	25.0
500	17.3	8.0	25.3
550	17.7	8.0	25.7
600	18.4	7.7	26.1
650	19.2	7.5	26.7
700	19.7	7.7	27.4
750	20.3	7.9	28.2
800	21.4	8.2	29.6
850	22.0	8.7	30.7
900	22.1	8.9	31.0
950	22.6	9.2	31.8
1000	22.5	9.6	32.1

Frequency (MHz)	AF (dB/m) 114607 Emco 3115 SN: 9412-4377	Gain (dB) 114690 µComp Nordic MCNA-40-0010800-25-10P	Cable loss (dB) 114691	Corr. (dB)
1000	23.6	45.1	2.1	-19.4
2000	27.1	44.7	3.3	-14.3
3000	30.5	44.2	4.2	-9.5
4000	32.7	43.5	4.9	-5.9
5000	33.2	43.1	5.6	-4.3
6000	34.6	43.0	6.3	-2.1
7000	35.2	42.9	6.4	-1.3
8000	37.0	43.3	7.2	0.9
9000	38.1	43.3	7.9	2.7
10000	38.2	43.0	8.2	3.4
11000	38.3	42.9	8.7	4.1
12000	39.1	42.6	9.0	5.5
13000	39.2	43.6	9.8	5.4
14000	41.1	44.3	9.7	6.5
15000	40.2	44.4	10.4	6.2
16000	37.5	44.3	10.8	4.0
17000	41.1	44.5	11.4	8.0
18000	44.0	44.9	11.4	10.5

Frequency (MHz)	AF (dB/m) Kiwa ID: 114518 Flann 20240-25 SN: 163703	Gain (dB) Kiwa ID: Schwarzbeck BBV 9721	Cable loss (dB) 114691	Corr. (dB)
18000	31.3	34.5	11.4	8.2
19000	31.5	34.9	11.2	7.8
20000	31.7	34.1	11.6	9.2
21000	31.9	33.6	12.1	10.4
22000	32.1	33.6	12.4	10.9
23000	32.2	33.3	13.6	12.5
24000	32.3	32.3	13.5	13.5
25000	32.4	33.0	13.4	12.8
26000	32.5	32.9	13.7	13.3

Frequency (MHz)	AF (dB/m) Kiwa ID: 114487 Scientific Atlanta	Gain (dB) Kiwa ID: Schwarzbeck BBV 9721	Cable loss (dB) 114691	Corr. (dB)
26000	35.3	32.9	13.7	16.1
27000	35.4	32.6	14.9	17.7
28000	35.6	32.6	14.4	17.4
29000	35.9	32.9	14.6	17.6
30000	36.2	32.7	15.2	18.7
31000	36.1	32.9	14.9	18.1
32000	36.0	33.8	16.7	18.9
33000	36.2	34.8	16.8	18.2
34000	36.3	35.5	15.9	16.7
35000	36.4	35.5	17.5	18.4
36000	36.5	34.6	17.9	19.8
37000	36.6	33.6	18.2	21.2
38000	36.8	32.5	17.7	22.0
39000	37.0	32.1	17.7	22.6
40000	37.2	29.9	19.0	26.3

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

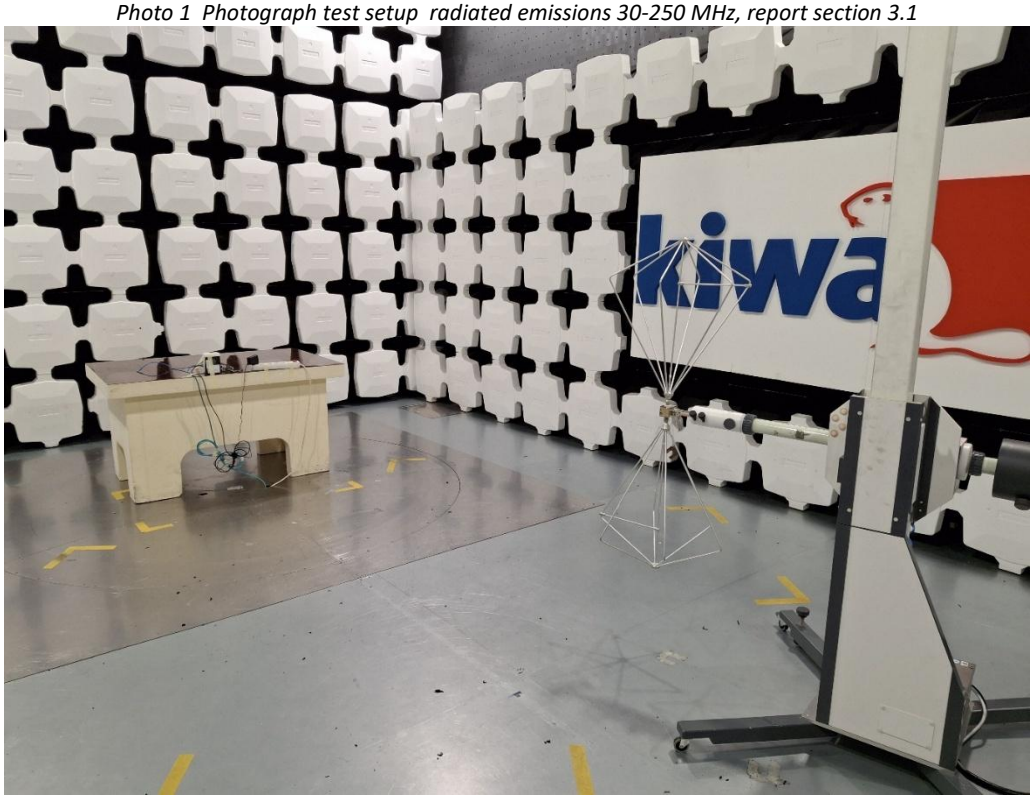


Photo 2 Photograph test setup radiated emissions 250-1000 MHz, report section 3.1

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

Photo 4 Photograph test setup conducted emissions, report section 3.2

<<END OF REPORT>>