

TEST REPORT

**According to FCC (and ISED) specifications
Electromagnetic compatibility of multimedia equipment**

Report Number: 123-27564-1

Date of issue: 2023-12-01

Total number of pages.....: 97

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preparing the Report**.....: FORCE Technology
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8200 Aarhus N
DENMARK



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SWEDEN

Test specification:: ANSI C63.10:2013 and ANSI C63.4: 2014

TRF template used:: IECCE OD-2020-F7:2020; ed. 2

Standards: 47 CFR Part 15, Subpart C (Specific rule part §15.225)
47 CFR Part 15, Subpart B (Specific rule part §15.109)
RSS-210:2019 + A1:2020
RSS-Gen:2019 + A1:2019 + A2:2021
ICES-003:2020

Test procedure: DANAK

Test Report Form No.: According to OD-2020, Clause 3.3

Test Report Form(s) Originator: FORCE Technology

Master TRF.....: Dated 2022-06-02 (according to 3.3.4)






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Test item description	Card reader system RFID devices – dual frequencies. (Not transmitting simultaneous)	
Trademark or brand name	N/A	
Manufacturer	AES GmbH, Markt 14, 99310 Arnstadt, GERMANY	
Model/Type reference(s)	SA3-I SA3-F SA3-D SA3-USB	
FCC ID	2ATGK-SA3-I 2ATGK-SA3-F 2ATGK-SA3-D 2ATGK-SA3-USB	
ISED ID	25111-SA3-I 25111-SA3-F 25111-SA3-D 25111-SA3-USB	
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
Testing Laboratory	FORCE Technology	
Testing location/ address	Agro Food Park 13 8200 Aarhus DENMARK	
Tested by (name, function, signature)	Jesper Salvesen Specialist	
Tested by (name, function, signature)	Peter Rosendal Overgaard Specialist, EMC	
Tested by (name, function, signature)	Rasmus Brun Behnke Specialist	
Tested by (name, function, signature)	Johan Weisbjerg Specialist	
Approved by (name, function, signature) ...:	Peter Wolf Frandsen Specialist EMC	

List of Attachments (including a total number of pages in each attachment): N/A
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Summary of testing

Tests performed according to ANSI C63.10:2013
(name of test and std. clause):

AC power-line conducted emission (6.2)
Radiated emission below 30 MHz (6.4)
Radiated emission 30 – 1000 MHz (6.5)
Frequency stability (6.8)
Occupied bandwidth (6.9)
Band edge (6.10)
Field strength of fundamental

Tests performed according to ANSI C63.4: 2014
(name of test and std. clause):

Radiated emission 1 – 12.75 GHz (8.3)

Testing location:
 FORCE Technology
 Agro Food Park 13
 8200 Aarhus
 DENMARK

Summary of compliance

The product fulfils the requirements of the following standard, with respect to the test listed below:

- 47 CFR Part 15, Subpart C (Specific rule part §15.225)
- 47 CFR Part 15, Subpart B (Specific rule part §15.109)*
- ISED RSS-210:2019 + A1:2020, RSS-Gen:2019 + A1:2019 + A2:2021
- ICES-003:2020*

* Additional test performed on test item SA3-USB due to high internal clock frequency.

The given result is based on a shared risk principle with respect to the measurement uncertainty.

Use of uncertainty of measurement for decisions on conformity (decision rule) :

The decision rule is inherent in the requested specification.

For additional information see 6.2.

Information on uncertainty of measurement:

Internal procedure used for type testing through which traceability of the measuring uncertainty has been established:

Calculations leading to the reported values are on file with the testing laboratory internal Quality Management System D4.

Statement not required by the standard used for type testing.

Possible test case verdicts:	
- test case does not apply to the test item .:	N/A (Not Applicable)
- test item does meet the requirement	P (Pass)
- test item does not meet the requirement .:	F (Fail)
Date of receipt of test item	
	2023-08-04
Date (s) of performance of tests	
	2023-08-07 to 2023-10-27
General remarks:	
<p>"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report.</p> <p>Throughout this report a <input type="checkbox"/> comma / <input checked="" type="checkbox"/> point is used as the decimal separator. Note: Throughout this TRF, numerical data taken from IEC standards are using a comma as the decimal separator.</p> <p>Throughout this report, the term "Test item" is used over terms such as Test object, EUT or DUT.</p>	
General product information (GPI) and other remarks:	
<p>Card reader system:</p> <p>4 types of RFID devices have been received for test and then documented in this report. 3 of the 4 items is designed with CAN bus interface for installation in vehicles. 1 item is designed with USB interface for use with a laptop/desktop computer.</p> <p>All 4 items operate on 2 frequencies, both 125 kHz and 13.56 MHz by alternating between the two frequencies. (Not transmitting simultaneous) Then, when placing an RFID card near the RFID device, the unique ID number can be read.</p>	

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1 General description of test item

Note: The information in this section has been provided by the applicant.

1.1 Photo(s) of the test item

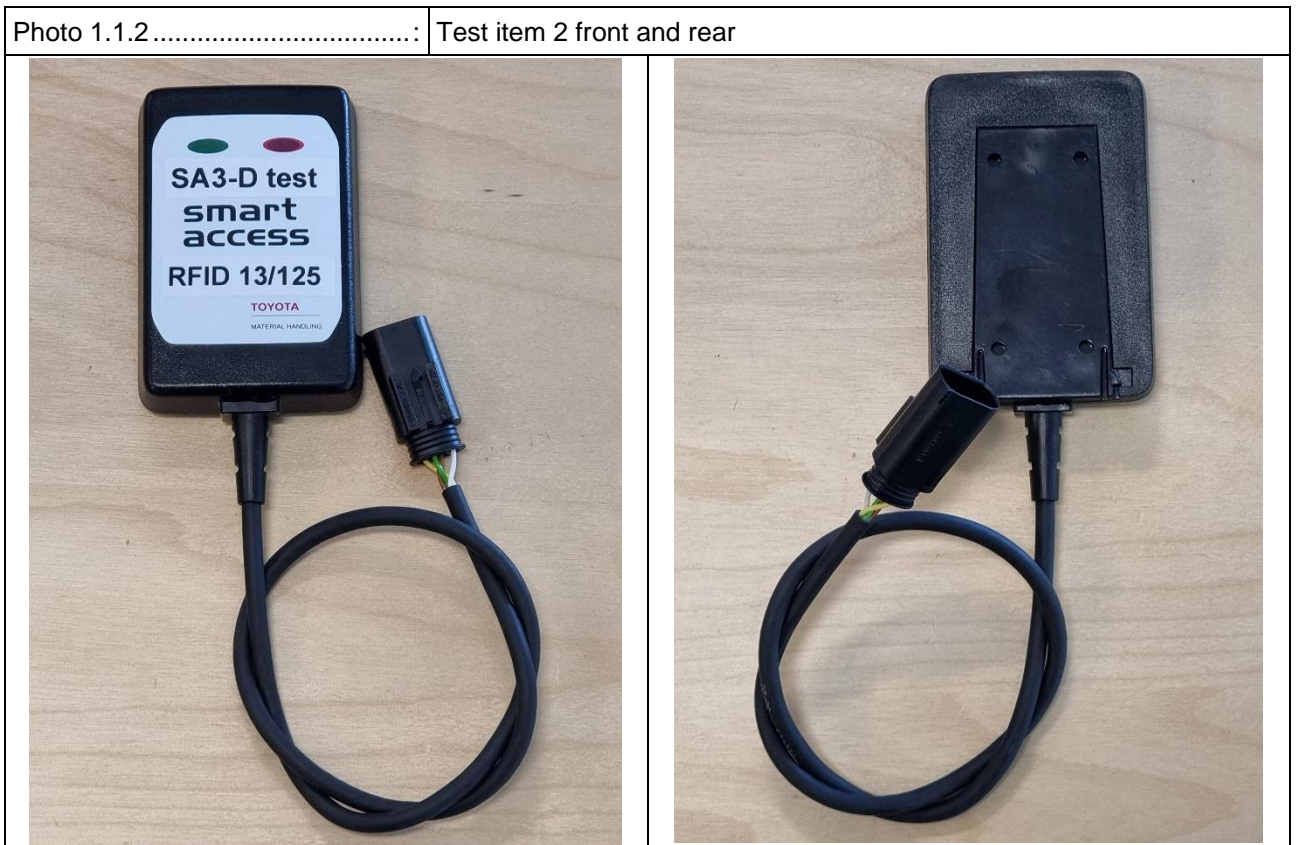


Photo 1.1.3.....: Test item 3 front and rear

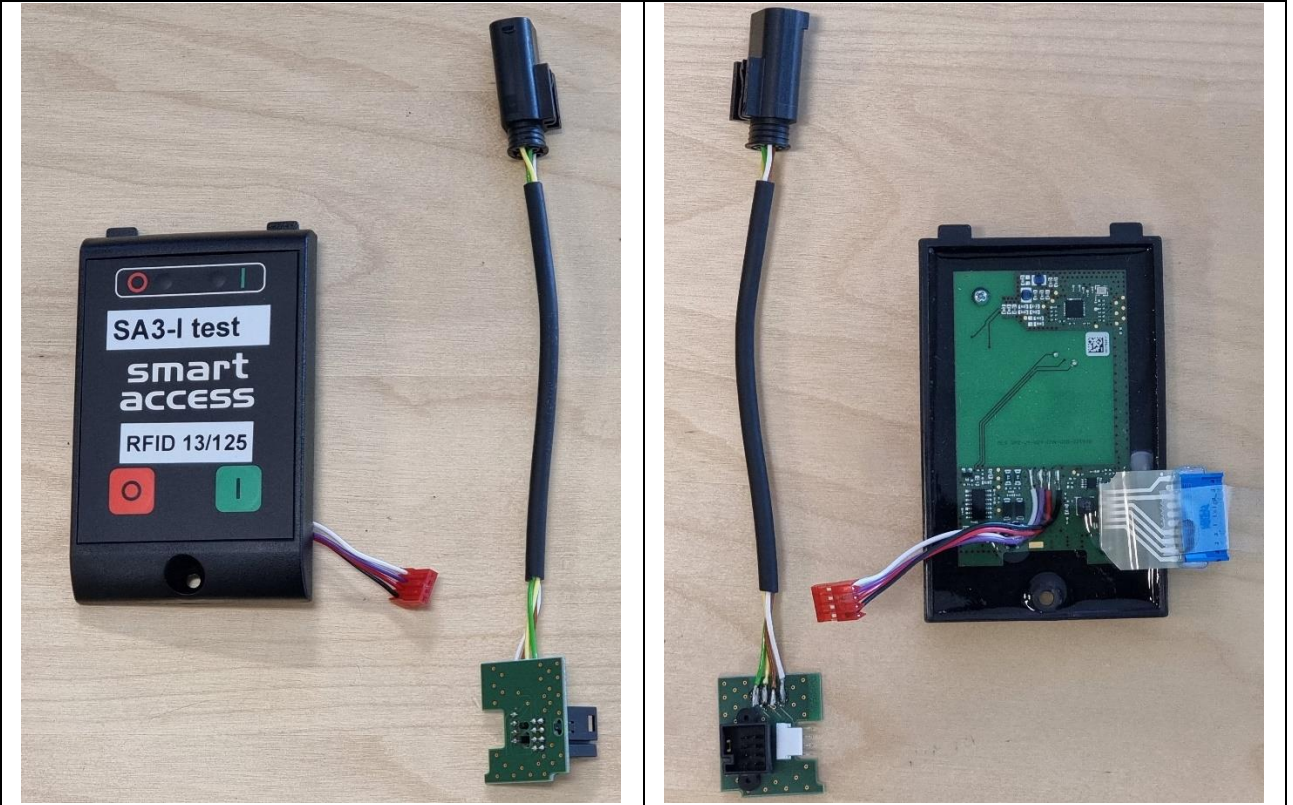


Photo 1.1.4.....: Test item 4 front and rear

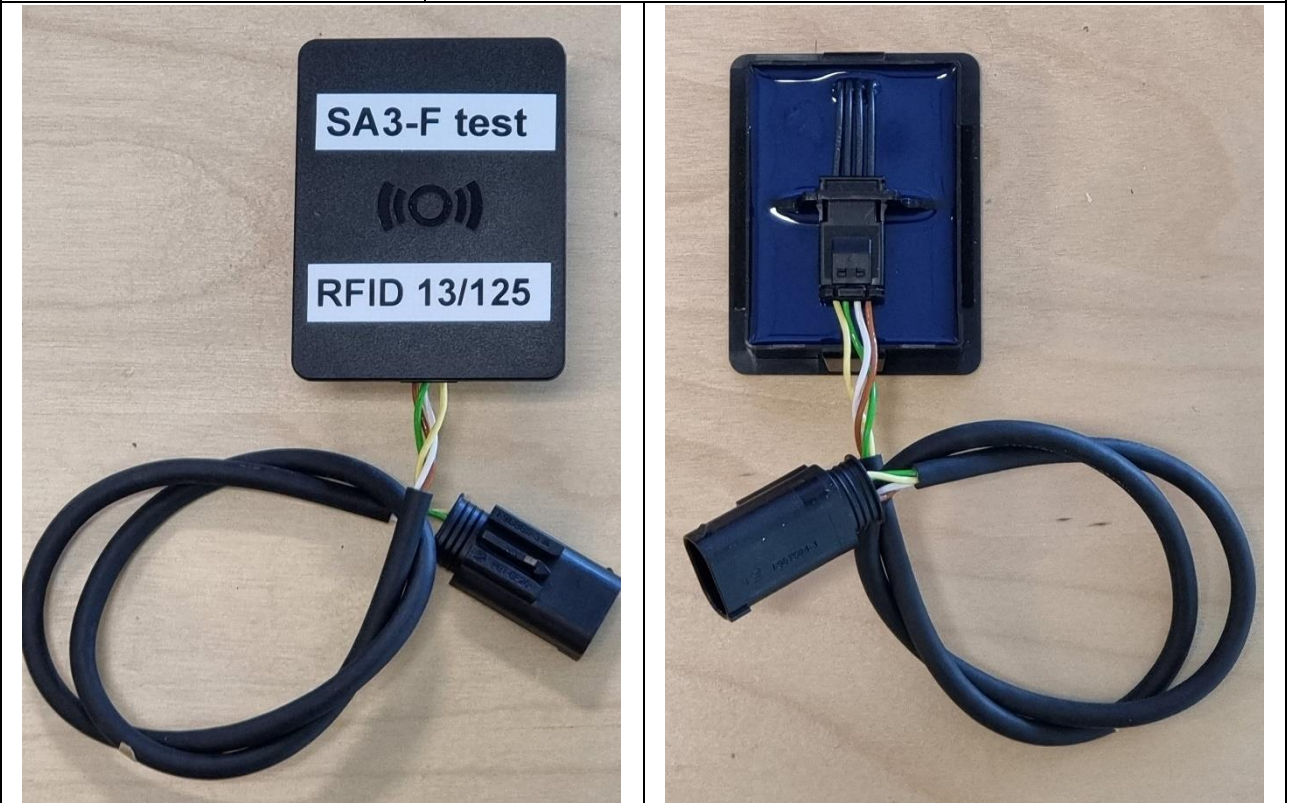
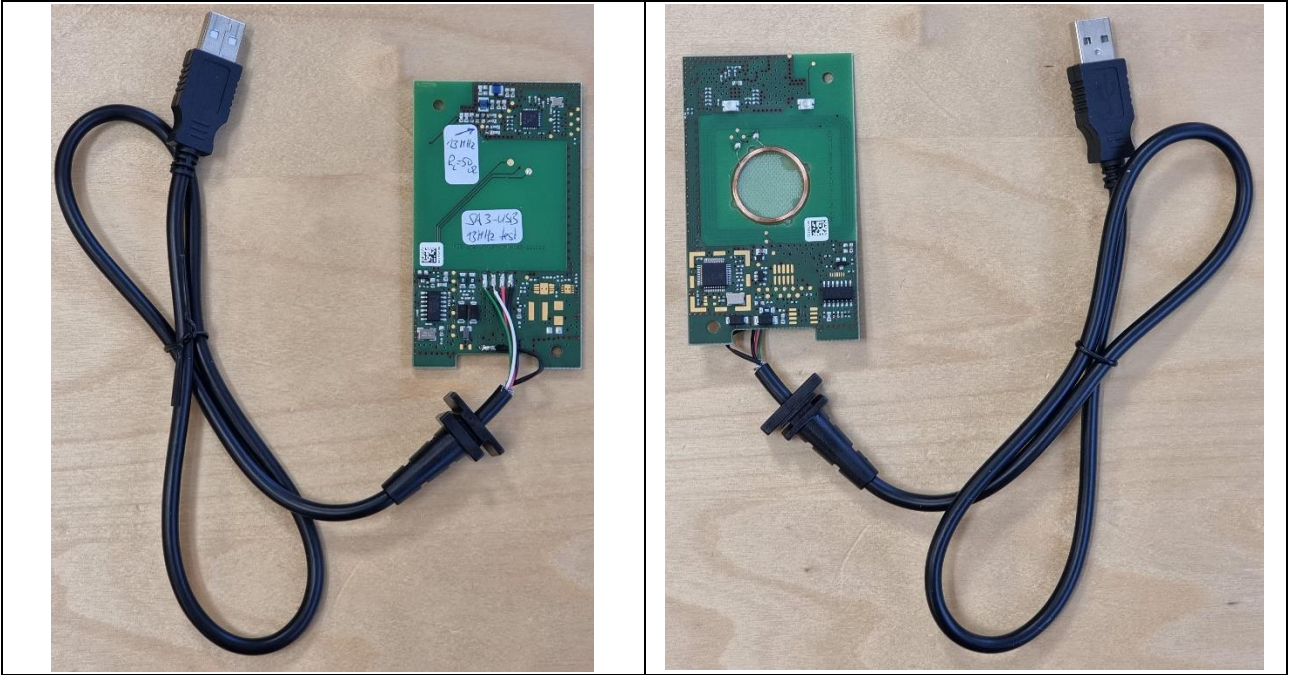


Photo 1.1.5.....: Test item 5 front and rear



1.2 Test item(s)

No.	Test item name	Unique identification / type / description	Extent of test
1	SA3-USB	SN: SA3-USD / full function version, USB interface	Tested in full
2	SA3-D	SN: SA3-D / full function version, CAN bus interface	Tested in full
3	SA3-I	SN: SA3-I / full function version, CAN bus interface. The flex cable on the rear is connected to the front dome buttons and isn't connected to the PCB.	Tested in full
4	SA3-F	SN: SA3-F / full function version, CAN bus interface	Tested in full
5	SA3-USBc	SN: SA3-USBc / Full function/radio with resistive load, USB interface	Con. EMI
Supplementary information: -			

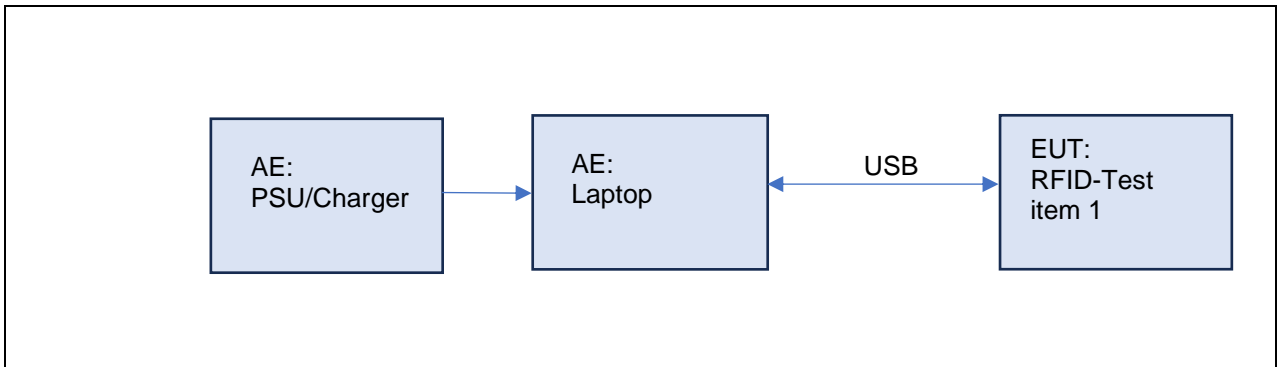
1.3 Port(s)

No.	Port Name	Type	Cable		
			Specified length in m	Attached during test	Shielded
1	Enclosure	Enclosure	-	-	-
2	USB	DC power and data (Test item 1, only)	<0,5	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
3	CAN bus	DC power and data (Test item 2,3,4)	<0,5	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4	RFID 125 kHz	Antenna	-	<input checked="" type="checkbox"/>	-
5	RFID 13.56 MHz	Antenna	-	<input checked="" type="checkbox"/>	-
Supplementary information: Test item 3 has a flex foil PCB with only 2 dome contacts – it is isolated from the PCB of the Test item.					

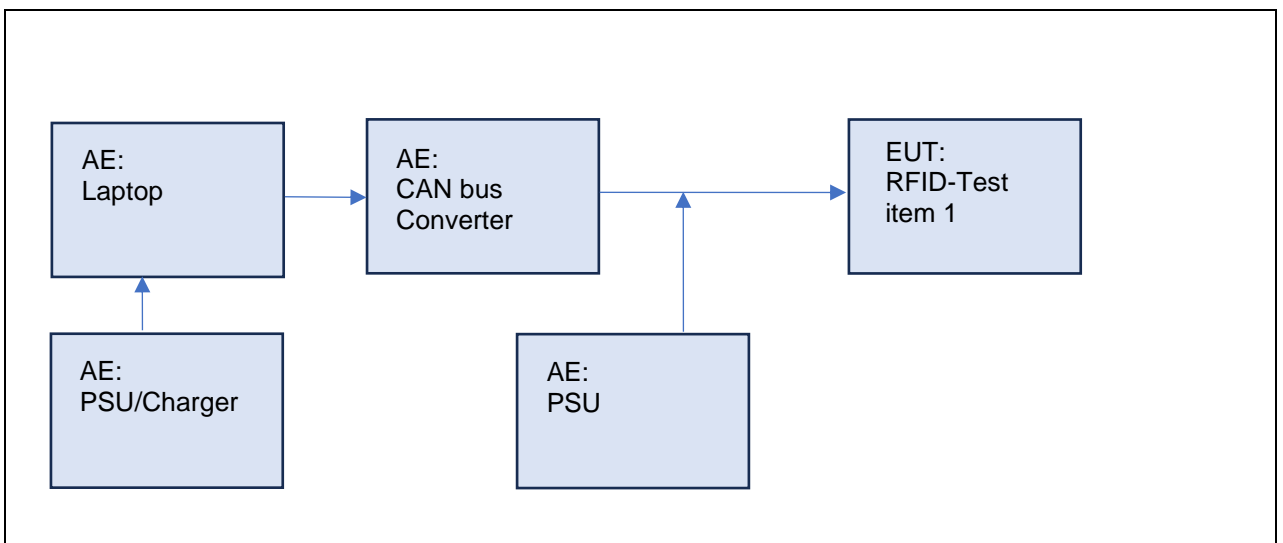
1.4 Power rating(s)

Power supply type..... :	<input type="checkbox"/>	AC, 1 phase
	<input type="checkbox"/>	AC, 2 phases
	<input type="checkbox"/>	AC, 3 phases
	<input type="checkbox"/>	Neutral
	<input type="checkbox"/>	Protective Earth
	<input checked="" type="checkbox"/>	DC 5 V USB (Test item 1)
	<input checked="" type="checkbox"/>	DC 24 V (Test item 2,3,4)
	<input type="checkbox"/>	Battery, not rechargeable in the device
	<input type="checkbox"/>	Battery, rechargeable in the device
Rated voltage	5 and 12 VDC	
Rated frequency	0 Hz / DC	
Rated power	< 1 watt	

1.5 Configuration and Connections with Test item 1 and 5



1.6 Configuration and Connections with Test item 2, 3 and 4



1.7 Additional parameters

Radio type	RFID Radio 125 kHz & 13.56 MHz (Not transmitting simultaneous)	
Antenna	Internal non-removeable antenna	
Clock frequencies.....	Highest internal clock frequency is 48 MHz and for SA3-USB: 480 MHz	
Duty cycle during test.....	12 %	
Software version	FW version SA3-I: 4.06, FW version SA3-F: 4.06, FW version SA3-D: 4.06, FW version SA3-USB: 4.10	
Hardware version	HW version SA3-I: 30_1, HW version SA3-F: 30_1, HW version SA3-D: 30_1, HW version SA3-USB: 30_1	
Dimensions (W x H x D).... [cm]	SA3-USB: 6.5 x 9.5 x 2.0 SA3-D: 6.5 x 9.5 x 2.0 SA3-I: 7 x 11 x 1.3 SA3-F: 5.5 x 7.0 x 3.0	
Mounting position	<input checked="" type="checkbox"/>	Table-top equipment (Test item 1)
	<input type="checkbox"/>	Wall/Ceiling mounted equipment
	<input type="checkbox"/>	Floor standing equipment
	<input type="checkbox"/>	Hand-held equipment
	<input checked="" type="checkbox"/>	Other: Test item 2,3,4 is mounted inside vehicle (tested as tabletop)

1.8 Operating mode(s)

No.	Abbreviation	Detailed description of the operating mode	Used for testing	
			Radiated and Conducted Emission	Radio Parameter
1	Normal	On, running – No card on reader – Radios alternating.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2	Reading 13.56 MHz	On, running – 13.56 MHz card on reader – Radio only operating at 13.56 MHz	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Supplementary information: Different scenarios was investigated – card/no-card – 125 kHz only – 13.56 MHz only – The dual radio mode, switching between 125 kHz and 13.56 MHz and no card have found to be worst case for conducted and radiated emission.

1.9 Auxiliary equipment

Advice to the TRF User: Include accessories which are not to be considered test items.

No.	AE Item Name	Type and description	Manufacturer (If not the same)
1	Laptop	Latitude3510,	DELL
2	PSU/Charger	Charger for laptop	DELL
3	CanBus conv.	-	-
4	PSU	DC supply for EUT	B&O

Supplementary information: -

1.10 Modifications to the test item during testing

<input checked="" type="checkbox"/>	No modifications done during testing	
<input type="checkbox"/>	Modifications done during testing (see details below)	
No.	Description of modification (if any)	Date of modification
1	-	-
Supplementary information: None		

2 Verdict summary section

USA: 47 CFR Part 15, Subpart C (Specific rule part §15.225) Canada: ISED RSS-210:2019 AM1:2020 + RSS-Gen:2019 AM1:2019 + AM2:2021				
Test Clause	Requirement – Test case	FCC & ISED rule part	Test methods	Results
6.2	Measurement of radio frequency voltage on mains / Conducted limits	47 CFR Part 15 C Subpart 15.107 & 15.207 RSS-Gen:2019 ICES-003:2020	ANSI C63.10:2013	P*
6.4 & 6.5	Measurement of radiated emission / field strength of harmonics	47 CFR Part 15 B** + C Subpart 15.109 & 15.209 47 CFR Part 15.225 RSS-Gen:2019 RSS-210:2019 Annex B.6 ICES-003:2020**	ANSI C63.10:2013 ANSI C63.4: 2014**	P
6.8	Frequency stability	47 CFR Part 15.225 RSS-210:2019 Annex B.6(b)	ANSI C63.10:2013	P
6.9	Measurement of occupied bandwidth	47 CFR Part 15.215(c) RSS-Gen:2019 clause 6.7	ANSI C63.10:2013	P
6.10	Measurement of band edge	47 CFR Part 15.209 & 15.225 RSS-210:2019 Annex B.6	ANSI C63.10:2013	P
6.6	Measurement of field strength of fundamental	47 CFR Part 15.225 RSS-210:2019 Annex B.6	ANSI C63.10:2013	P
<p>Supplementary information:</p> <p>* The test objects contain no AC mains ports. Only test item SA3-USB is relevant for this test due to the USB port. The measurement was performed on AC/DC adapter Auxiliary equipment no.2 as a representable AC mains source.</p> <p>** Measurement of radiated emission 1-12.75 MHz was performed on SA3-USB due to high internal clock frequency on the USB port, Test method according to ANSI C63.4: 2014.</p>				

3 Test conditions

3.1 General

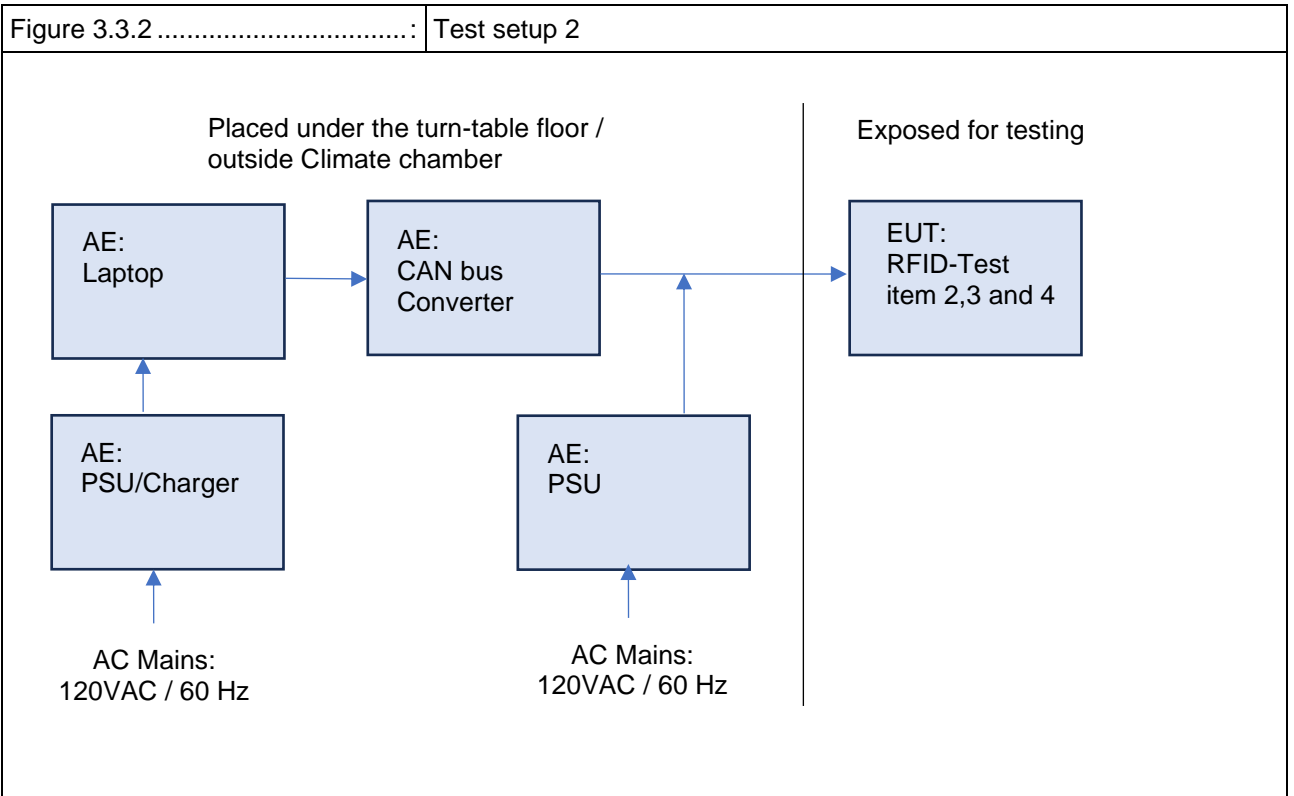
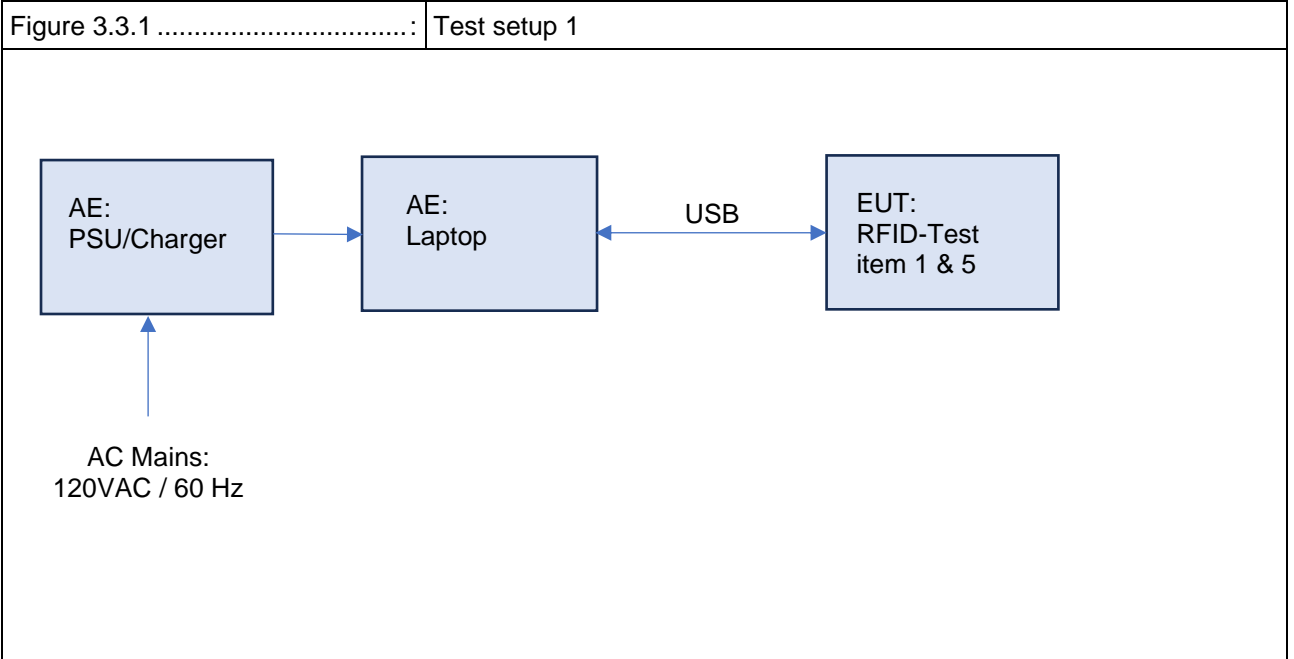
Environmental reference conditions.....:	The climatic conditions during the tests are within the limits specified by the manufacturer for the operation of the EUT and the test equipment. The climatic conditions during the tests were within the following limits:		
	Temperature	Humidity (rh)	Atmospheric pressure
	15 °C – 35 °C	30 % - 60 %	800 hPa – 1060 hPa
	If explicitly required in the basic standard or applied product standard the climatic values are recorded and documented separately in this test report.		
Measurement uncertainties	For all measurements where guidance for the calculation of the instrumentation uncertainty of a measurement is specified in CISPR 16-4-2, the measurement instrumentation uncertainty has been calculated and applied in accordance with the standard.		

3.2 Operational requirements during testing

The operation of the EUT shall conform to the following provisions:

- a) The unlicensed wireless device shall be configured to operate at 100 % duty cycle. For systems incapable of supporting 100 % duty cycle, the unlicensed wireless device shall be operated using the maximum possible duty cycle, and this information shall be noted as such in the test report.
- b) The unlicensed wireless device shall be tested operating at the highest transmit power allowed for each antenna configuration.
- c) The system shall be tested with each modulation to identify the worst-case modulation that produces the highest level of emissions. Where a multi modulation scheme is used, justification for the single modulation chosen shall be provided in the test report.
- d) The system shall be tested using the data rate that yields the highest fundamental emission levels for each modulation type. The data rate and rationale or supporting test data shall be included in the test reports.
- e) For frequency hopping systems, the hopping sequence shall be stopped for certain test suites to allow for measurements on a single channel.
- f) Where applicable, the device shall also be configured to transmit at the worst-case duty cycle under normal operating conditions to determine the average correction factor.
- g) The software shall allow configuration and operation on all available unlicensed wireless device channels.
- h) The software shall allow configuration and operation in the unmodulated carrier model, where applicable.

3.3 Test setups



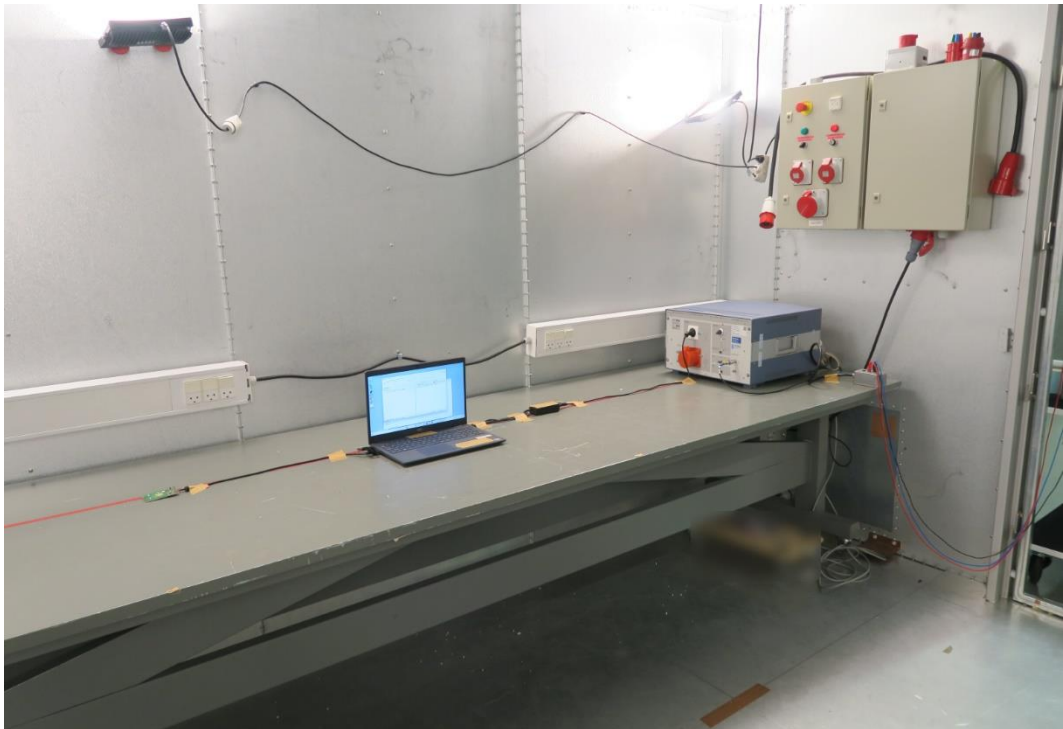
4 Emission

4.1 Measurement of AC power-line conducted emission

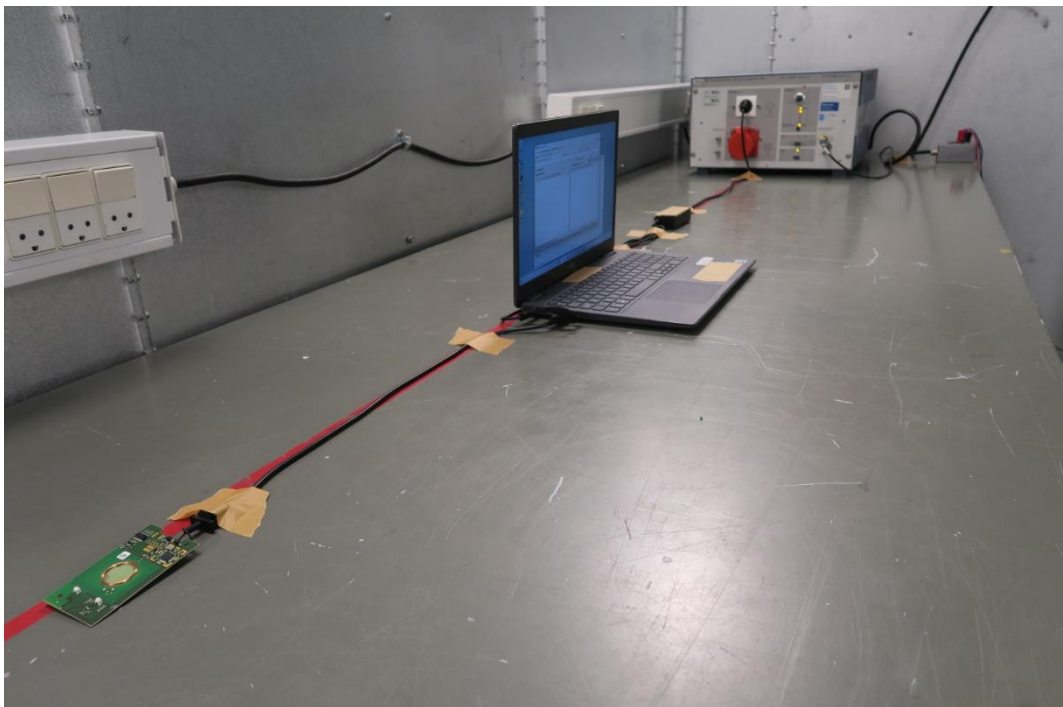
Name.....	Peter Rosendal Overgaard	
Date.....	2023-09-04	
Rationale for verdict N/A	-	
Test location (stand).....	Aarhus Room 4, AEA2 / AEA3	
Applied limit class.....	<input checked="" type="checkbox"/>	Limit according to 47 CFR Part 15 C Subpart 15.107 & 15.207 and RSS-Gen:2019
	<input type="checkbox"/>	Other: -
Test setup description	<input checked="" type="checkbox"/>	40 cm distance to vertical ground plane, 80 cm over ground plane
	<input type="checkbox"/>	Floor standing equipment setup (10 cm over ground plane)
	<input type="checkbox"/>	Other: -
	<input type="checkbox"/>	Artificial hand applied
Supplementary test setup description	<p>If the EUT is normally operated with a ground (safety) connection, then the EUT shall be connected to the ground at the LISN through a conductor provided in the lead from the ac power to the LISN.</p> <p>The excess length of the power cord between the EUT and the LISN receptacle shall be folded back and forth at the centre of the lead to form a bundle not exceeding 40 cm in length.</p> <p>The system shall be arranged in one typical equipment arrangement for the test.</p>	
Test method applied.....	<input checked="" type="checkbox"/>	Artificial mains network (AMN): 50 Ω , 50 μ H
	<input type="checkbox"/>	Other: -
Supplementary information	<p>AC power-line conducted emission measurements shall be made, unless otherwise specified, over the frequency range from 150 kHz to 30 MHz, to determine the line-to-ground radio-noise voltage that is conducted from all of the EUT current-carrying power input terminals that are directly (or indirectly via separate transformers or power supplies) connected to a public power network. These measurements may also be required between 9 kHz and 150 kHz.</p> <p>If the test item normally receives power from another device that in turn connects to the public utility ac power lines, measurements shall be made on that device with the EUT in operation to demonstrate that the device continues to comply with the appropriate limits while providing the EUT with power. If the EUT is operated only from internal or dedicated batteries, with no provisions for connection to the public utility ac power lines (600 VAC or less) to operate the EUT (such as an adapter), then ac power-line conducted measurements are not required.</p> <p>The test item no 5 has been fitted with a resistive load instead of an antenna according to standard for measuring conducted emission on radio transmitters, KDB 174176 D01 Line Conducted FAQ v01r01.</p>	

Photo 4.1.1: Measurement of AC power-line conducted emission

a. High angle front view of EUT and AE on setup table



b. High angle rear oblique view of EUT



Test results for AC power-line conducted emission	
Test item no(s) ref. cl. 1.2	5
Operating mode no(s) ref. cl. 1.7 :	1
Test setup no(s) ref. cl. 3.3	1

Tabulated Results summary

Frequency (MHz)	QuasiPeak (dB μ V)	CAverage (dB μ V)	Limit (dB μ V)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Corr. (dB)
0.15	---	28.73	55.88	27.15	15000	9	L1	FLO	21.6
0.15	47.17	---	65.88	18.71	15000	9	L1	FLO	21.6
0.40	---	26.25	47.95	21.70	15000	9	L1	FLO	21.6
0.40	30.90	---	57.95	27.05	15000	9	L1	FLO	21.6
0.98	---	18.24	46.00	27.76	15000	9	L1	FLO	21.6
0.98	22.80	---	56.00	33.20	15000	9	L1	FLO	21.6
0.98	---	18.95	46.00	27.05	15000	9	L1	FLO	21.6
0.98	23.53	---	56.00	32.47	15000	9	L1	FLO	21.6
13.56	---	26.95	50.00	23.05	15000	9	N	FLO	22.1
13.56	34.78	---	60.00	25.22	15000	9	N	FLO	22.1
13.56	---	27.56	50.00	22.44	15000	9	N	FLO	22.1
13.56	35.32	---	60.00	24.68	15000	9	N	FLO	22.1
16.59	---	26.51	50.00	23.49	15000	9	L1	FLO	22.2
16.59	31.82	---	60.00	28.18	15000	9	L1	FLO	22.2
16.64	---	26.55	50.00	23.45	15000	9	L1	FLO	22.2
16.64	31.77	---	60.00	28.23	15000	9	L1	FLO	22.2
27.12	---	19.37	50.00	30.63	15000	9	N	FLO	22.2
27.12	27.32	---	60.00	32.68	15000	9	N	FLO	22.2
27.12	---	18.43	50.00	31.57	15000	9	N	FLO	22.2
27.12	26.04	---	60.00	33.96	15000	9	N	FLO	22.2

The result is calculated by adjusting the receiver reading with the correction factor.

Correction factor (dB) = LISN factor (dB) + Cable loss (dB) + Attenuation (dB)

Tabulated Result terms:

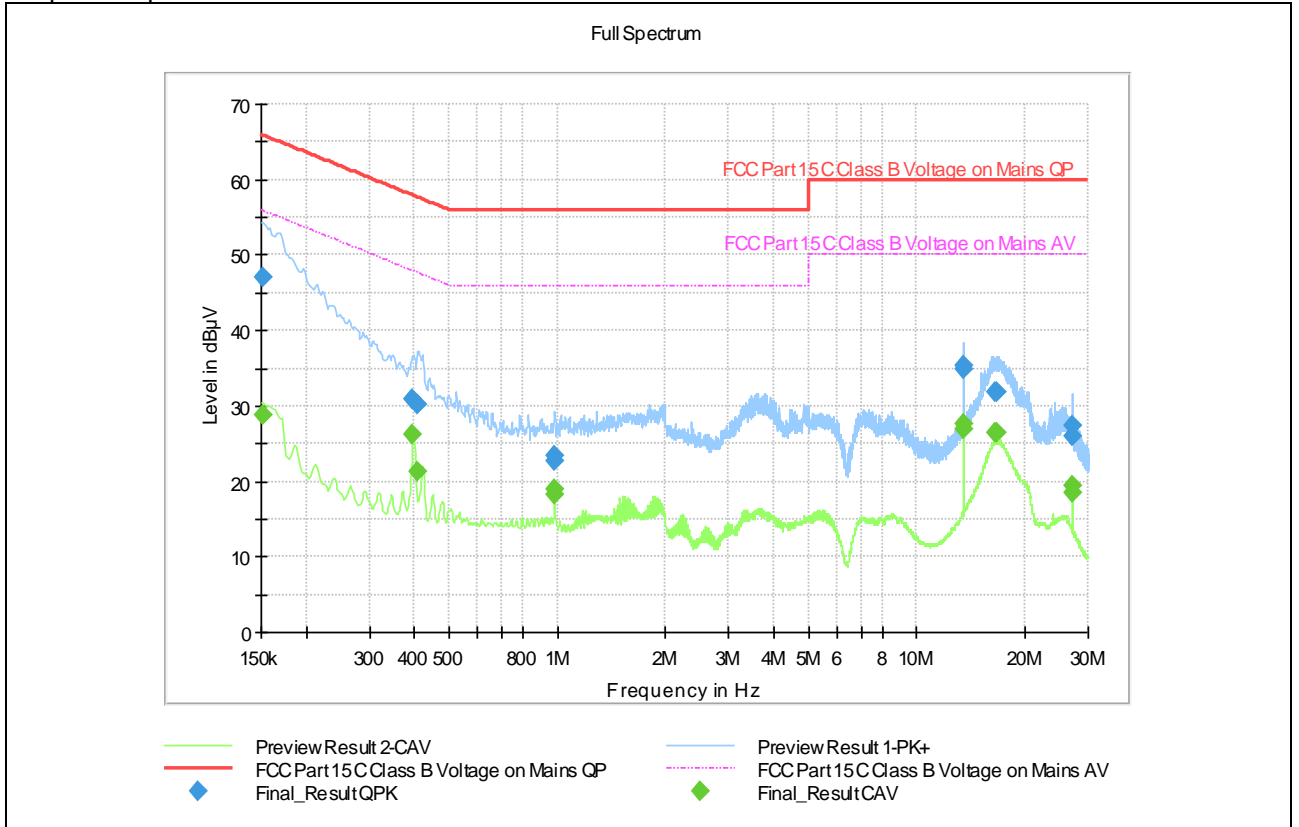
Result = QuasiPeak (dB μ V) and CAverage (dB μ V))

Correction factor = Corr. (dB)

Note: The test software state attenuation as a positive value and amplification as a negative value.

Sample calculation: 47.17 dB μ V (result) = 25.57 dB μ V (receiver reading) + 21.6 dB (Correction factor)

Graphical representation

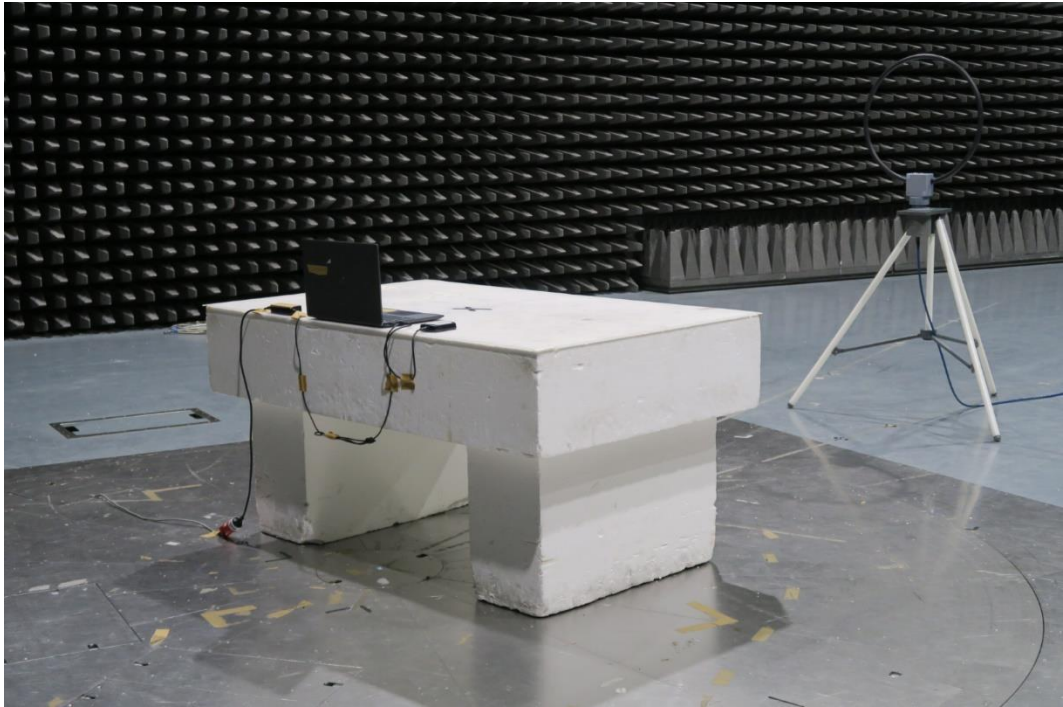


4.2 Measurement of radiated emission below 30 MHz (Magnetic field)

Name.....	Peter Rosendal Overgaard	
Date.....	2023-08-09 and 2023-08-10	
Rationale for verdict N/A	-	
Test location (stand).....	Aarhus Room 1	
Applied limit class.....	<input checked="" type="checkbox"/>	Limit according to 47 CFR Part 15 C Subpart 15.209, Subpart 15.225, RSS-Gen:2019 and RSS-210:2019 Annex B.6
	<input type="checkbox"/>	Other:
Test setup description	<input checked="" type="checkbox"/>	Equipment on a table 80 cm height
	<input type="checkbox"/>	Equipment on the floor (isolated from ground plane)
	<input type="checkbox"/>	Other (e.g., height of pallet):
Supplementary test setup description	<p>Any controlling device (e.g., notebook, laptop, or desktop computer) shall be positioned such that it shall not significantly influence the measurement results.</p> <p>External antenna(s) shall be positioned for maximum radiated emissions.</p> <p>EUTs with integral antennas shall be evaluated in their normal orientation.</p> <p>Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the centre, forming a bundle 30 cm to 40 cm long.</p>	
Test method applied.....	<input checked="" type="checkbox"/>	Active loop antennas, as specified in ANSI C63.2 and/or CISPR 16-1-4:2010.
	<input checked="" type="checkbox"/>	SAC with measurement distance [m]: 3
Supplementary information	The calculation of the correction of the limit lines from 30/300 meter to 3 meters: $\text{Limit2} = \text{Limit1} + 40 * \text{Log} (D1 / D2)$. This is done according to FCC Part 15, Section 31.	

Photo 4.2.1	Measurement of radiated emission below 30 MHz (Magnetic field) SA3-USB
-------------------	--

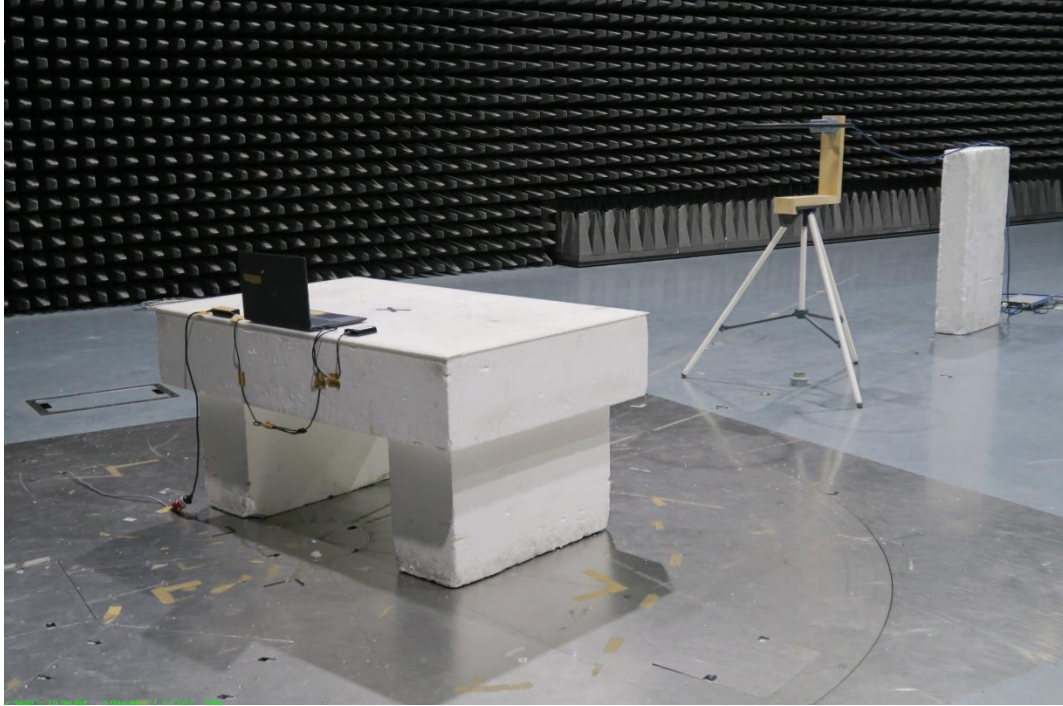
a. High angle front view of EUT on setup table, antenna axis X



b. High angle rear oblique view of EUT antenna axis Y



c. High angle front view of EUT on setup table, antenna axis Z



Test results for radiated emission below 30 MHz (Magnetic field) SA3-USB	
Test item no(s) ref. cl. 1.2	1
Operating mode no(s) ref. cl. 1.7 :	1
Test setup no(s) ref. cl. 3.3	1

Tabulated Results summary SA3-USB

X-axis								
Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Azimuth (deg)	Corr. (dB)
0.125020	48.54	104.76	56.22	15000.0	0.200	100.0	-16.0	20.5
13.560000	43.96	124.00	80.05	15000.0	9.000	100.0	-114.0	20.6
Y-axis								
Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Azimuth (deg)	Corr. (dB)
0.124980	28.77	104.76	75.99	15000.0	0.200	100.0	146.0	20.5
13.560000	49.54	124.00	74.46	15000.0	9.000	100.0	-50.0	20.6
Z-axis								
Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Azimuth (deg)	Corr. (dB)
0.125020	59.73	104.76	45.03	15000.0	0.200	100.0	113.0	20.5
13.560000	46.22	124.00	77.78	15000.0	9.000	100.0	180.0	20.6

The result is calculated by adjusting the receiver reading with the correction factor.

Correction factor (dB) = Antenna factor (dB) + Cable loss (dB) + Attenuation (dB) + Pre-amp gain (dB)

Tabulated Result terms:

Field strength = QuasiPeak (dB μ V/m)

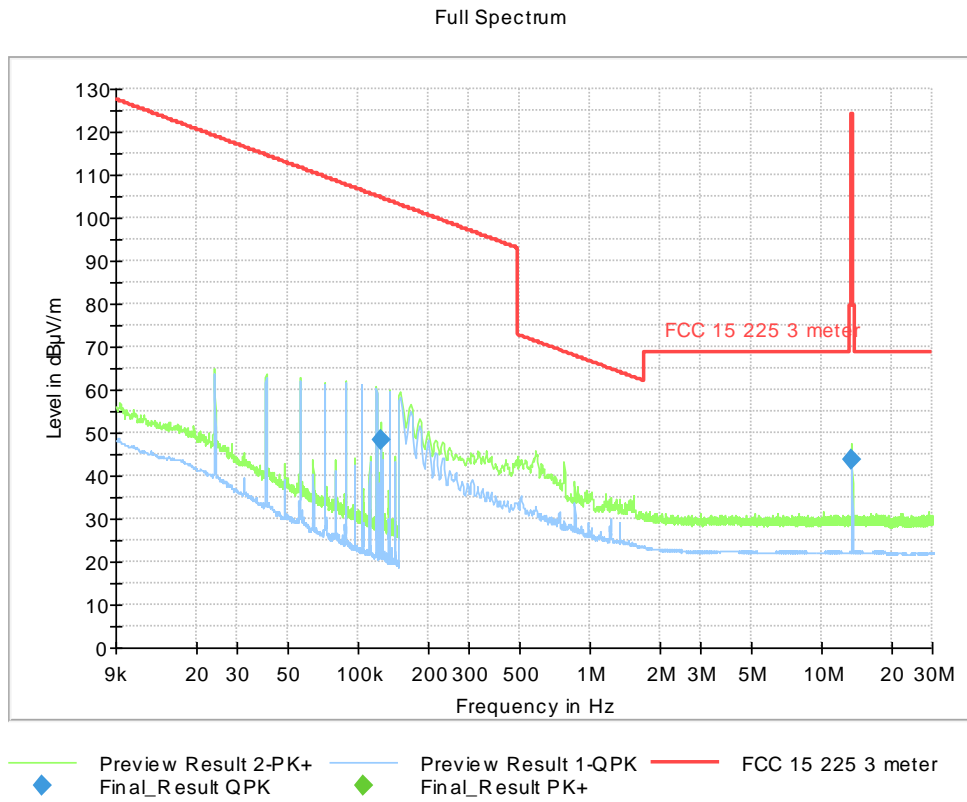
Correction factor = Corr. (dB)

Note: The test software state attenuation as a positive value and amplification as a negative value.

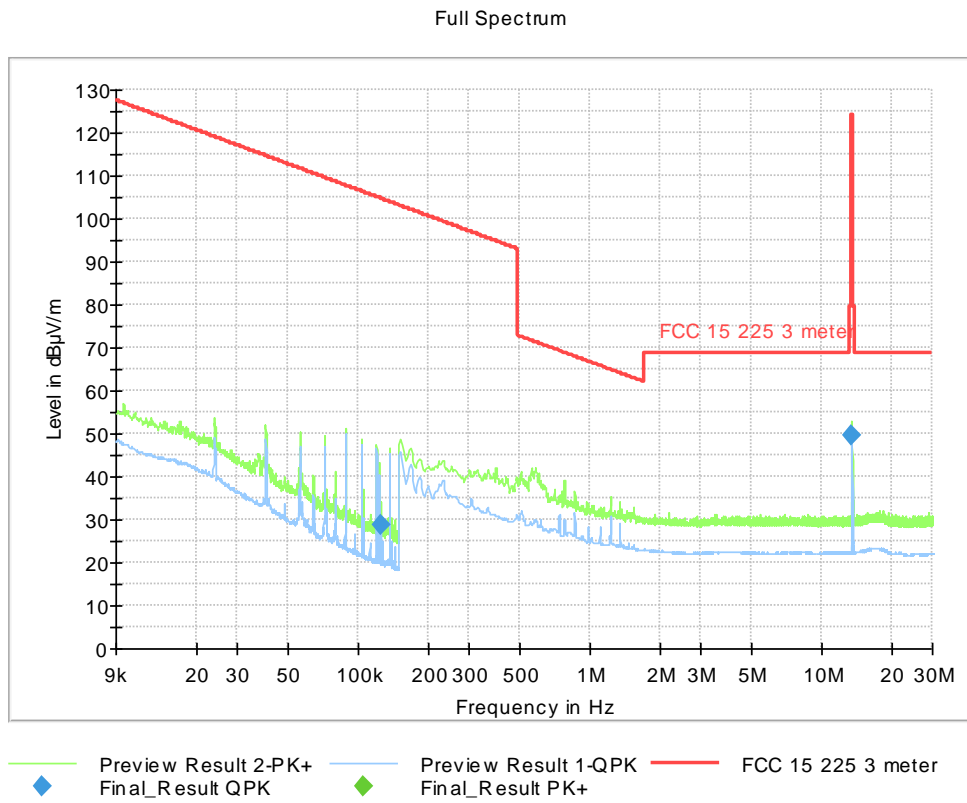
Sample calculation: 59.73 dB μ V/m (field strength) = 39.23 dB μ V (receiver reading) + 20.5 dB (Correction factor)

Graphical representation SA3-USB

X-axis



Y-axis



Z-axis

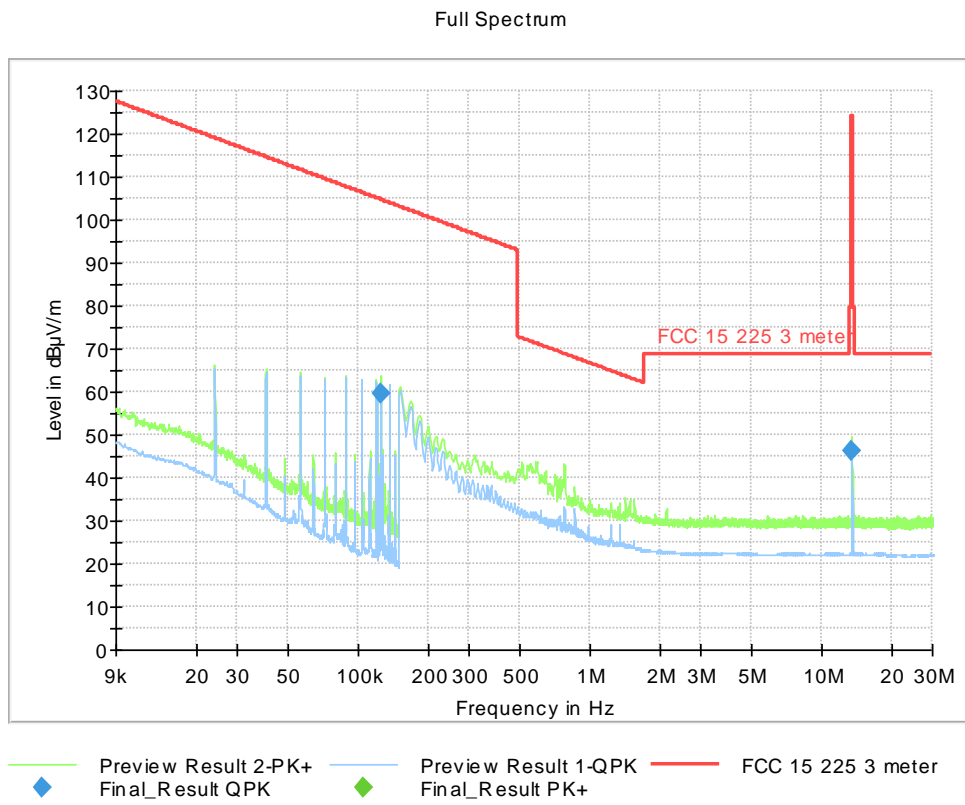
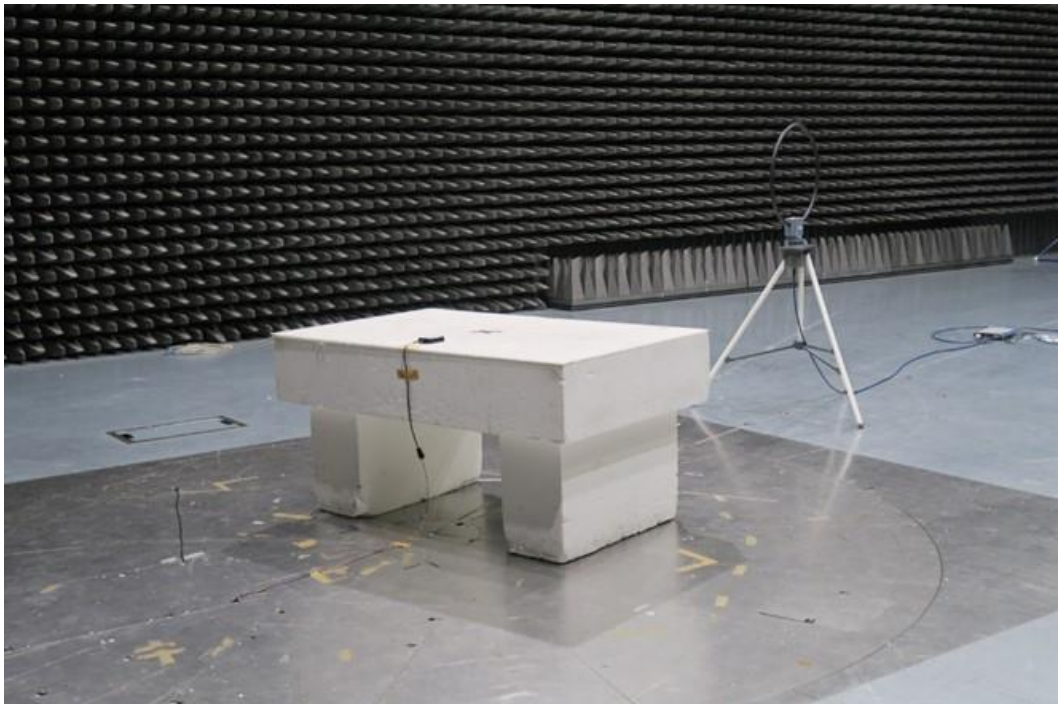


Photo 4.2.2	Measurement of radiated emission below 30 MHz (Magnetic field) SA3-D
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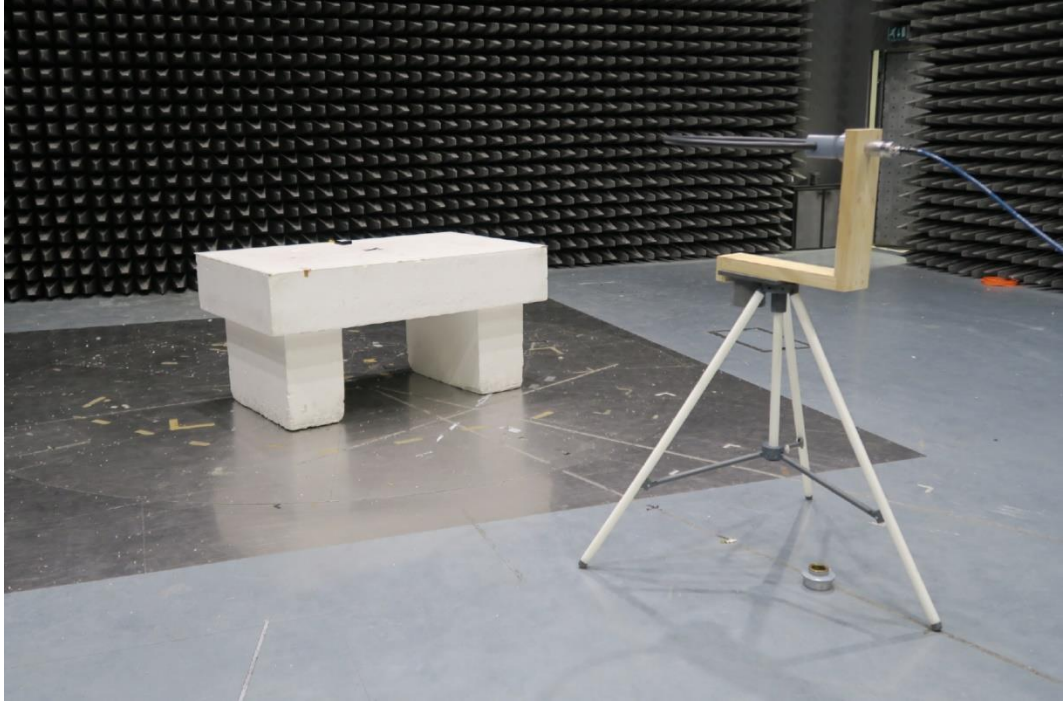
a. High angle front view of EUT on setup table, antenna axis X



b. High angle rear oblique view of EUT antenna axis Y



c. High angle front view of EUT on setup table, antenna axis Z



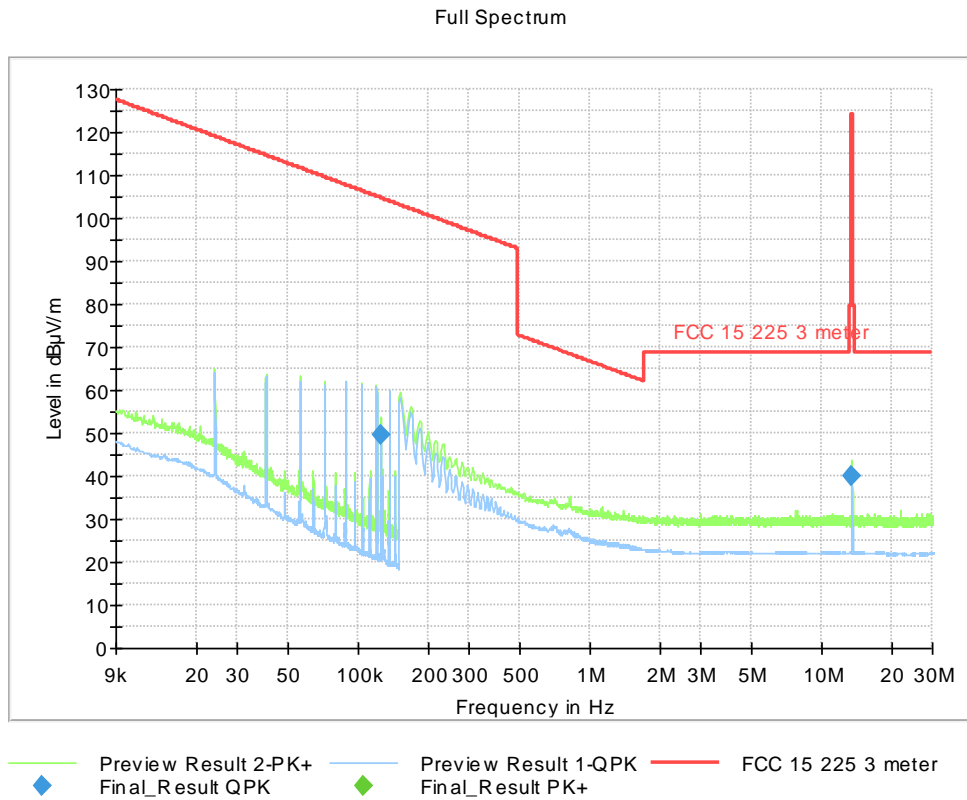
Test results for radiated emission below 30 MHz (Magnetic field) SA3-D	
Test item no(s) ref. cl. 1.2	2
Operating mode no(s) ref. cl. 1.7 :	1
Test setup no(s) ref. cl. 3.3	2

Tabulated Results summary SA3-D

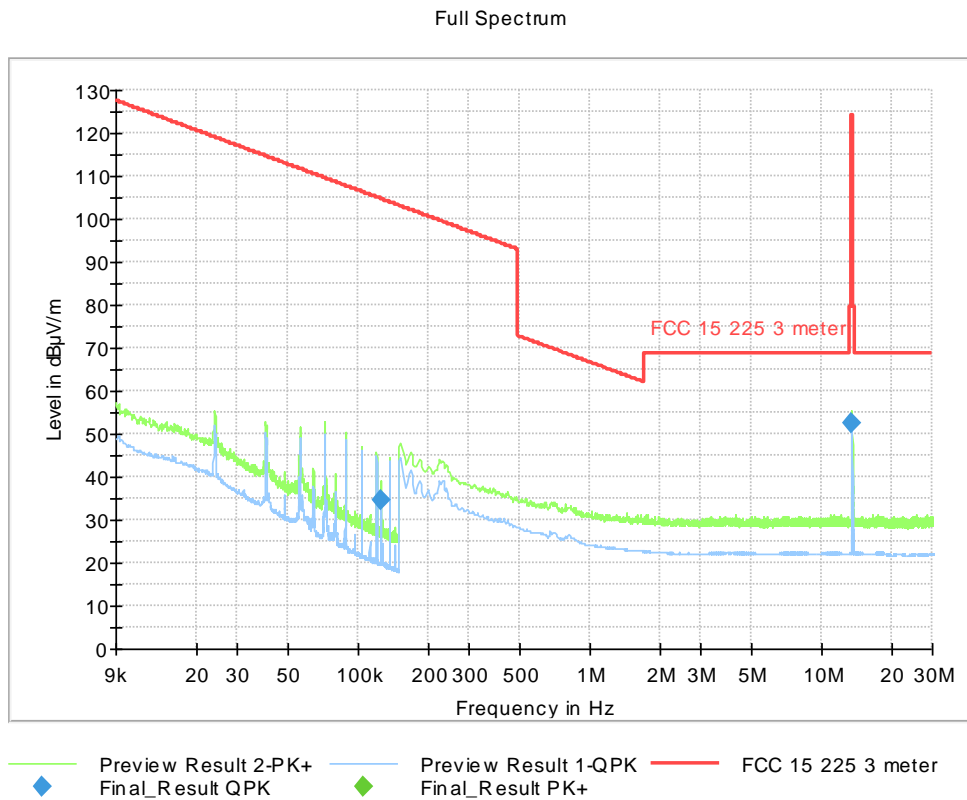
X-axis								
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Azimuth (deg)	Corr. (dB/m)
0.124980	49.77	104.76	54.99	15000.0	0.200	100.0	-67.0	20.5
13.560000	39.82	124.00	84.18	15000.0	9.000	100.0	-55.0	20.6
Y-axis								
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Azimuth (deg)	Corr. (dB/m)
0.125020	34.54	104.76	70.22	15000.0	0.200	100.0	25.0	20.5
13.560000	52.43	124.00	71.57	15000.0	9.000	100.0	57.0	20.6
Z-axis								
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Azimuth (deg)	Corr. (dB/m)
0.124980	59.09	104.76	45.67	15000.0	0.200	100.0	-105.0	20.5
13.560000	44.50	124.00	79.50	15000.0	9.000	100.0	-62.0	20.6
<p>The result is calculated by adjusting the receiver reading with the correction factor. Correction factor (dB) = Antenna factor (dB) + Cable loss (dB) + Attenuation (dB) + Pre-amp gain (dB)</p> <p>Tabulated Result terms: Field strength = QuasiPeak (dBµV/m) Correction factor = Corr. (dB) Note: The test software state attenuation as a positive value and amplification as a negative value.</p> <p>Sample calculation: 59.09 dBµV/m (field strength) = 38.59 dBµV (receiver reading) + 20.5 dB (Correction factor)</p>								

Graphical representation SA3-D

X-axis

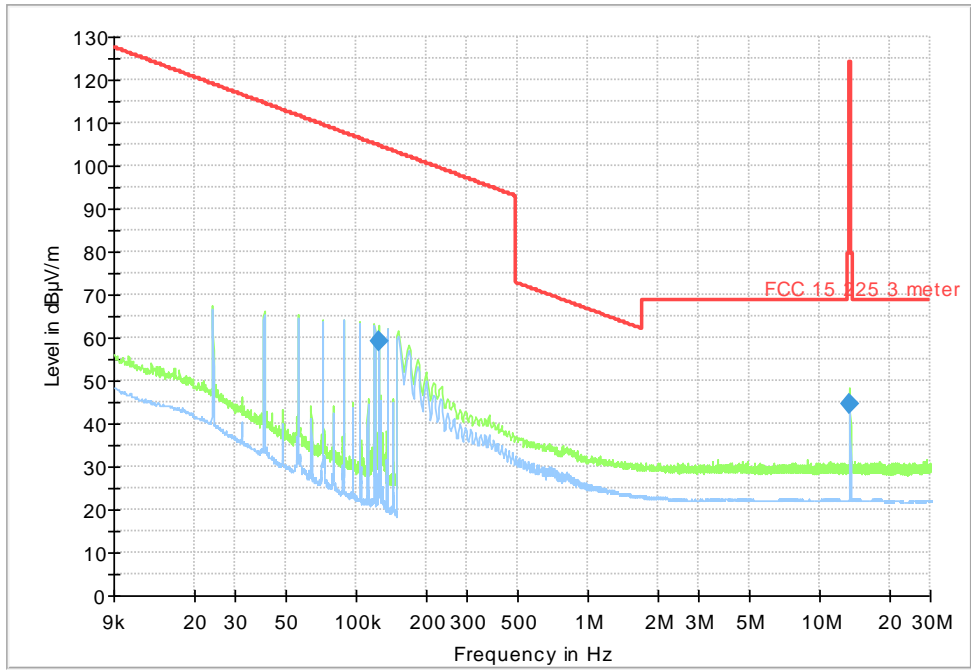


Y-axis



Z-axis

Full Spectrum



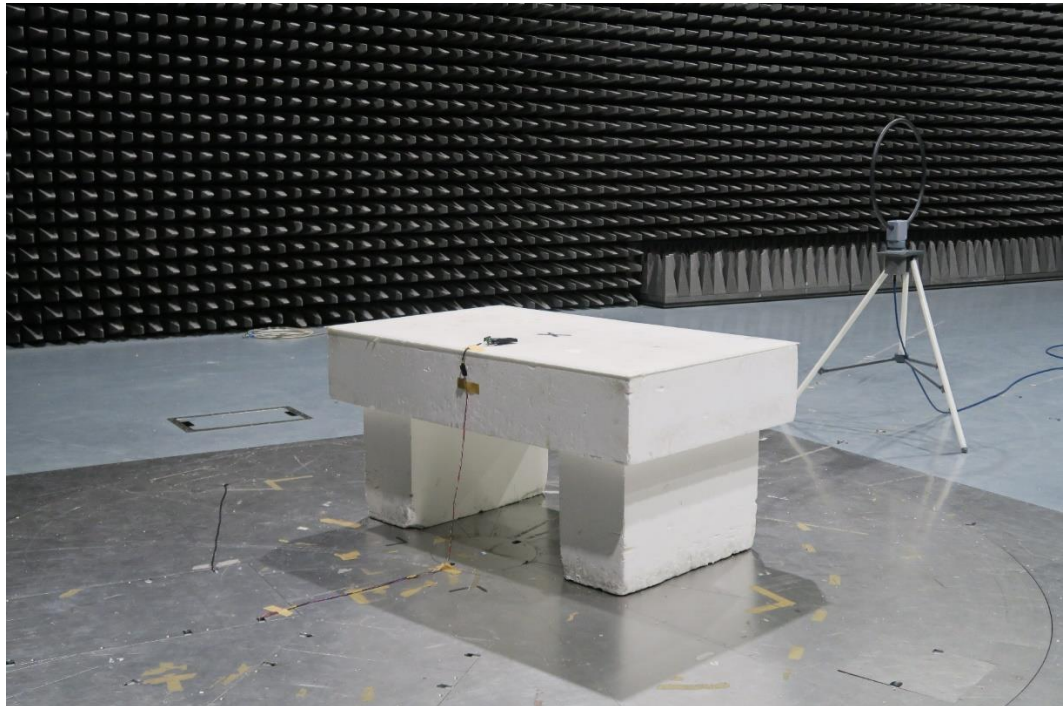
— Preview Result 2-PK+ — Preview Result 1-QPK — FCC 15.225.3 meter
◆ Final_Result QPK ◆ Final_Result PK+

Photo 4.2.3.....	Measurement of radiated emission below 30 MHz (Magnetic field) SA3-I
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a. High angle front view of EUT on setup table, antenna axis X



b. High angle rear oblique view of EUT antenna axis Y



c. High angle front view of EUT on setup table, antenna axis Z



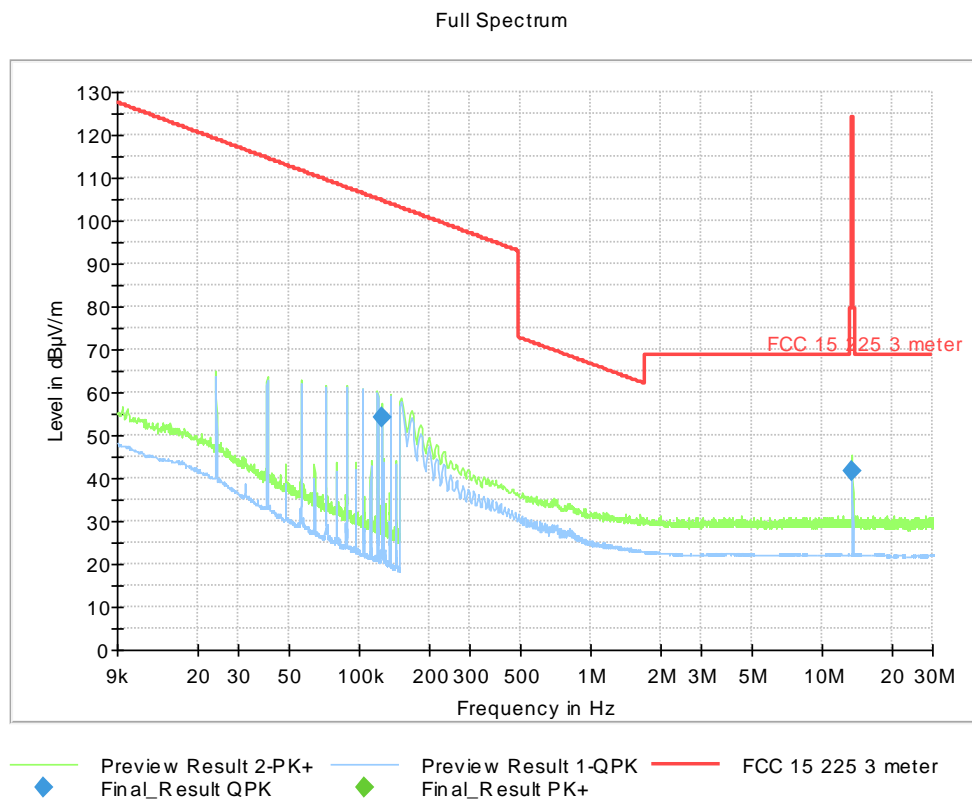
Test results for radiated emission below 30 MHz (Magnetic field) SA3-I	
Test item no(s) ref. cl. 1.2	3
Operating mode no(s) ref. cl. 1.7 :	1
Test setup no(s) ref. cl. 3.3	2

Tabulated Results summary SA3-I

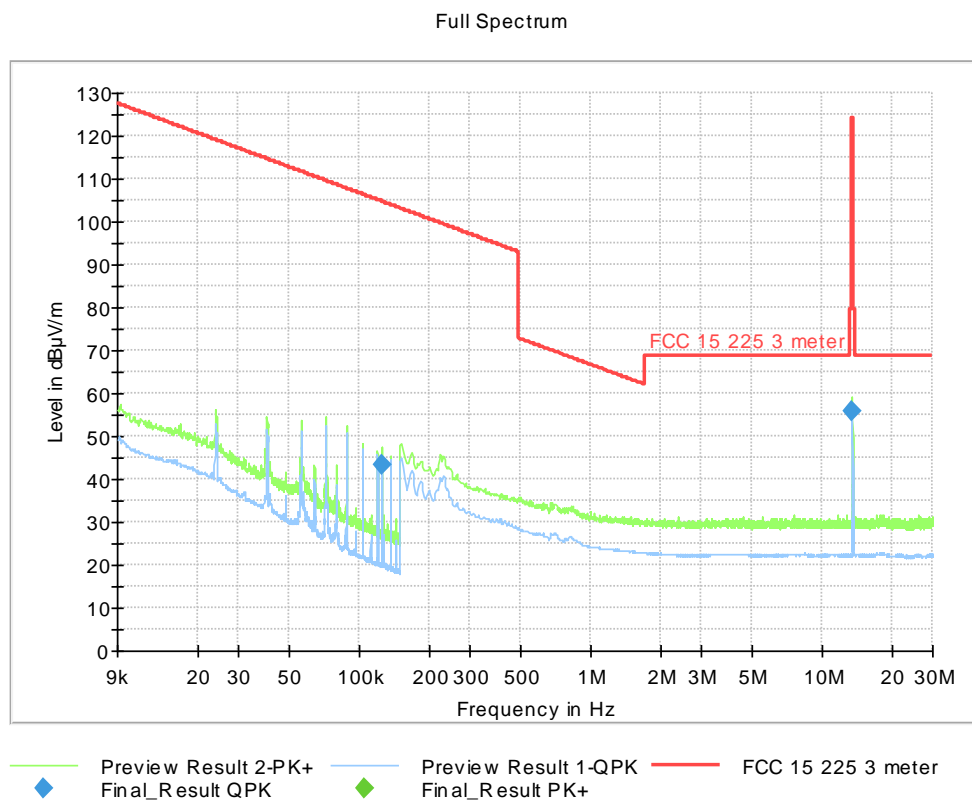
X-axis								
Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Azimuth (deg)	Corr. (dB/m)
0.125020	54.09	104.76	50.67	15000.0	0.200	100.0	95.0	20.5
13.560000	41.80	124.00	82.20	15000.0	9.000	100.0	-8.0	20.6
Y-axis								
Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Azimuth (deg)	Corr. (dB/m)
0.125020	43.52	104.76	61.23	15000.0	0.200	100.0	-30.0	20.5
13.560000	55.94	124.00	68.06	15000.0	9.000	100.0	84.0	20.6
Z-axis								
Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Azimuth (deg)	Corr. (dB/m)
0.125020	59.63	104.76	45.13	15000.0	0.200	100.0	107.0	20.5
13.560000	45.43	124.00	78.57	15000.0	9.000	100.0	-39.0	20.6
<p>The result is calculated by adjusting the receiver reading with the correction factor. Correction factor (dB) = Antenna factor (dB) + Cable loss (dB) + Attenuation (dB) + Pre-amp gain (dB)</p> <p>Tabulated Result terms: Field strength = QuasiPeak (dBμV/m) Correction factor = Corr. (dB) Note: The test software state attenuation as a positive value and amplification as a negative value.</p> <p>Sample calculation: 59.63 dBμV/m (field strength) = 39.13 dBμV (receiver reading) + 20.5 dB (Correction factor)</p>								

Graphical representation SA3-I

X-axis

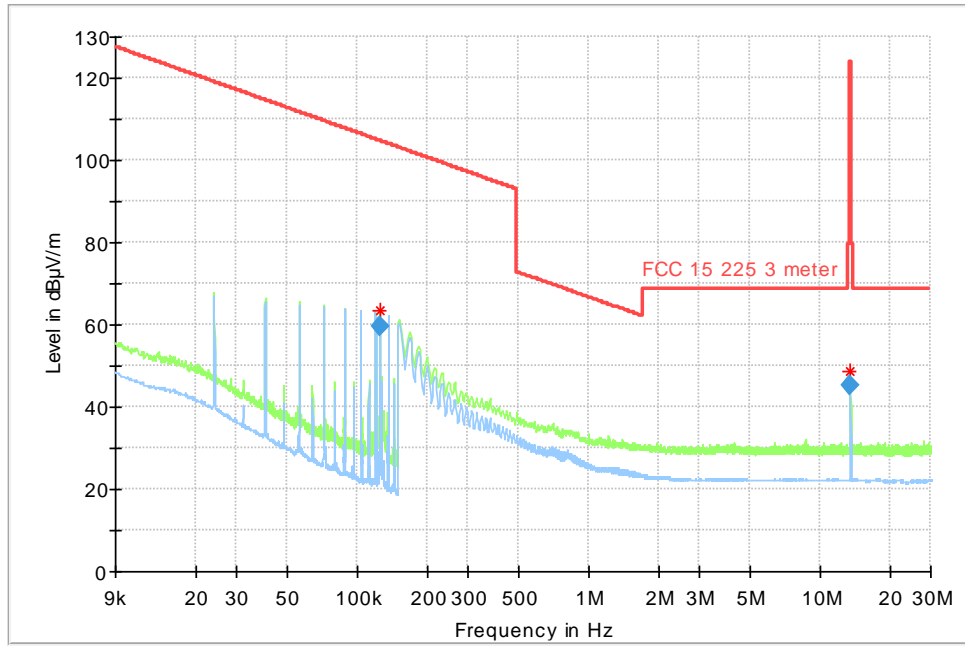


Y-axis



Z-axis

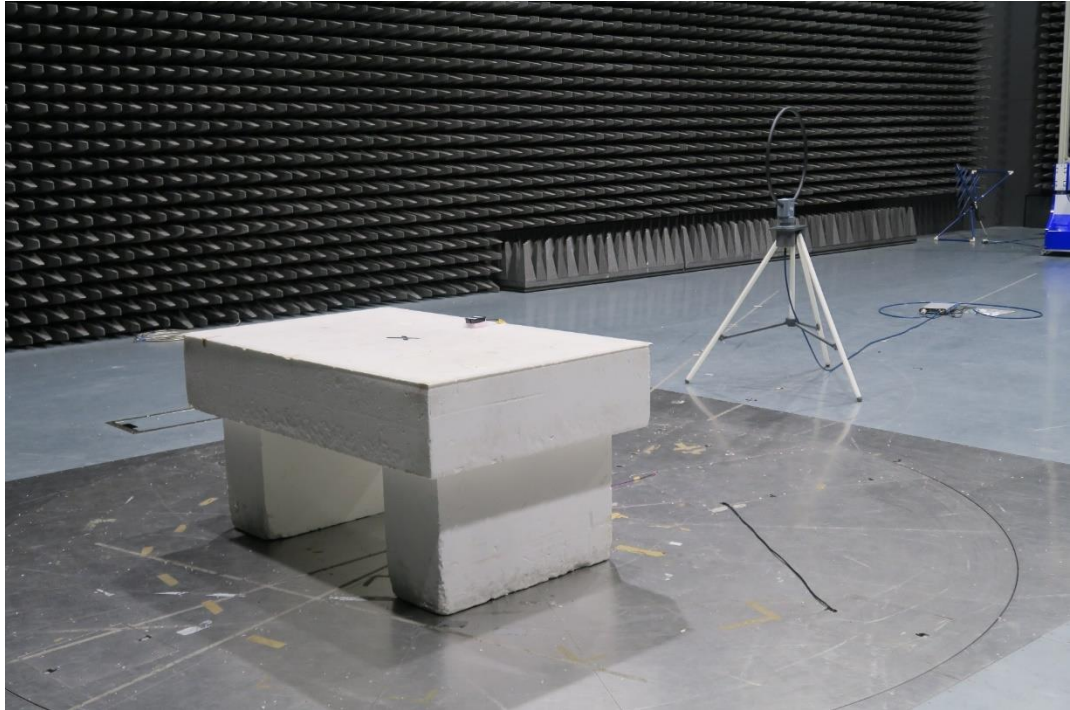
Full Spectrum



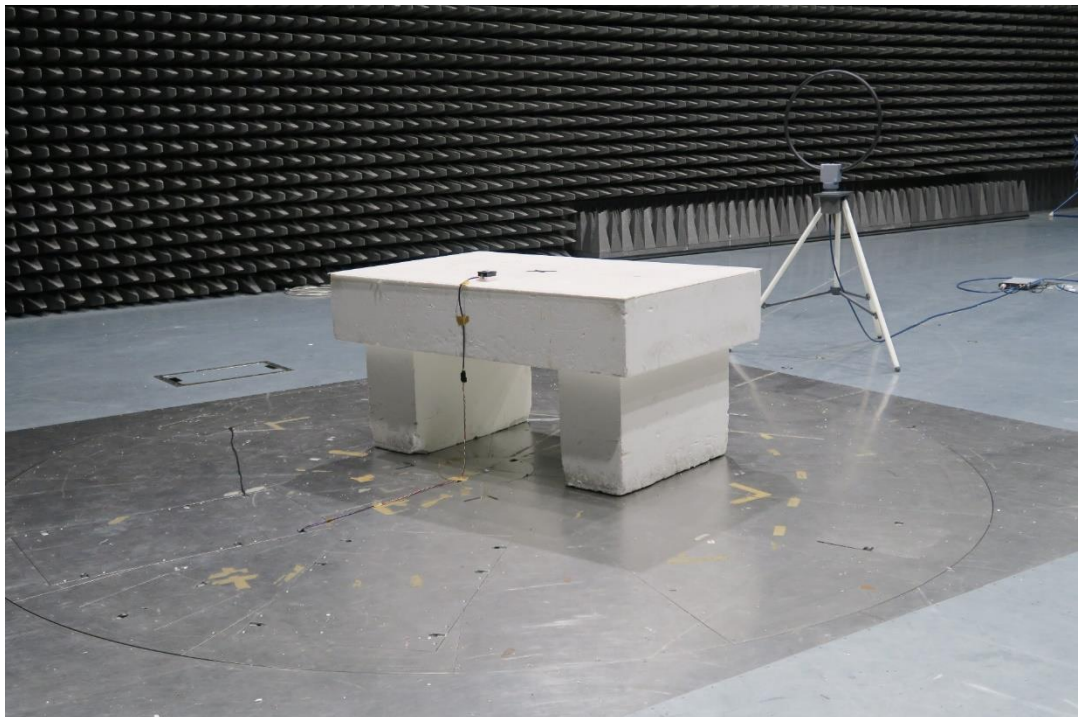
- Preview Result 2-PK+
- Preview Result 1-QPK
- FCC 15 225 3 meter
- QPK
- Final_Result PK+
- Fina_Result QPK

Photo 4.2.4	Measurement of radiated emission below 30 MHz (Magnetic field) SA3-F
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a. High angle front view of EUT on setup table, antenna axis X



b. High angle rear oblique view of EUT antenna axis Y



c. High angle front view of EUT on setup table, antenna axis Z



Test results for radiated emission below 30 MHz (Magnetic field) SA3-F	
Test item no(s) ref. cl. 1.2	4
Operating mode no(s) ref. cl. 1.7 :	1
Test setup no(s) ref. cl. 3.3	2

Tabulated Results summary SA3-F

X-axis

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Azimuth (deg)	Corr. (dB)
0.125020	43.66	104.76	61.10	15000.0	0.200	100.0	21.0	20.5
13.559860	49.05	124.00	74.95	15000.0	9.000	100.0	-43.0	20.6

Y-axis

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Azimuth (deg)	Corr. (dB)
0.125020	28.02	104.76	76.74	15000.0	0.200	100.0	98.0	20.5
13.560100	62.39	124.00	61.61	15000.0	9.000	100.0	19.0	20.6

Z-axis

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Azimuth (deg)	Corr. (dB)
0.125020	51.71	104.76	53.05	15000.0	0.200	100.0	54.0	20.5
13.560000	49.03	124.00	74.97	15000.0	9.000	100.0	-57.0	20.6

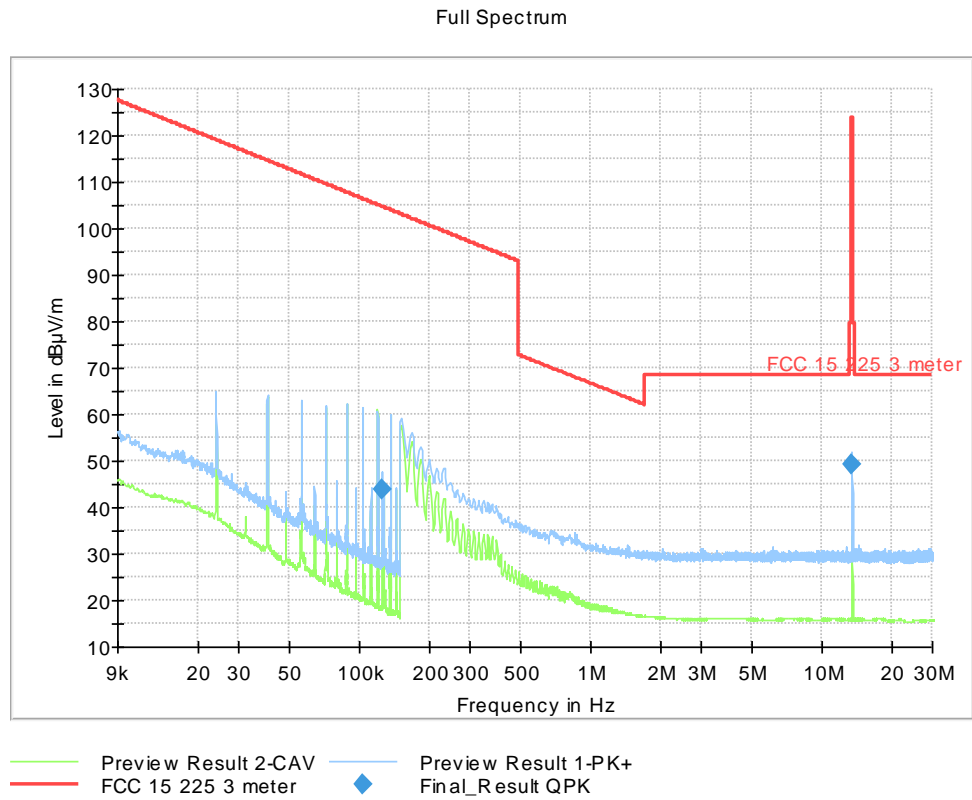
The result is calculated by adjusting the receiver reading with the correction factor.
 Correction factor (dB) = Antenna factor (dB) + Cable loss (dB) + Attenuation (dB) + Pre-amp gain (dB)

Tabulated Result terms:
 Field strength = QuasiPeak (dBµV/m)
 Correction factor = Corr. (dB)
 Note: The test software state attenuation as a positive value and amplification as a negative value.

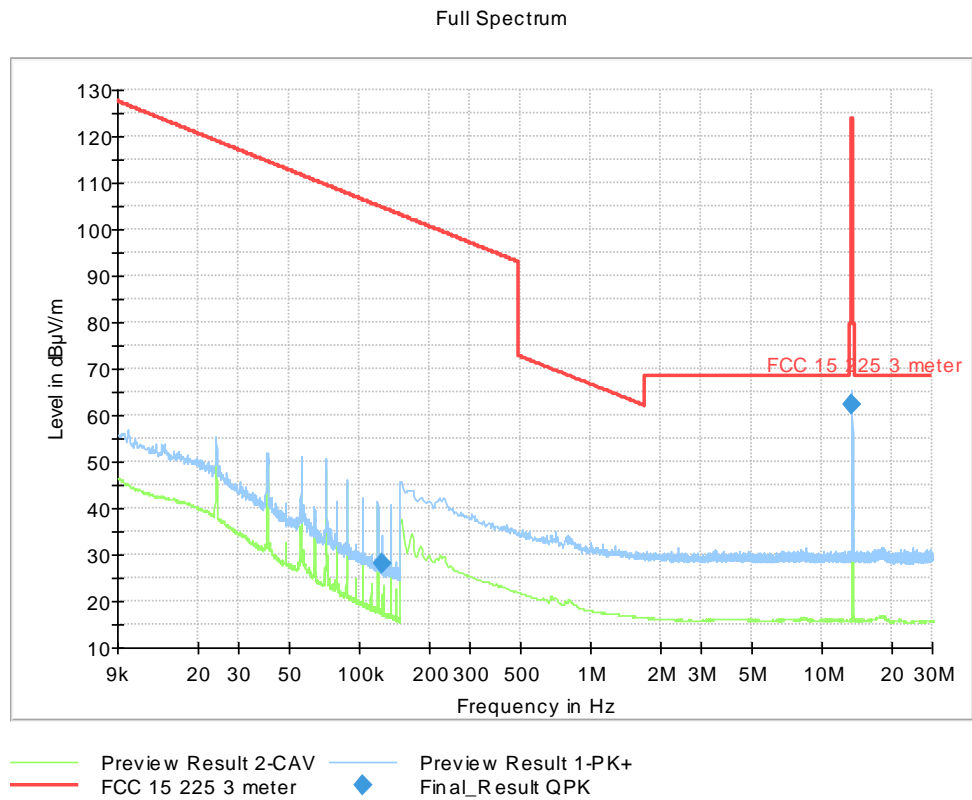
Sample calculation: 51.71 dBµV/m (field strength) = 31.21 dBµV (receiver reading) + 20.5 dB (Correction factor)

Graphical representation SA3-F

X-axis

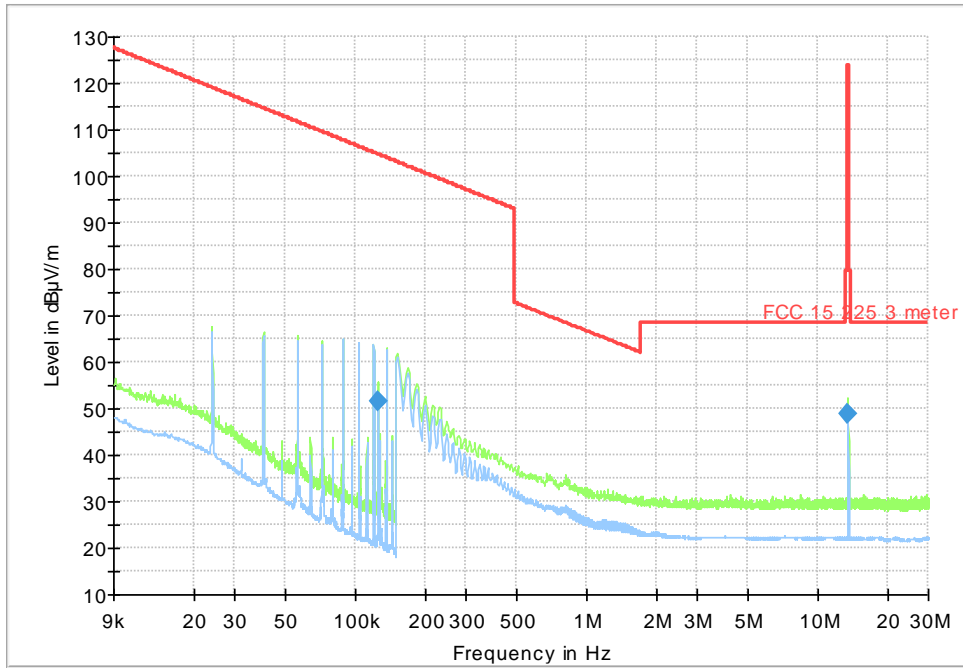


Y-axis



Z-axis

Full Spectrum



- Preview Result 2-PK+
- Preview Result 1-QPK
- FCC 15.225.3 meter
- Final_Result QPK

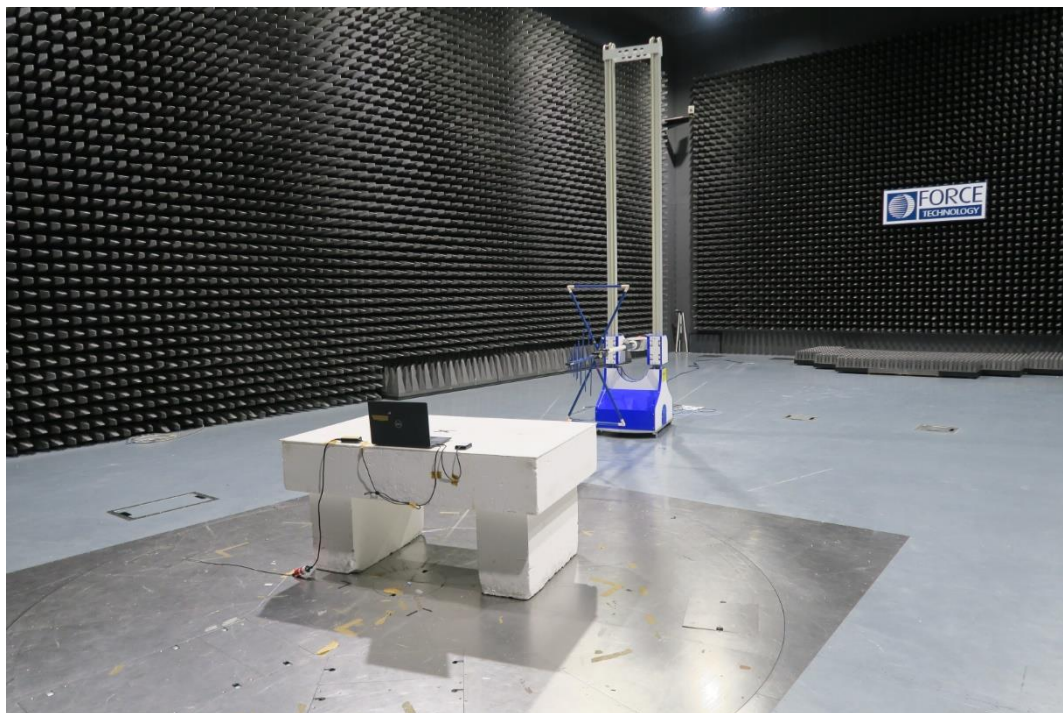
4.3 Measurement of radiated emission 30 - 1000 MHz

Name	Peter Rosendal Overgaard
Date	2023-08-10
Rationale for verdict N/A	-

Test location (stand).....	Aarhus Room 1, Setup AEC1	
Applied limit class.....	<input checked="" type="checkbox"/>	Limit according to 47 CFR Part 15 C Subpart 15.209, Subpart 15.225, RSS-Gen:2019 and RSS-210:2019 Annex B.6
	<input type="checkbox"/>	Other:
Test setup description	<input checked="" type="checkbox"/>	Equipment on a table 80 cm height
	<input type="checkbox"/>	Equipment on the floor (isolated from ground plane)
	<input type="checkbox"/>	Other (e.g., height of pallet):
Supplementary test setup description	-	
Test method applied.....	<input checked="" type="checkbox"/>	SAC with measurement distance [m]: 3
	<input type="checkbox"/>	FAR with measurement distance [m]:
Supplementary information	Measurements were made in semi-anechoic chamber that complies to CISPR 16. Preliminary (peak) measurements. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in horizontal and vertical polarities. Final measurements (quasi-peak detector below 1GHz) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4 m. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.	

Photo 4.3.1 Measurement of Radiated emission 30 - 1000 MHz SA3-USB

a. High angle front view of EUT on setup table



b. High angle rear oblique view of EUT

**Test results for Radiated emission 30 - 1000 MHz SA3-USB**

Test item no(s) ref. cl. 1.2	1
Operating mode no(s) ref. cl. 1.7 :	1
Test setup no(s) ref. cl. 3.3	1

Tabulated Results summary

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
94.920000	35.35	43.52	8.17	15000.0	120.000	400.0	H	25.0	-4.8
108.480000	31.54	43.52	11.98	15000.0	120.000	325.0	H	16.0	-3.2
216.940000	37.51	46.02	8.51	15000.0	120.000	179.0	H	132.0	-4.2
224.300000	35.00	46.02	11.02	15000.0	120.000	136.0	H	123.0	-3.5
244.080000	38.39	46.02	7.63	15000.0	120.000	107.0	H	-13.0	-1.2
332.990000	25.92	46.02	20.10	15000.0	120.000	100.0	H	119.0	1.7
995.570000	32.87	53.98	21.11	15000.0	120.000	334.0	V	-148.0	16.2

The result is calculated by adjusting the receiver reading with the correction factor.

Correction factor (dB) = Antenna factor (dB) + Cable loss (dB) + Attenuation (dB) + Pre-amp gain (dB)

Tabulated Result terms:

Field strength = QuasiPeak (dB μ V/m)

Correction factor = Corr. (dB)

Note: The test software state attenuation as a positive value and amplification as a negative value.

Sample calculation: 38.39 dB μ V/m (field strength) = 39.59 dB μ V (receiver reading) + -1.2 dB (Correction factor)

Graphical representation

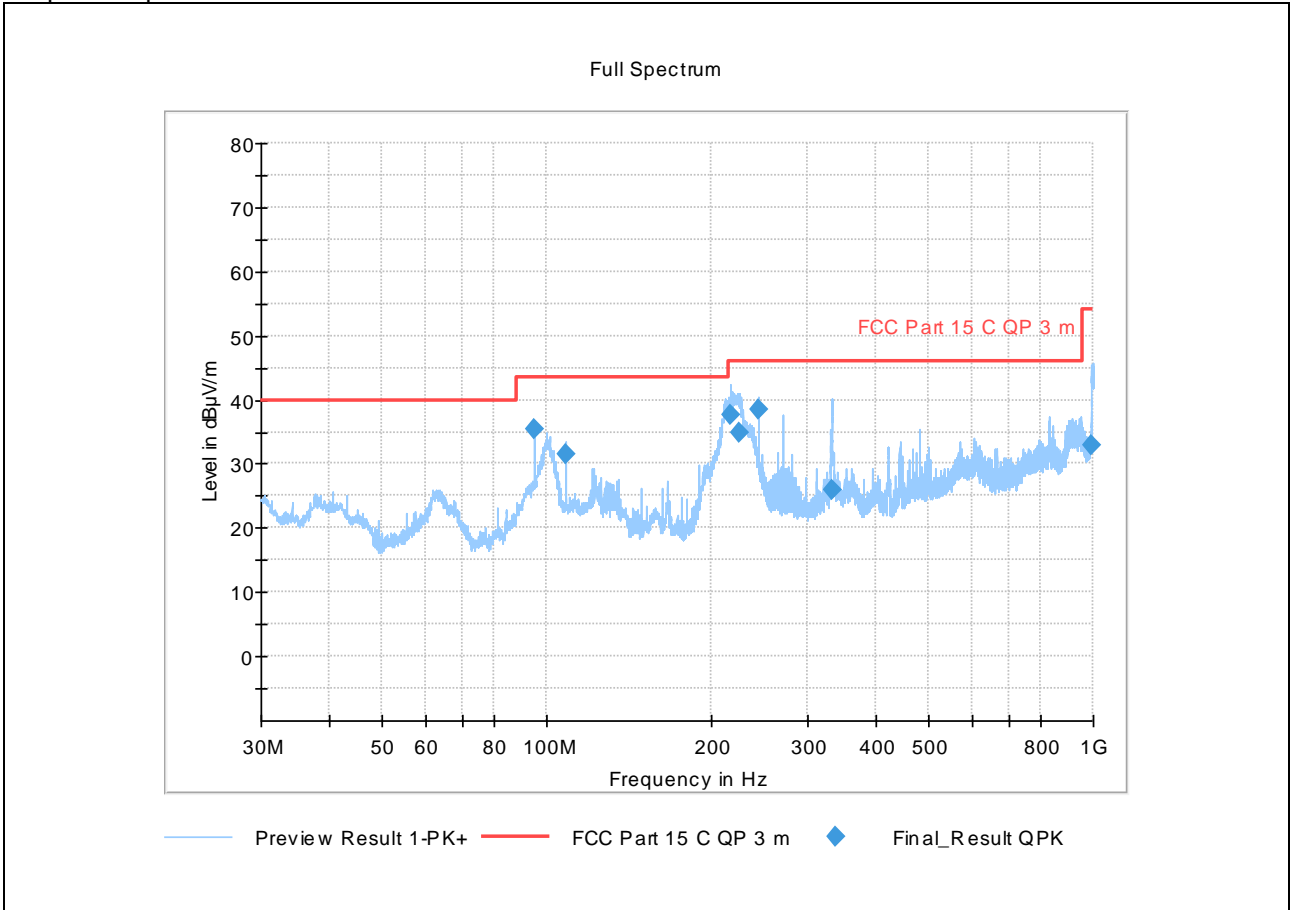
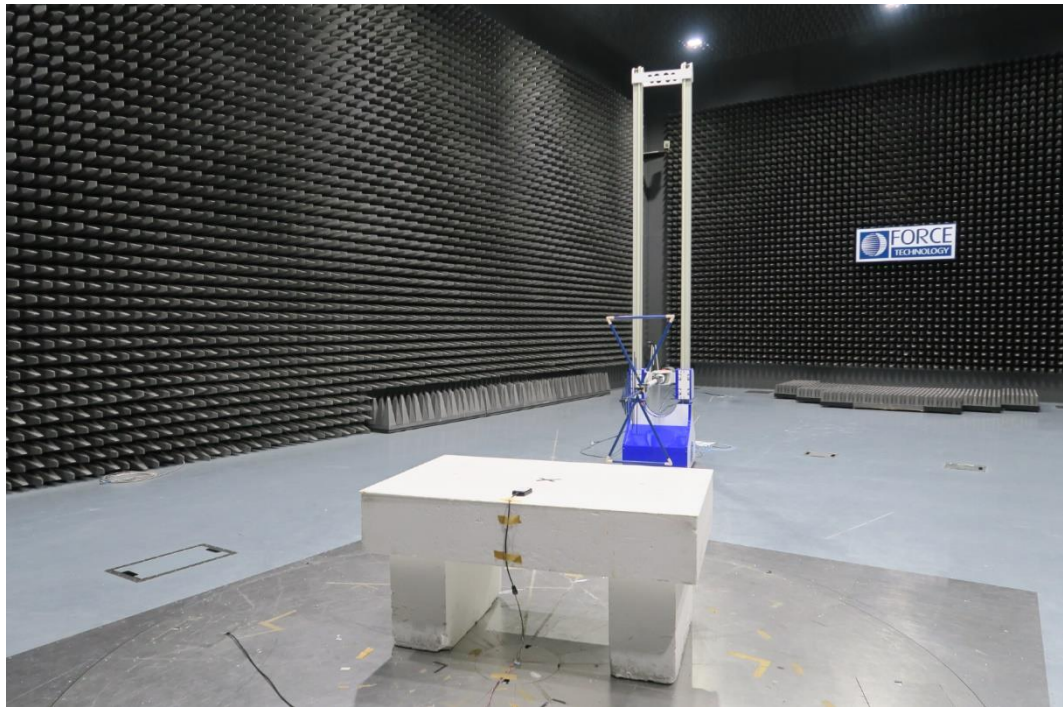
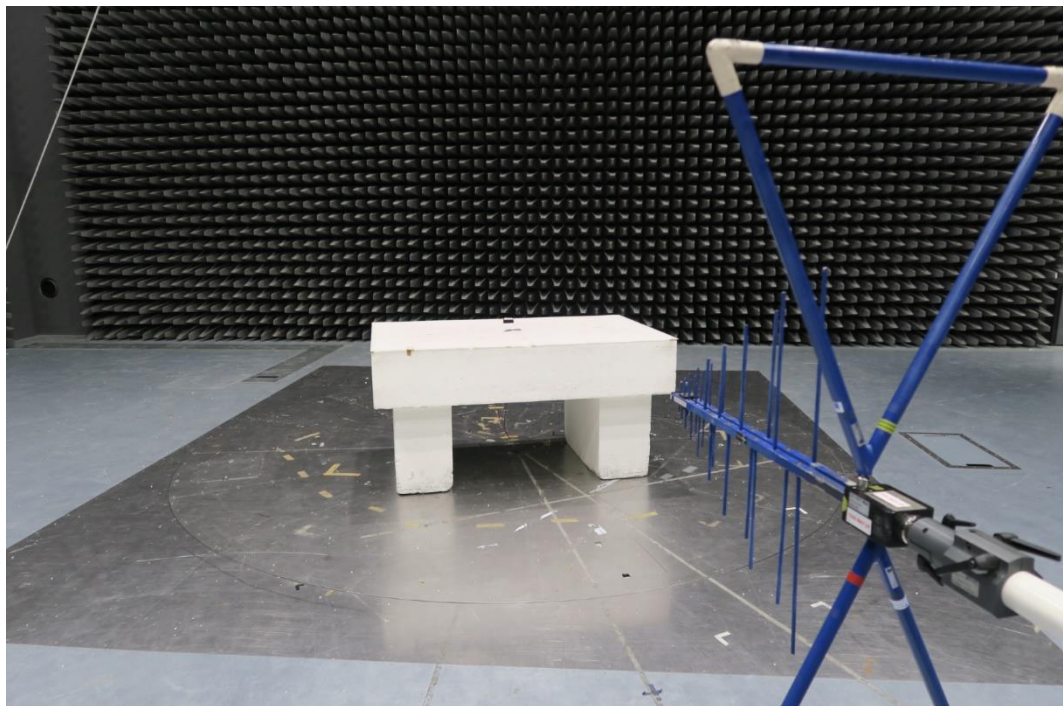


Photo 4.3.2: Measurement of Radiated emission 30 - 1000 MHz SA3-D

a. High angle front view of EUT on setup table



b. High angle rear oblique view of EUT



Test results for Radiated emission 30 - 1000 MHz SA3-D	
Test item no(s) ref. cl. 1.2	2
Operating mode no(s) ref. cl. 1.7 :	1
Test setup no(s) ref. cl. 3.3	2

Tabulated Results summary

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
40.680000	25.69	40.00	14.31	15000.0	120.000	155.0	V	-45.0	-1.7
54.240000	30.58	40.00	9.42	15000.0	120.000	400.0	V	141.0	-7.7
58.720000	31.13	40.00	8.87	15000.0	120.000	100.0	V	82.0	-8.6
60.200000	32.16	40.00	7.84	15000.0	120.000	400.0	V	59.0	-8.7
67.800000	28.53	40.00	11.47	15000.0	120.000	155.0	V	21.0	-8.7
104.770000	22.65	43.52	20.87	15000.0	120.000	219.0	H	131.0	-3.6
122.040000	25.31	43.52	18.21	15000.0	120.000	100.0	V	131.0	-2.1
135.600000	29.35	43.52	14.17	15000.0	120.000	118.0	H	197.0	-2.3
189.840000	31.40	43.52	12.12	15000.0	120.000	155.0	V	-177.0	-4.8
332.190000	11.05	46.02	34.97	15000.0	120.000	155.0	H	-72.0	1.6

The result is calculated by adjusting the receiver reading with the correction factor.
Correction factor (dB) = Antenna factor (dB) + Cable loss (dB) + Attenuation (dB) + Pre-amp gain (dB)

Tabulated Result terms:
Field strength = QuasiPeak (dB μ V/m)
Correction factor = Corr. (dB)
Note: The test software state attenuation as a positive value and amplification as a negative value.

Sample calculation: 32.16 dB μ V/m (field strength) = 40.86 dB μ V (receiver reading) + -8.7 dB (Correction factor)

Graphical representation

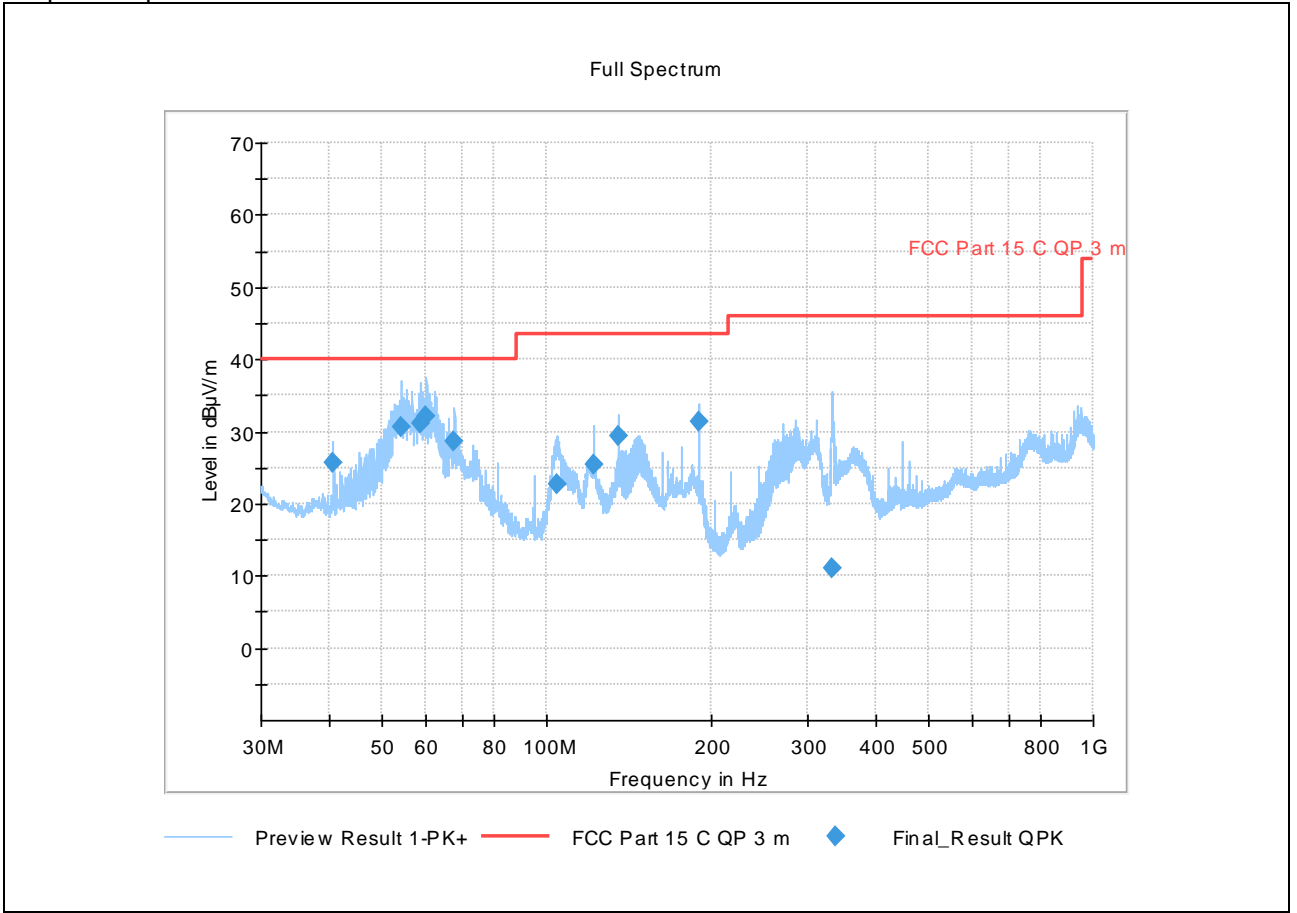
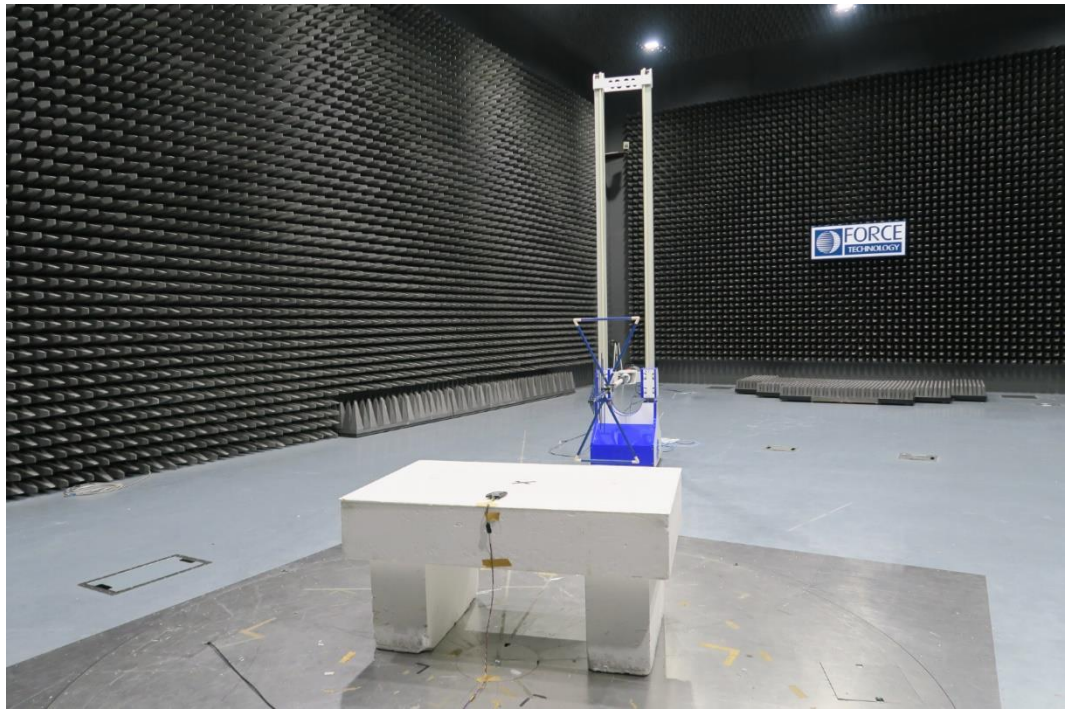
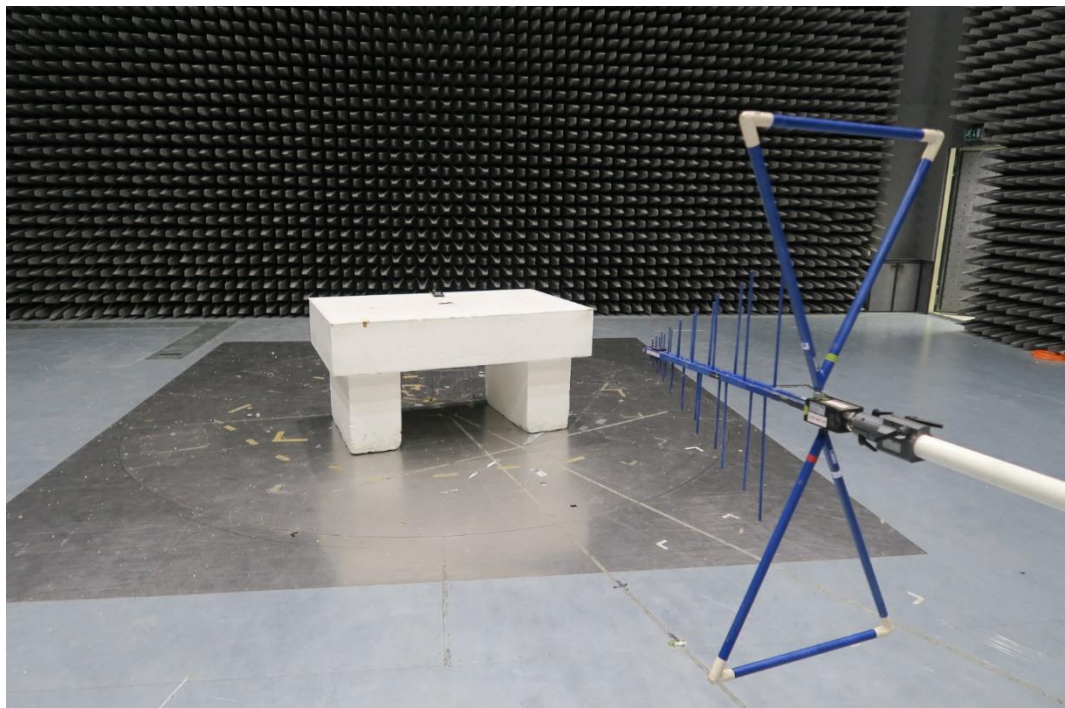


Photo 4.3.3.....: Measurement of Radiated emission 30 - 1000 MHz SA3-I

a. High angle front view of EUT on setup table



b. High angle rear oblique view of EUT



Test results for Radiated emission 30 - 1000 MHz SA3-I	
Test item no(s) ref. cl. 1.2	3
Operating mode no(s) ref. cl. 1.7 :	1
Test setup no(s) ref. cl. 3.3	2

Tabulated Results summary

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
40.680000	27.01	40.00	12.99	15000.0	120.000	107.0	V	153.0	-1.7
60.200000	32.21	40.00	7.79	15000.0	120.000	107.0	V	53.0	-8.7
67.800000	35.01	40.00	4.99	15000.0	120.000	100.0	V	21.0	-8.7
189.84000	36.40	43.52	7.12	15000.0	120.000	207.0	H	119.0	-4.8
332.07000	23.11	46.02	22.91	15000.0	120.000	100.0	H	126.0	1.6
840.81000	20.49	46.02	25.53	15000.0	120.000	100.0	H	128.0	14.5

The result is calculated by adjusting the receiver reading with the correction factor.
Correction factor (dB) = Antenna factor (dB) + Cable loss (dB) + Attenuation (dB) + Pre-amp gain (dB)

Tabulated Result terms:
Field strength = QuasiPeak (dB μ V/m)
Correction factor = Corr. (dB)

Note: The test software state attenuation as a positive value and amplification as a negative value.

Sample calculation: 35.01 dB μ V/m (field strength) = 43.71 dB μ V (receiver reading) + -8.7 dB (Correction factor)

Graphical representation

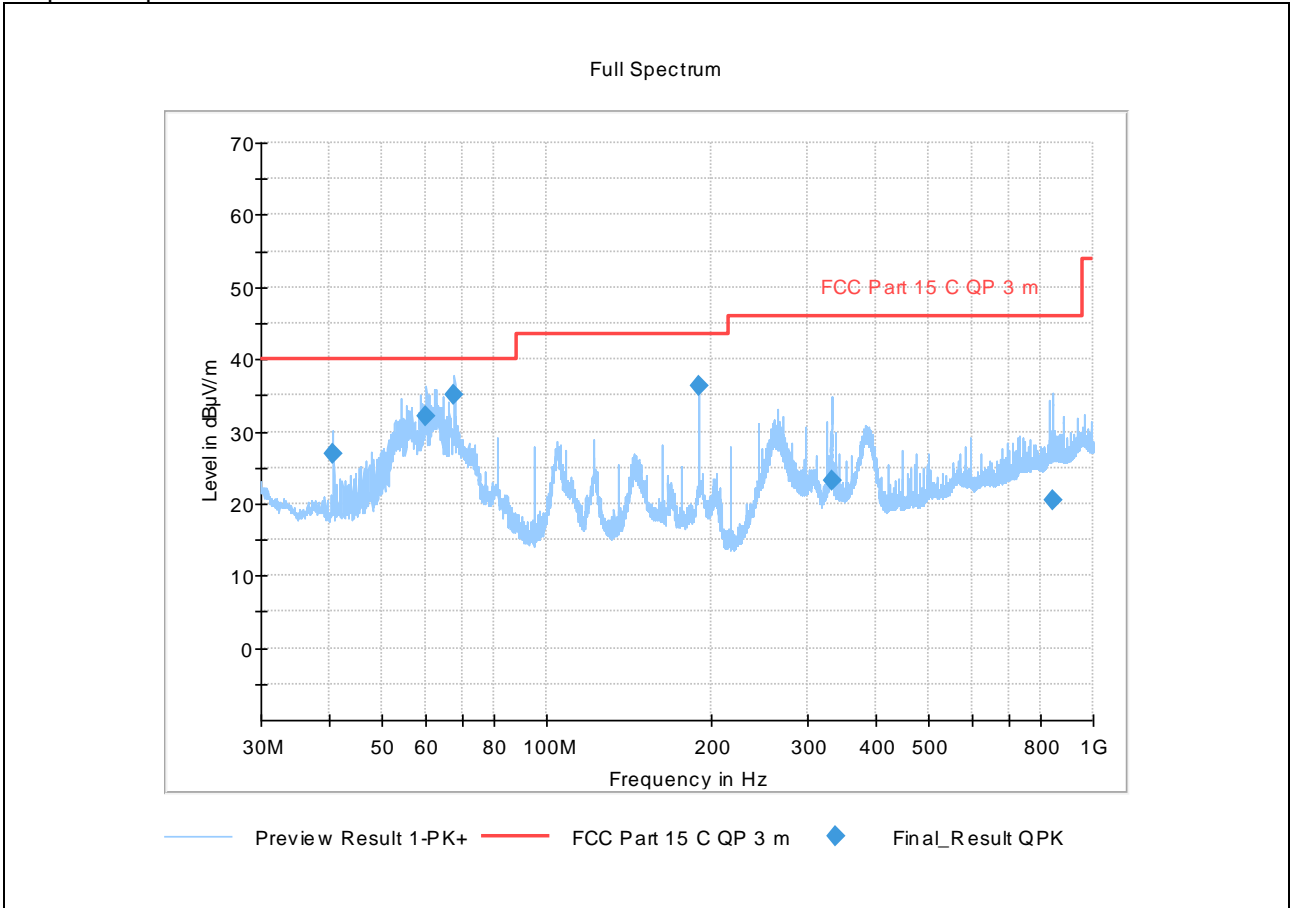


Photo 4.3.4: Measurement of Radiated emission 30 - 1000 MHz SA3-F

a. High angle front view of EUT on setup table



b. High angle rear oblique view of EUT

