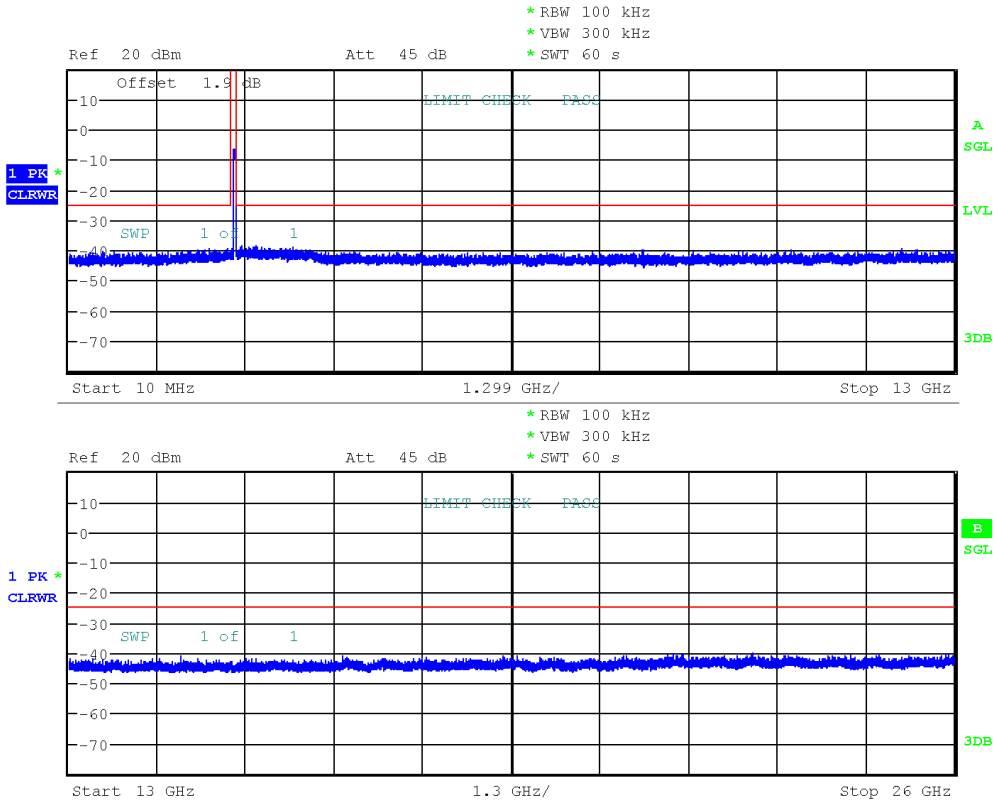
Conducted Spurious Emissions

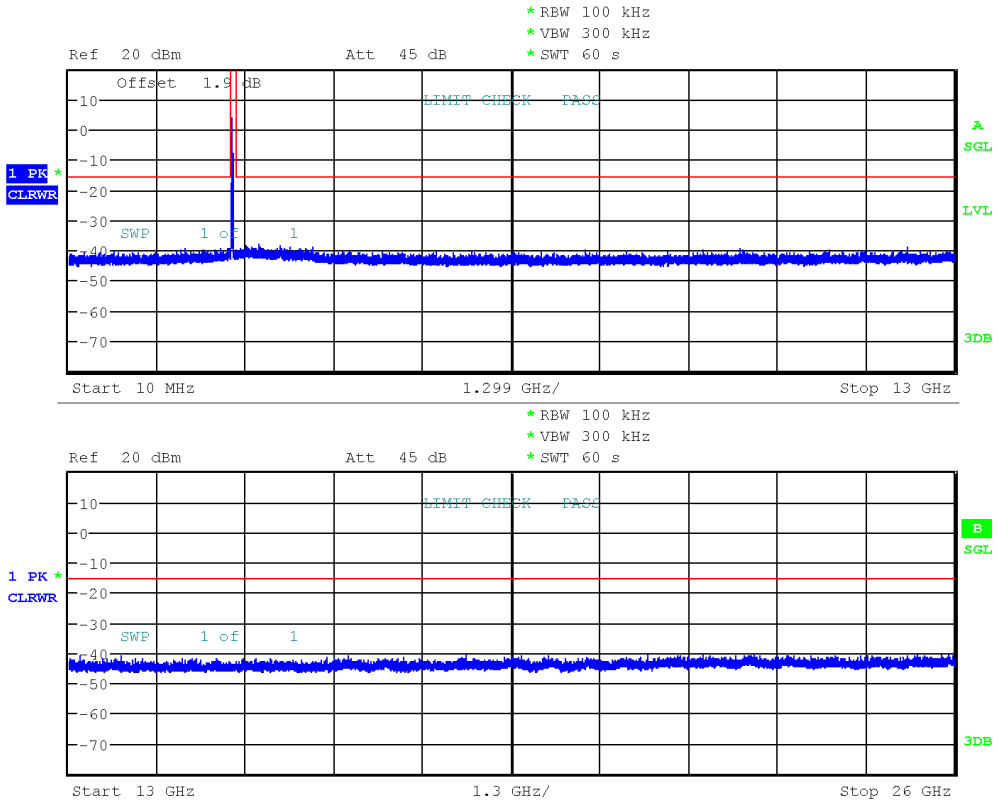
Project Number:	G0M-2309-2215
Applicant:	Panasonic Industrial Devices Europe GmbH
Model Description:	Wi-Fi 6 Dual Band 2.4 GHz/5 GHz, Bluetooth® and 802.15.4 Module
Model:	ENWF9511C1KF
Test Sample ID:	46902
Reference Standards:	FCC 15.247, RSS-247
Reference Method:	ANSI C63.10:2013, Section 11.11
Operational Mode:	IEEE 802.11 n HT40, Channel: 9, 2452 MHz
Operating Conditions:	Tnom/Vnom
Operator:	Md Abu Bakar Siddique
Test Site:	Eurofins Product Service GmbH
Test Date:	2024-03-04
Max. in-band Frequency [MHz]:	2435.7
Max. in-band Level [dBm/100 kHz]:	-4.8
Out-of-band Limit [dBm/100 kHz]:	-24.8



Date: 4.MAR.2024 16:08:35

Conducted Spurious Emissions

Project Number:	G0M-2309-2215
Applicant:	Panasonic Industrial Devices Europe GmbH
Model Description:	Wi-Fi 6 Dual Band 2.4 GHz/5 GHz, Bluetooth® and 802.15.4 Module
Model:	ENWF9511C1KF
Test Sample ID:	46902
Reference Standards:	FCC 15.247, RSS-247
Reference Method:	ANSI C63.10:2013, Section 11.11
Operational Mode:	IEEE 802.11 n HT20, Channel: 1, 2412 MHz
Operating Conditions:	Tnom/Vnom
Operator:	Md Abu Bakar Siddique
Test Site:	Eurofins Product Service GmbH
Test Date:	2024-03-04
Max. in-band Frequency [MHz]:	2414.5
Max. in-band Level [dBm/100 kHz]:	4.9
Out-of-band Limit [dBm/100 kHz]:	-15.1



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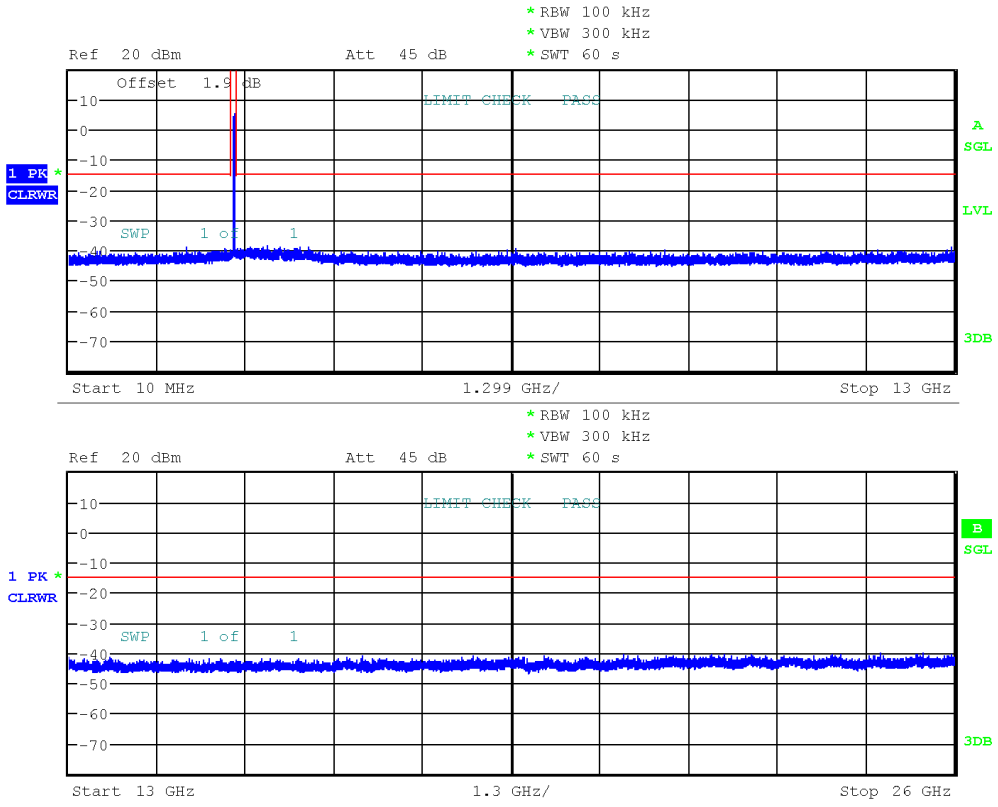
Conducted Spurious Emissions

Project Number:	G0M-2309-2215
Applicant:	Panasonic Industrial Devices Europe GmbH
Model Description:	Wi-Fi 6 Dual Band 2.4 GHz/5 GHz, Bluetooth® and 802.15.4 Module
Model:	ENWF9511C1KF
Test Sample ID:	46902
Reference Standards:	FCC 15.247, RSS-247
Reference Method:	ANSI C63.10:2013, Section 11.11
Operational Mode:	IEEE 802.11 n HT20, Channel: 7, 2442 MHz
Operating Conditions:	Tnom/Vnom
Operator:	Md Abu Bakar Siddique
Test Site:	Eurofins Product Service GmbH
Test Date:	2024-03-04
Max. in-band Frequency [MHz]:	2444.5
Max. in-band Level [dBm/100 kHz]:	5.1
Out-of-band Limit [dBm/100 kHz]:	-14.9



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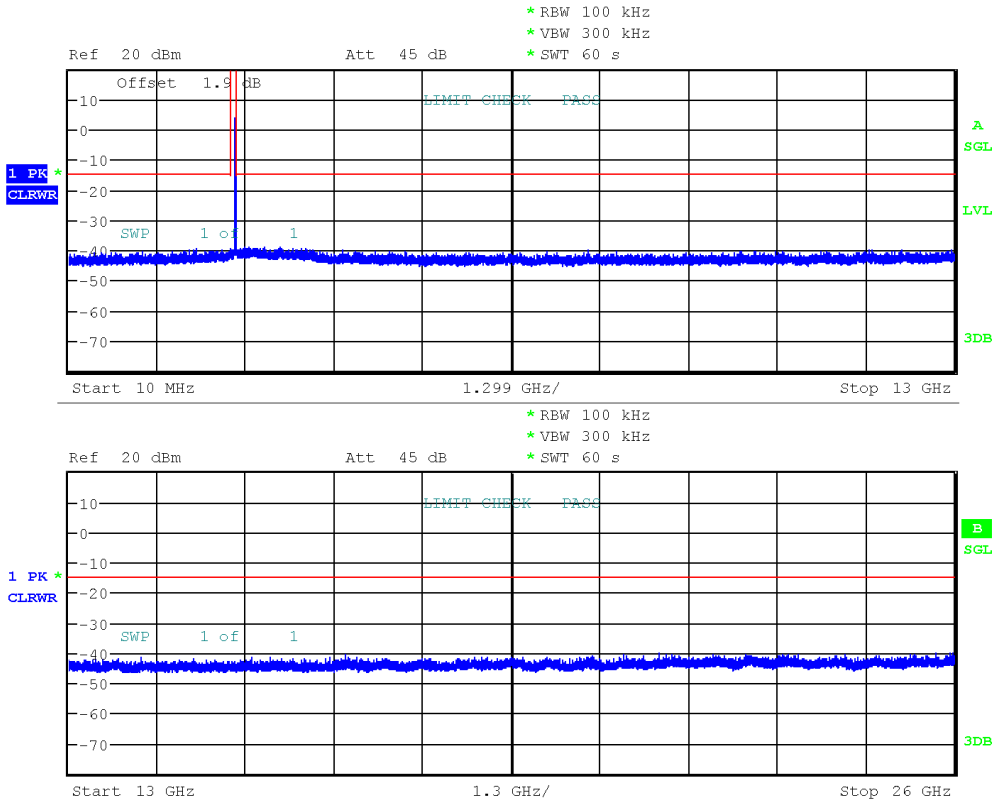
Conducted Spurious Emissions

Project Number:	G0M-2309-2215
Applicant:	Panasonic Industrial Devices Europe GmbH
Model Description:	Wi-Fi 6 Dual Band 2.4 GHz/5 GHz, Bluetooth® and 802.15.4 Module
Model:	ENWF9511C1KF
Test Sample ID:	46902
Reference Standards:	FCC 15.247, RSS-247
Reference Method:	ANSI C63.10:2013, Section 11.11
Operational Mode:	IEEE 802.11 n HT20, Channel: 11, 2462 MHz
Operating Conditions:	Tnom/Vnom
Operator:	Md Abu Bakar Siddique
Test Site:	Eurofins Product Service GmbH
Test Date:	2024-03-04
Max. in-band Frequency [MHz]:	2464.5
Max. in-band Level [dBm/100 kHz]:	5.2
Out-of-band Limit [dBm/100 kHz]:	-14.8



Date: 4.MAR.2024 16:20:14

3.7 Test Conditions and Results - Transmitter radiated emissions

3.7.1 Information

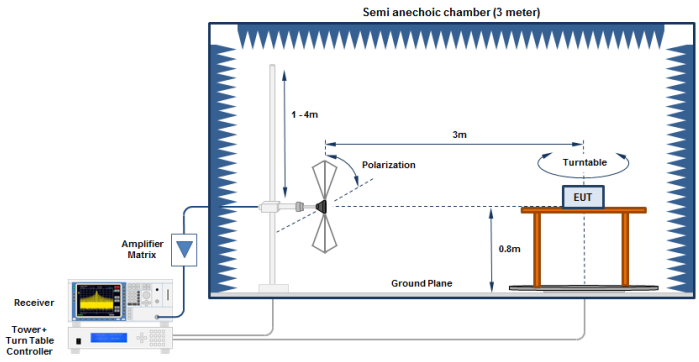
Test Information	
Reference	FCC § 15.247(d); FCC § 15.209; ISED RSS-Gen, Issue 5 A2 (section 6.13)
Measurement Uncertainty	± 5.95 dB
Measurement Method	ANSI C63.10 6.4, 6.5, 6.6, 11.12
Operator	Md Abu Bakar Siddique
Date	2024-03-07

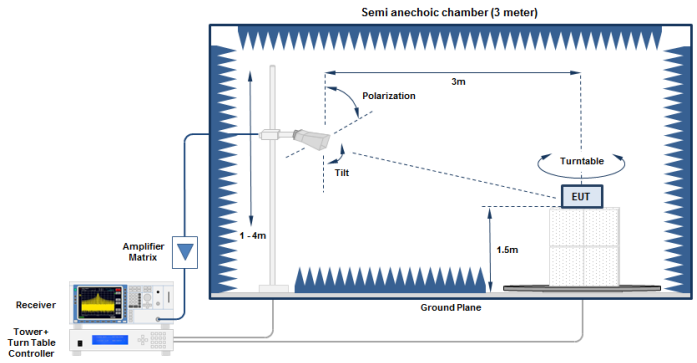
3.7.2 Limits

Limits			
Frequency range [MHz]	Detector	Field strength [µV/m]	Measurement distance [m]
0.009 - 0.09	Average	2400/F[kHz]	300
0.09 - 0.110	Quasi-Peak	2400/F[kHz]	300
0.110 - 0.490	Average	2400/F[kHz]	300
0.490 - 1.705	Quasi-Peak	24000/F[kHz]	30
1.705 - 30.0	Quasi-Peak	30	30
30 - 88	Quasi-Peak	100	3
88 - 216	Quasi-Peak	150	3
216 - 960	Quasi-Peak	200	3
960 - 1000	Quasi-Peak	500	3
>1000	Average	500	3

3.7.3 Setup

Test Setup 30 MHz - 1000 MHz



Test Setup > 1 GHz


3.7.4 Equipment

Test Software			
Description	Manufacturer	Name	Version
EMC Software	DARE Instruments	RadiMation	2020.1.8

Test Equipment 30 - 1000 MHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC1	EF00062	2022-11	2025-11
Measurement Receiver	R&S	ESU8	EF00379	2023-08	2024-08
Antenna	Schwarzbeck	VULB 9168	EF01824	2022-10	2025-10

Test Equipment > 1 GHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC2	EF01616	2023-12	2024-12
Spectrum analyzer	R&S	FSW43	EF00896	2023-08	2024-08
Antenna	Schwarzbeck	BBHA 9120B	EF01678	2021-03	2024-03
Antenna	Schwarzbeck	HWRD 650	EF01679	2021-03	2024-03

3.7.5 Procedure

Test Procedure 30 MHz - 1000 MHz
1. EUT is placed on a non conducting support at the center of a turn table 0.8 m above the ground 2. EUT set to test mode 3. The receiver is set to peak detection with max hold 4. The EUT is rotated through 360° and the height of the antenna is varied from 1 m to 4 m 5. All significant emissions are measured again using the corresponding final detector

Test Procedure > 1 GHz
1. EUT is placed on a non conducting support at the center of a turn table 1.5 m above the ground 2. EUT set to test mode 3. The receiver is set to peak detection with max hold 4. The EUT is rotated through 360° and the height of the antenna is varied from 1 m to 4 m 5. All significant emissions are measured again using the corresponding final detector

3.7.6 Results

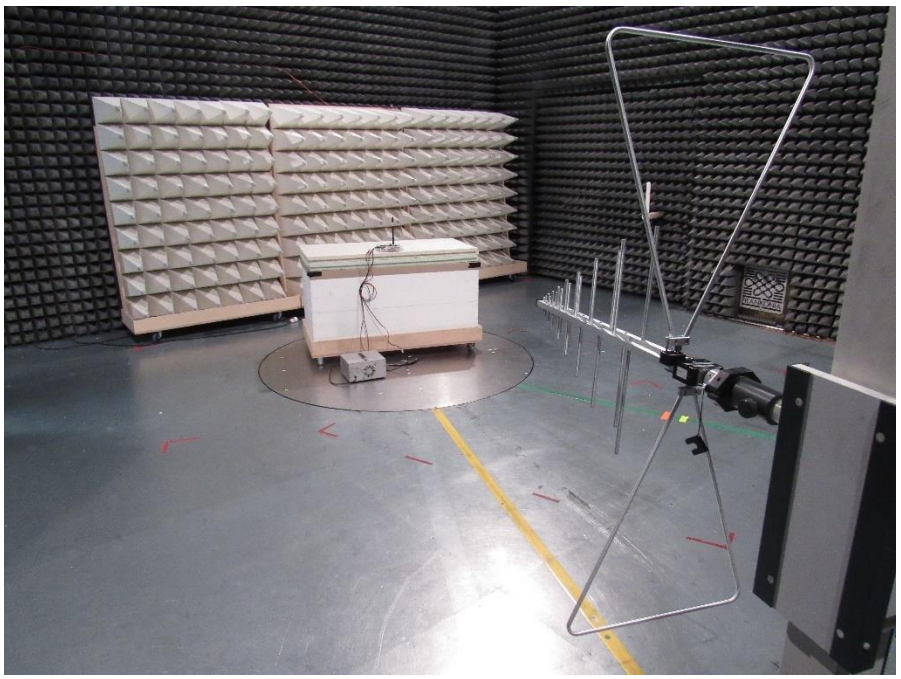
Test Results – Antenna 1 (External, ANT-Taoglas-GW.51.5153) – Annex A							
Mode	Channel [MHz]	Emission [MHz]	Level [dBµV/m]	Det.	Pol.	Limit [dBµV/m]	Margin [dB]
HE40,RU-484,Index 65	2422	2389.7	63.67	pk	ver	74.00	-10.33
HE40,RU-484,Index 65	2422	2389.7	46.56	avg	ver	54.00	-07.44
HE40,RU-484,Index 65	2422	2483.6	53.33	pk	ver	74.00	-20.67
HE40,RU-484,Index 65	2422	2483.6	38.41	avg	ver	54.00	-15.59
HE40,RU-484,Index 65	2437	2389.8	62.06	pk	ver	74.00	-11.94
HE40,RU-484,Index 65	2437	2389.8	49.90	avg	ver	54.00	-04.10
HE40,RU-484,Index 65	2437	2483.7	61.82	pk	ver	74.00	-12.18
HE40,RU-484,Index 65	2437	2483.7	52.30	avg	ver	54.00	-01.70
HE40,RU-484,Index 65	2452	2483.5	67.81	pk	ver	74.00	-06.19
HE40,RU-484,Index 65	2452	2483.5	51.06	avg	ver	54.00	-02.94
HE40,RU-484,Index 65	2452	3990	54.59	pk	ver	74.00	-19.41
HE40,RU-484,Index 65	2452	3990	42.04	avg	ver	54.00	-11.96
HE40,RU-484,Index 65	2452	18150	48.85	pk	ver	74.00	-25.15
HE40,RU-484,Index 65	2452	18150	37.20	avg	ver	54.00	-16.80
HE20,RU-26,Index 3	2437	2857.7	45.31	pk	ver	74.00	-28.69
HE20,RU-26,Index 3	2437	2857.7	25.92	avg	ver	54.00	-28.08
HE20,RU-26,Index 8	2462	2487.1	59.43	pk	ver	74.00	-14.57
HE20,RU-26,Index 8	2462	2487.1	41.86	avg	ver	54.00	-12.14
HE20,RU-26,Index 8	2462	3997	45.09	pk	ver	74.00	-28.91
HE20,RU-26,Index 8	2462	3997	32.08	avg	ver	54.00	-21.92
HE20, RU-242-ER	2412	2387.5	67.20	pk	ver	74.00	-06.80
HE20, RU-242-ER	2412	2387.5	46.50	avg	ver	54.00	-07.50
HE20, RU-242-ER	2462	2483.7	71.01	pk	ver	74.00	-02.99
HE20, RU-242-ER	2462	2483.7	49.02	avg	ver	54.00	-04.98
HE20, RU-242-ER	2462	2484	68.61	pk	ver	74.00	-05.39
HE20, RU-242-ER	2462	2484	52.16	avg	ver	54.00	-01.84
HE20, RU-106-ER	2412	1531	45.80	pk	hor	74.00	-28.20
HE20, RU-106-ER	2412	1531	27.80	avg	hor	54.00	-26.20
HE20, RU-106-ER	2412	2389.9	55.49	pk	ver	74.00	-18.51
HE20, RU-106-ER	2412	2389.9	47.51	avg	ver	54.00	-06.49
HE20, RU-106-ER	2412	3982.5	45.31	pk	ver	74.00	-28.69
HE20, RU-106-ER	2412	3982.5	31.86	avg	ver	54.00	-22.14
HE20, RU-106-ER	2462	2388	44.06	pk	ver	74.00	-29.94
HE20, RU-106-ER	2462	2388	33.56	avg	ver	54.00	-20.44
HE20, RU-106-ER	2462	2484.2	72.46	pk	ver	74.00	-01.54
HE20, RU-106-ER	2462	2485.6	72.46	pk	ver	74.00	-01.54

Test Results – Antenna 2 (External, ANT-2J Antennas-2JF1002P) – Annex B							
Mode	Channel [MHz]	Emission [MHz]	Level [dBµV/m]	Det.	Pol.	Limit [dBµV/m]	Margin [dB]
HE20,RU-26,Index 0	2412	1199.9	40.69	pk	ver	74.00	-33.31
HE20,RU-26,Index 0	2412	1199.9	35.49	avg	ver	54.00	-18.51
HE20,RU-26,Index 8	2462	3927	53.91	pk	ver	74.00	-20.09
HE20,RU-26,Index 8	2462	3927	42.54	avg	ver	54.00	-11.46
HE20, RU-242-ER	2412	2377.6	66.46	pk	hor	74.00	-07.54
HE20, RU-242-ER	2412	2377.6	44.52	avg	hor	54.00	-09.48
HE20, RU-242-ER	2412	2387.5	66.56	pk	hor	74.00	-07.44
HE20, RU-242-ER	2412	2387.5	47.13	avg	hor	54.00	-06.87
HE20, RU-242-ER	2412	2486.3	47.42	pk	hor	74.00	-26.58
HE20, RU-242-ER	2412	2486.3	32.06	avg	hor	54.00	-21.94

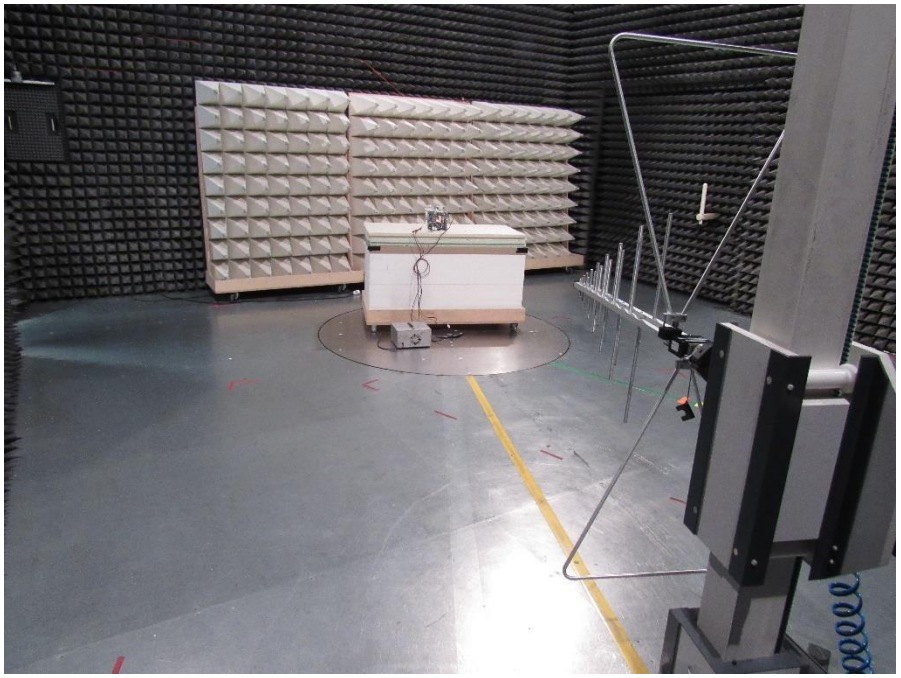
Test Results – Antenna 3 (External, ANT-TDK-ANT162442DT-2001A2) – Annex C							
Mode	Channel [MHz]	Emission [MHz]	Level [dBµV/m]	Det.	Pol.	Limit [dBµV/m]	Margin [dB]
HE20,RU-26,Index 0	2412	1596.7	45.02	pk	ver	74.00	-28.98
HE20,RU-26,Index 0	2412	1596.7	26.57	avg	ver	54.00	-27.43
HE20,RU-26,Index 0	2412	2389.7	53.21	pk	ver	74.00	-20.79
HE20,RU-26,Index 0	2412	2389.7	40.10	avg	ver	54.00	-13.90
HE20, RU-242-ER	2412	3971.3	45.21	pk	ver	74.00	-28.79
HE20, RU-242-ER	2412	3971.3	31.69	avg	ver	54.00	-22.31
HE20, RU-242-ER	2462	2484.7	65.77	pk	ver	74.00	-08.23
HE20, RU-242-ER	2462	2484.7	47.44	avg	ver	54.00	-06.56

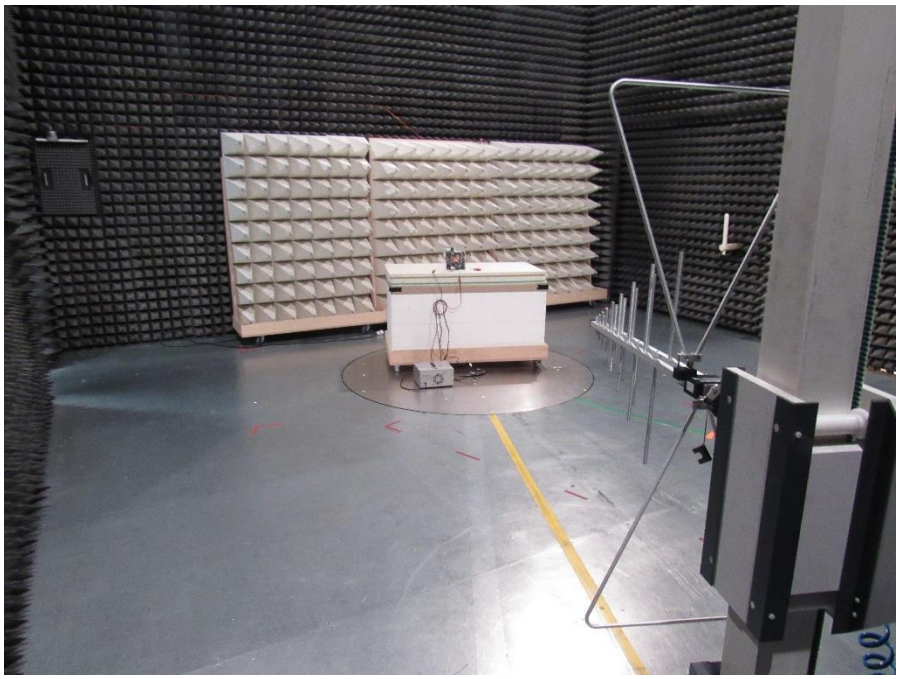
3.7.7 Setup Photos

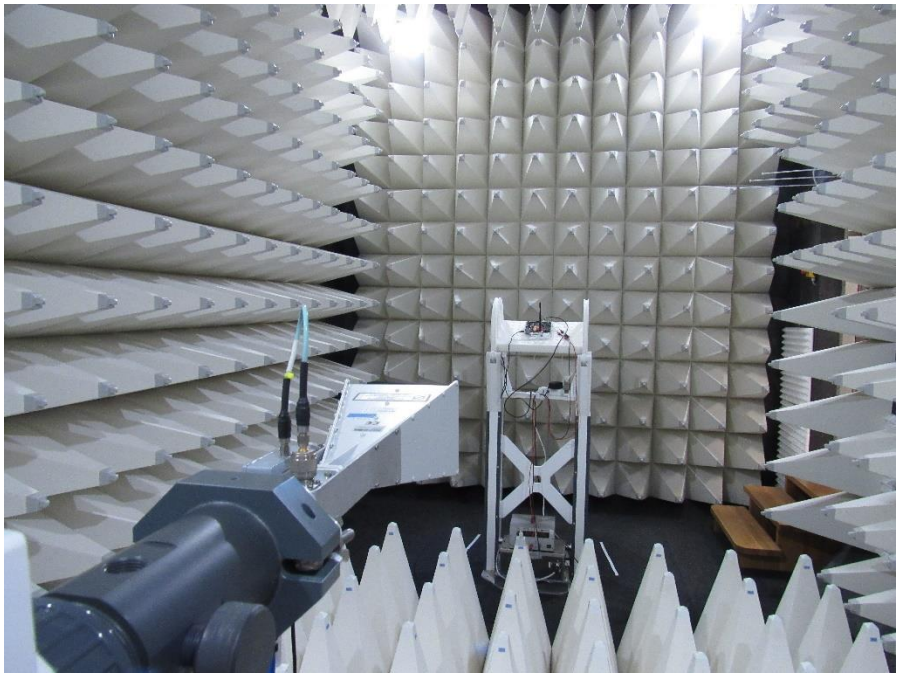
Setup for measurements below 1 GHz- Antenna 1



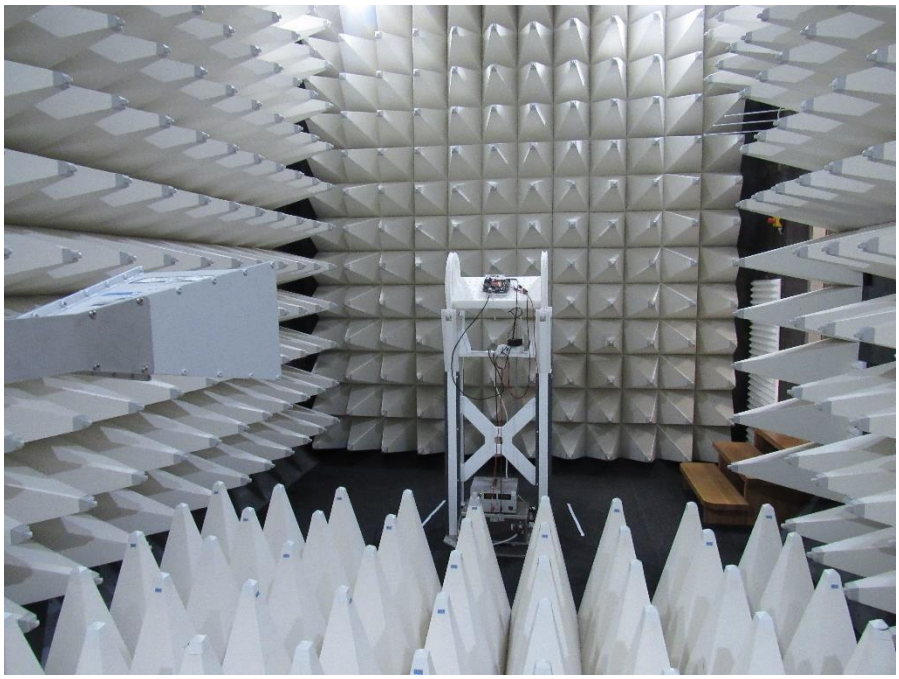
Setup for measurements below 1 GHz- Antenna 2



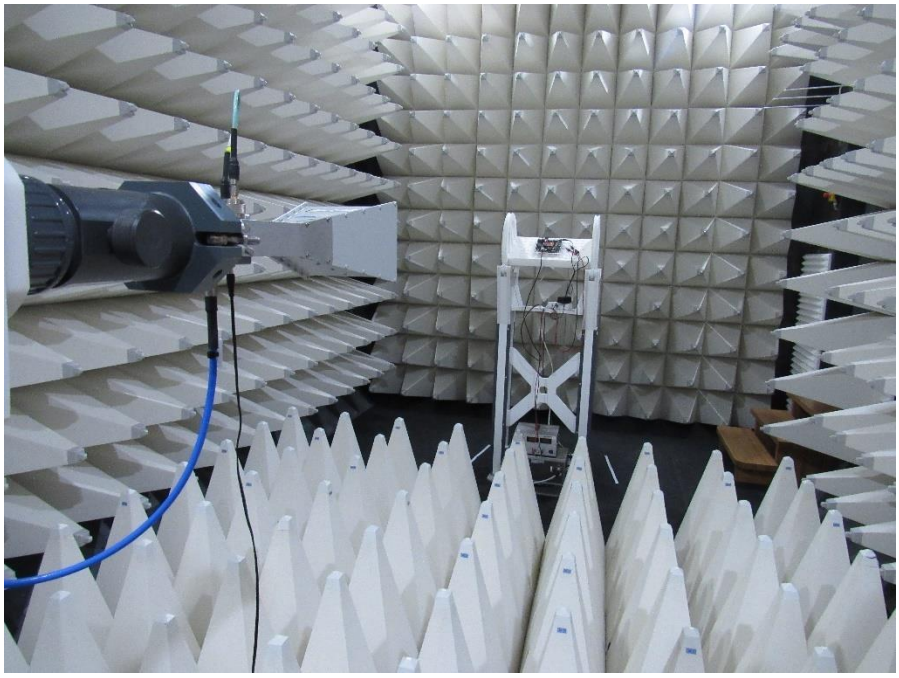
Setup for measurements below 1 GHz- Antenna 3


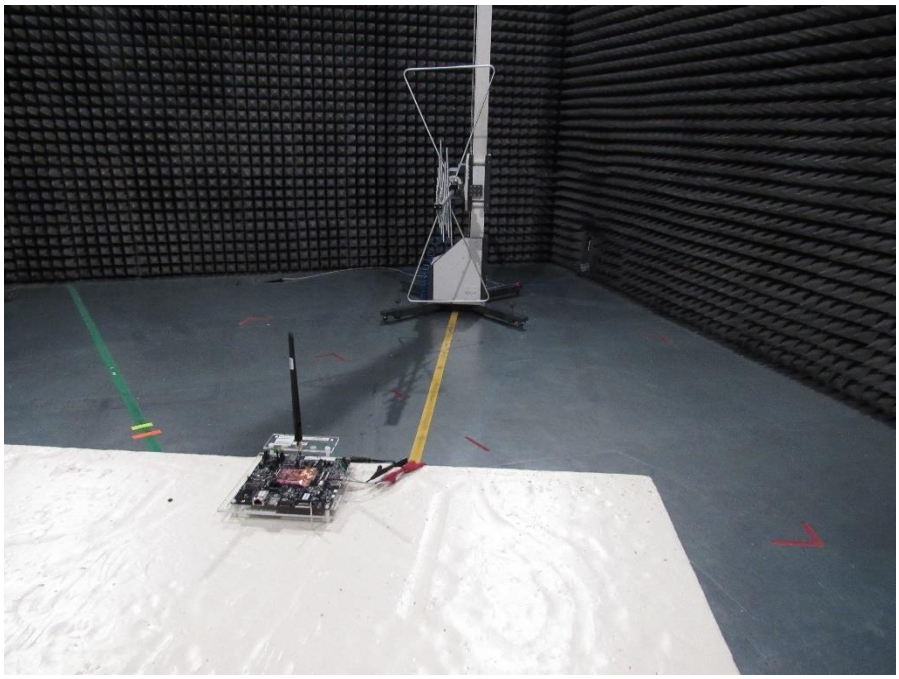
Setup for measurements above 1 GHz-Antenna 1


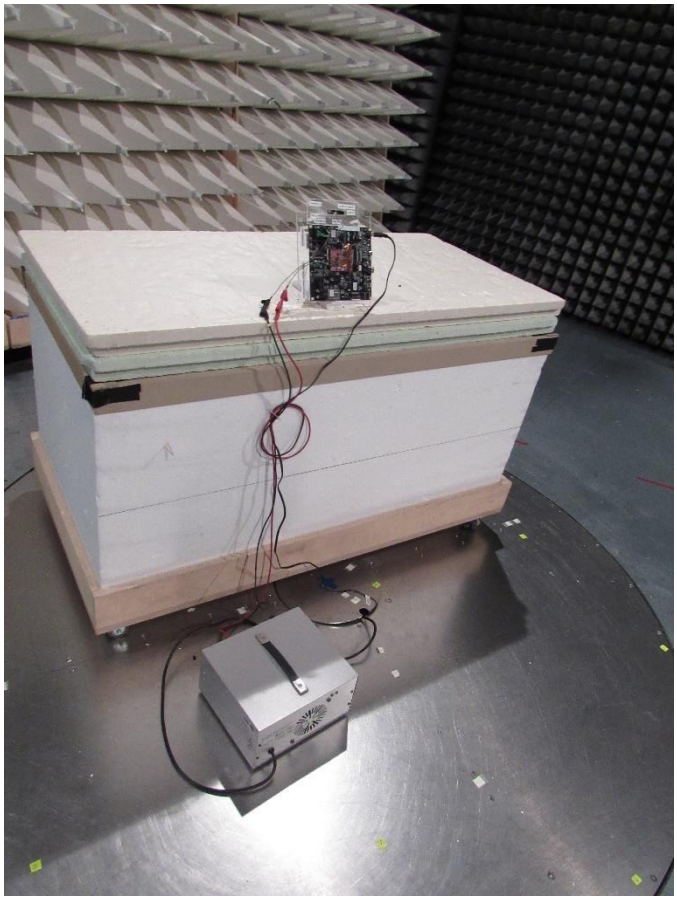
Setup for measurements above 1 GHz-Antenna 2



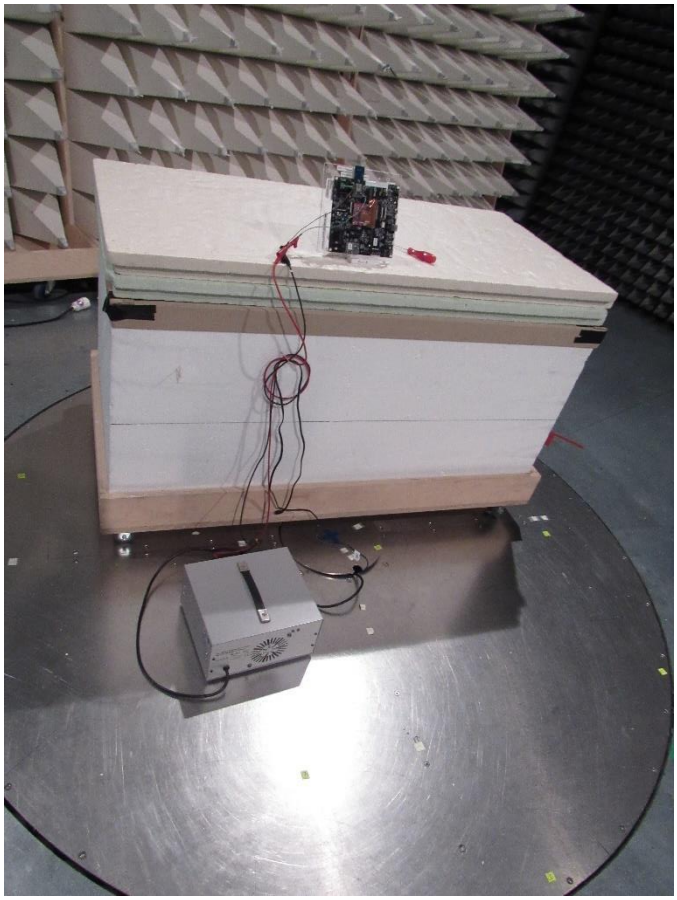
Setup for measurements above 1 GHz-Antenna 3



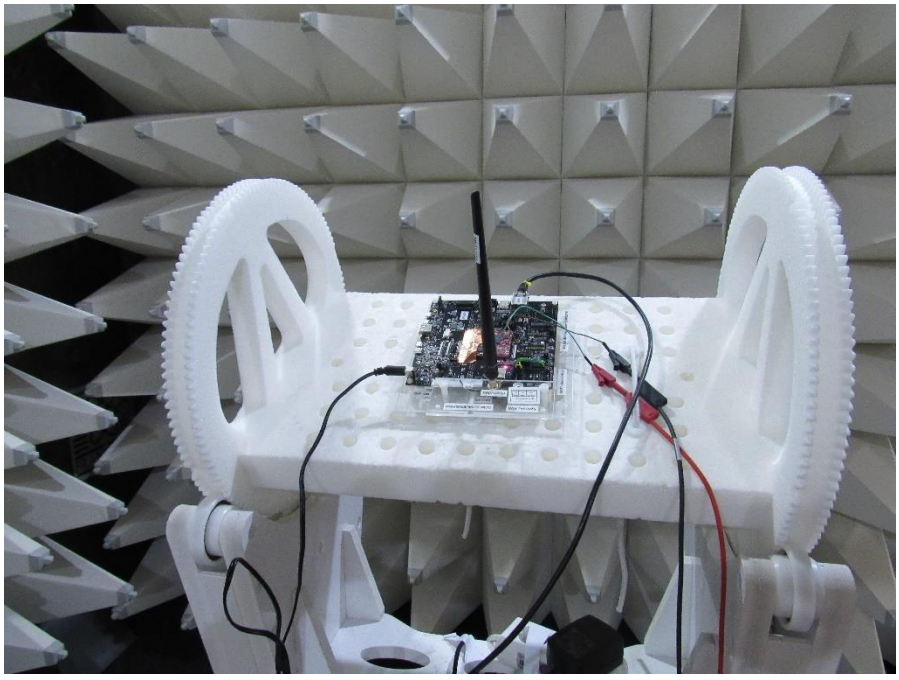
EUT Test Setup below 1 GH- Antenna 1


EUT Test Setup below 1 GH- Antenna 2


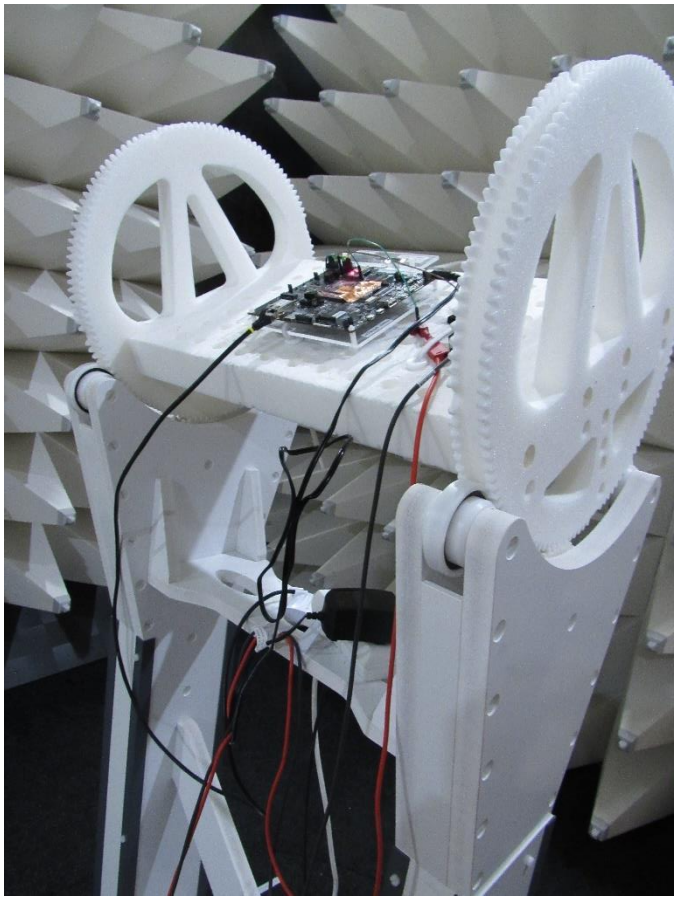
EUT Test Setup below 1 GH- Antenna 3



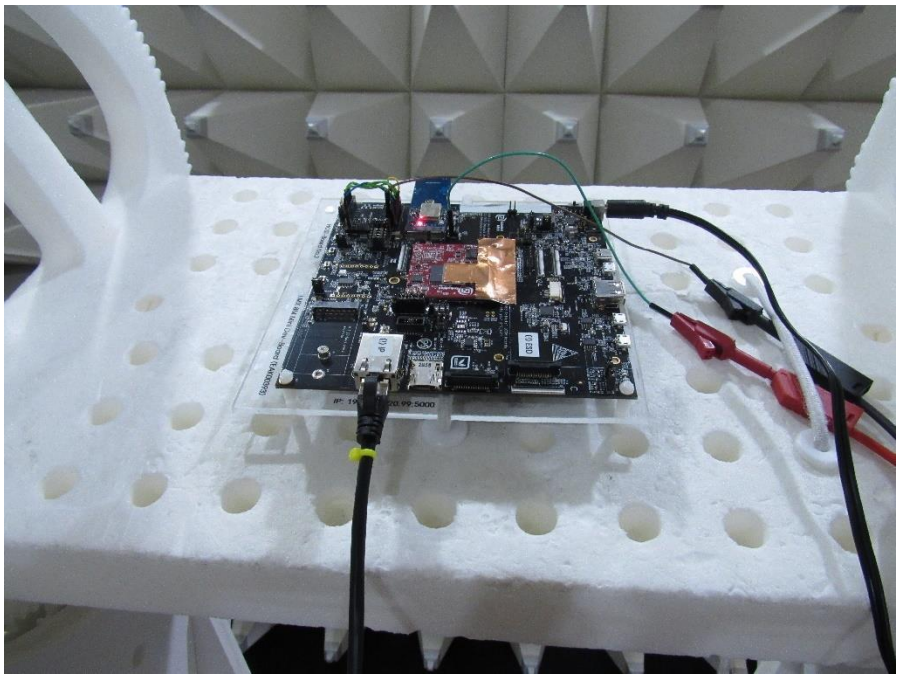
EUT Test Setup above 1 GHz-Antenna 1



EUT Test Setup above 1 GHz-Antenna 2



EUT Test Setup above 1 GHz-Antenna 3



3.8 Test Conditions and Results - Receiver radiated emissions

3.8.1 Information

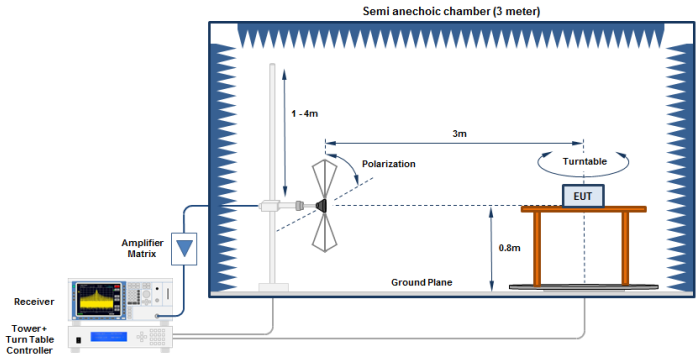
Test Information	
Reference	ISED RSS-247, Issue 3 (section 3.1)
Measurement Uncertainty	± 5.95 dB
Measurement Method	ANSI C63.4-2014 8.1-8.3
Operator	Md Abu Bakar Siddique
Date	2024-03-07

3.8.2 Limits

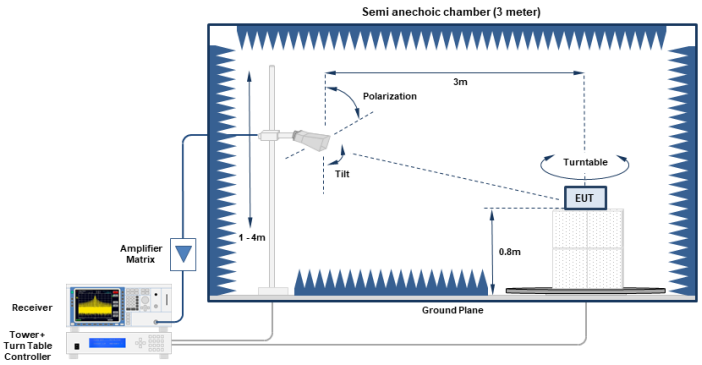
Limits			
Frequency range [MHz]	Detector	Field strength [µV/m]	Measurement distance [m]
30 - 88	Quasi-Peak	100	3
88 - 216	Quasi-Peak	150	3
216 - 960	Quasi-Peak	200	3
960 - 1000	Quasi-Peak	500	3
>1000	Average	500	3

3.8.3 Setup

Test Setup 30 MHz - 1000 MHz



Test Setup > 1 GHz



3.8.4 Equipment

Test Software			
Description	Manufacturer	Name	Version
EMC Software	DARE Instruments	RadiMation	2020.1.8

Test Equipment 30 - 1000 MHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC1	EF00062	2022-11	2025-11
Measurement Receiver	R&S	ESU8	EF00379	2023-08	2024-08
Antenna	Schwarzbeck	VULB 9168	EF01824	2022-10	2025-10

Test Equipment > 1 GHz					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic Chamber	Frankonia	AC2	EF01616	2023-12	2024-12
Spectrum analyzer	R&S	FSW43	EF00896	2023-08	2024-08
Antenna	Schwarzbeck	BBHA 9120B	EF01678	2021-03	2024-03
Antenna	Schwarzbeck	HWRD 650	EF01679	2021-03	2024-03

3.8.5 Procedure

Test Procedure
1. EUT is placed on a non conducting support at the center of a turn table 0.8 m above the ground
2. EUT is set to test mode
3. The receiver is set to peak detection with max hold
4. The EUT is rotated through 360° and the height of the antenna is varied from 1 m to 4 m
5. All significant emissions are measured again using the corresponding final detector

3.8.6 Results

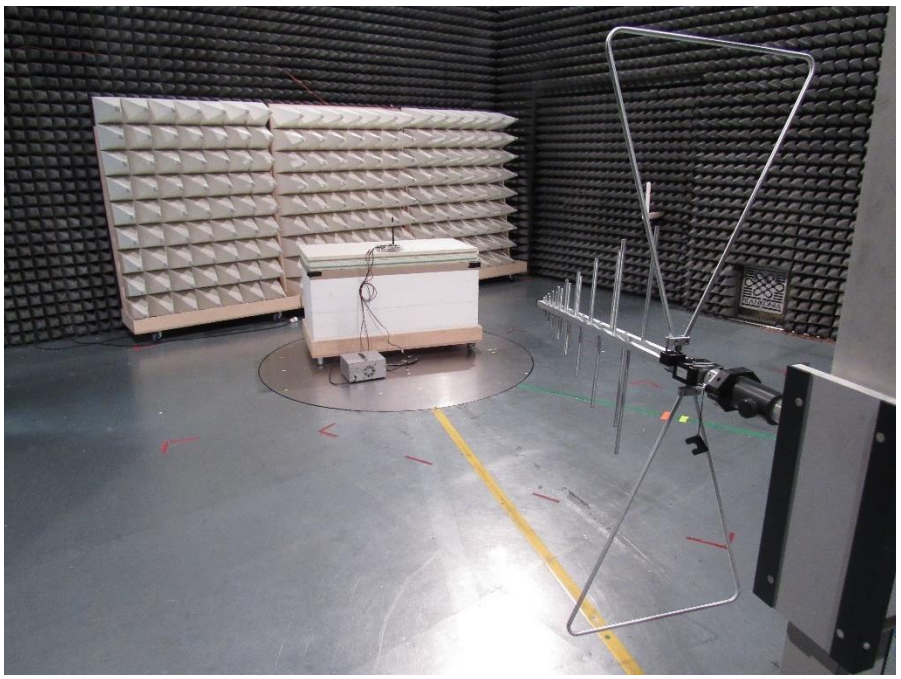
Test Results – Antenna 1 (External, ANT-Taoglas-GW.51.5153) – Annex D						
Channel [MHz]	Emission [MHz]	Level dBµV/m	Det.	Pol.	Limit dBµV/m	Margin [dB]
2412	1016	42.27	pk	ver	53.98	-11.71
2412	1514	39.44	pk	hor	53.98	-14.54
2437	1097	42.41	pk	hor	53.98	-11.57
2437	3249	41.72	pk	ver	53.98	-12.26
2437	1706	43.4	pk	hor	53.98	-10.58

Test Results – Antenna 2 (External, ANT-2J Antennas-2JF1002P) – Annex E						
Channel [MHz]	Emission [MHz]	Level [dBµV/m]	Det.	Pol.	Limit [dBµV/m]	Margin [dB]
2412	1112	46.48	pk	ver	53.98	-07.50
2412	2152	44.83	pk	hor	53.98	-09.15

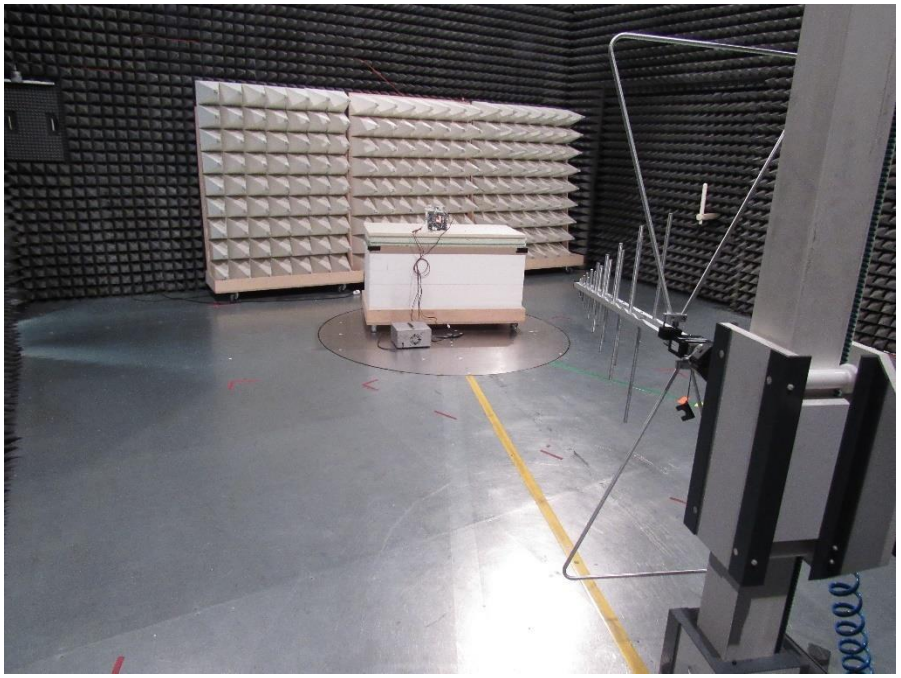
Test Results – Antenna 3 (External, ANT-TDK-ANT162442DT-2001A2) – Annex F						
Channel [MHz]	Emission [MHz]	Level [dBµV/m]	Det.	Pol.	Limit [dBµV/m]	Margin [dB]
2412	1018	44.01	pk	ver	53.98	-09.97
2412	1600	41.60	pk	hor	53.98	-12.38
2462	1768	42.74	pk	hor	53.98	-11.24
2462	7964	42.43	pk	ver	53.98	-11.55

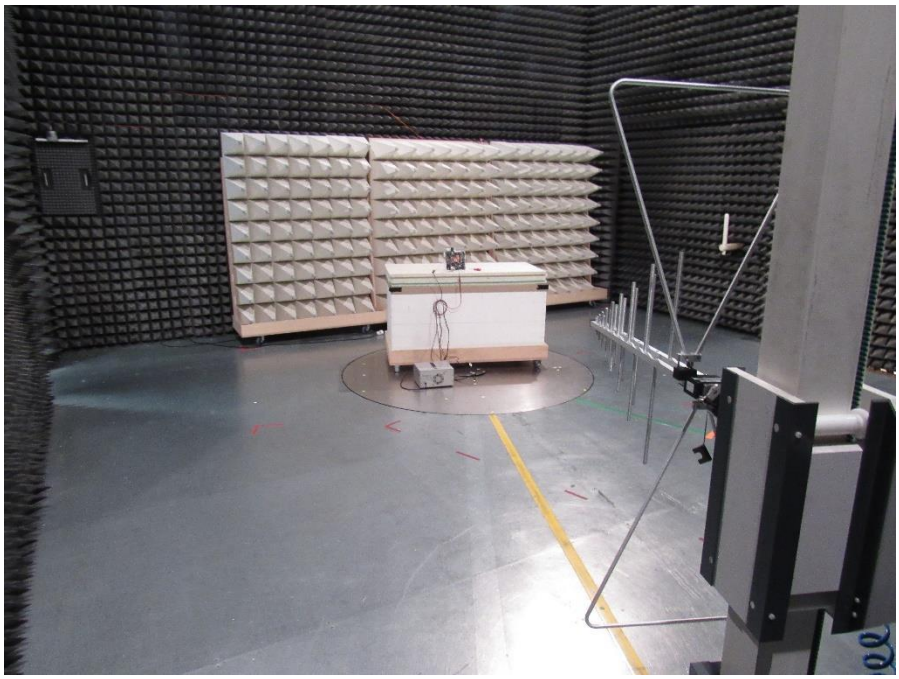
3.8.7 Setup Photos

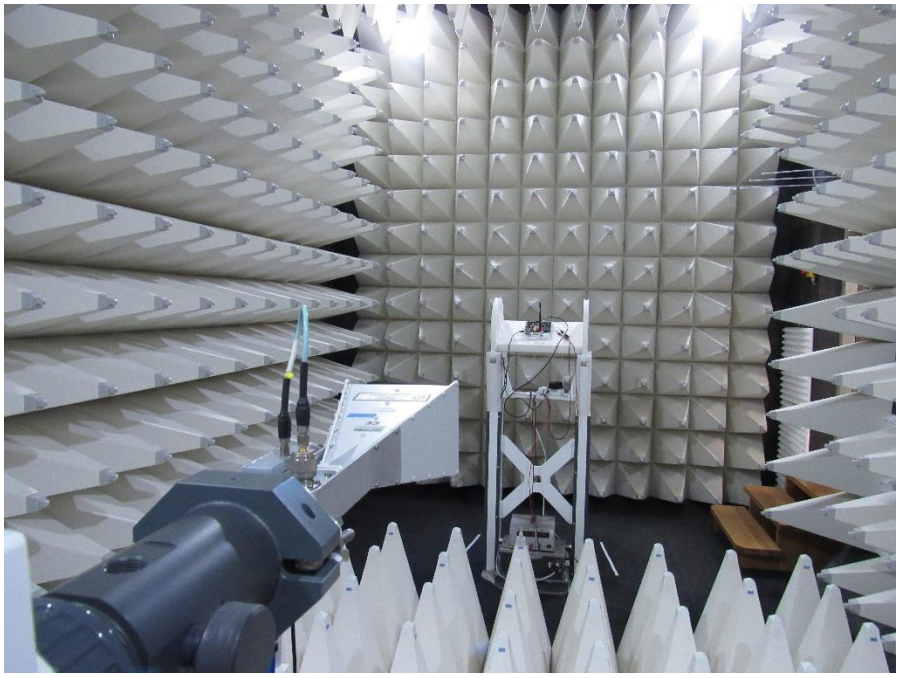
Setup for measurements below 1 GHz- Antenna 1

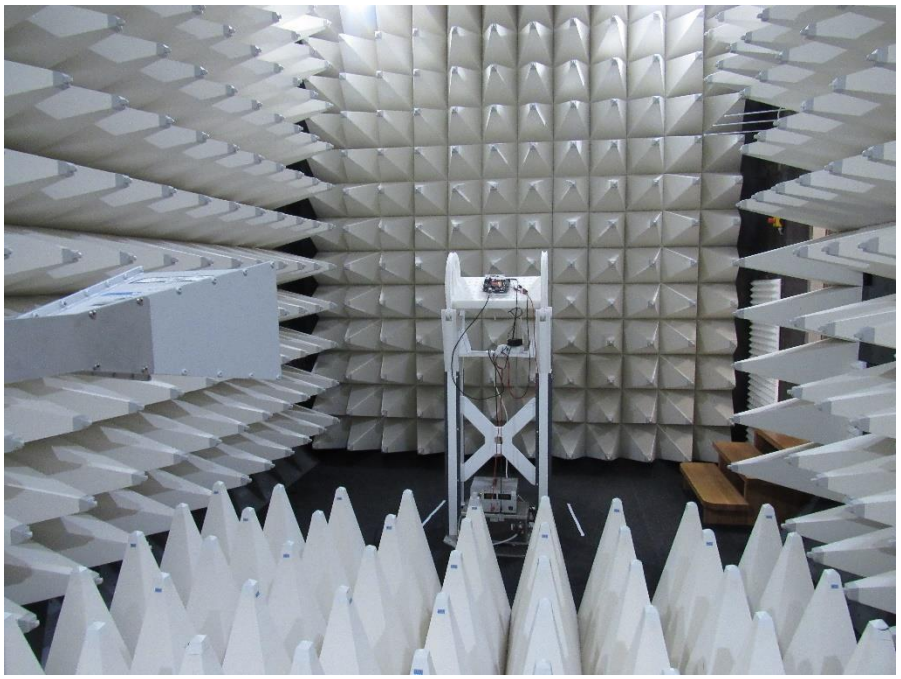


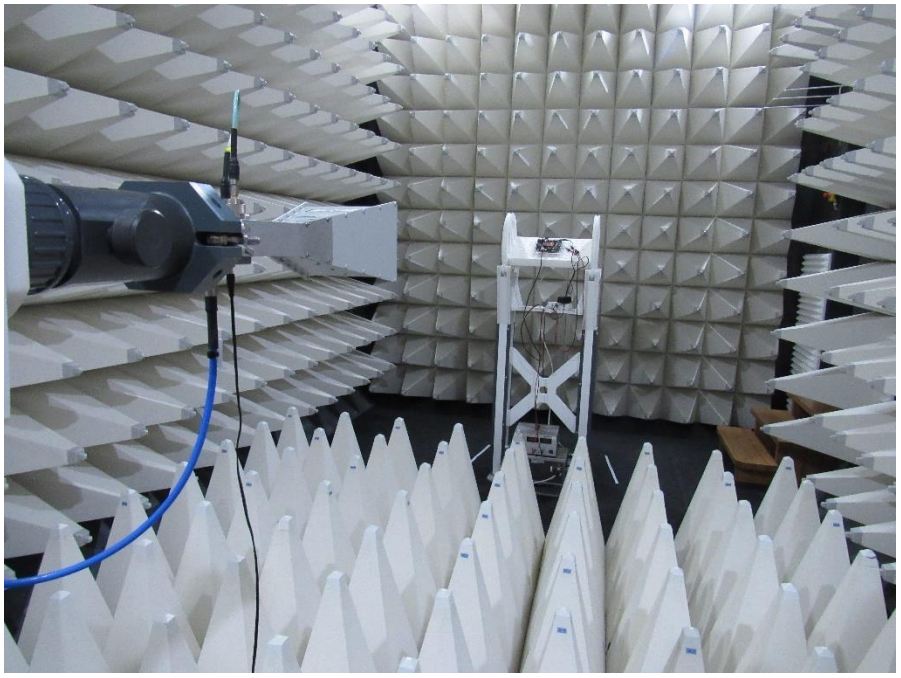
Setup for measurements below 1 GHz- Antenna 2

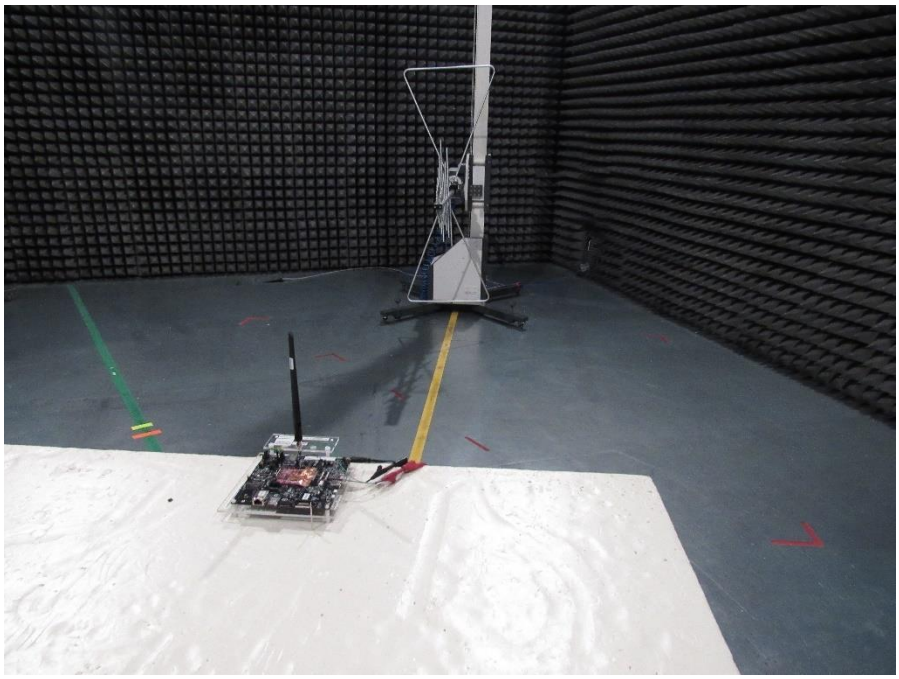


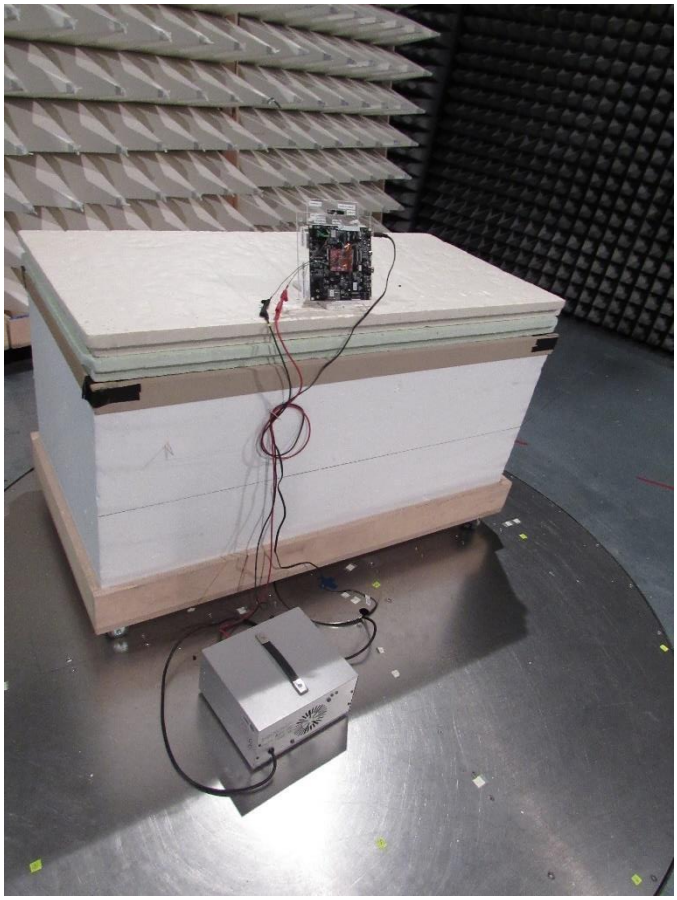
Setup for measurements below 1 GHz- Antenna 3


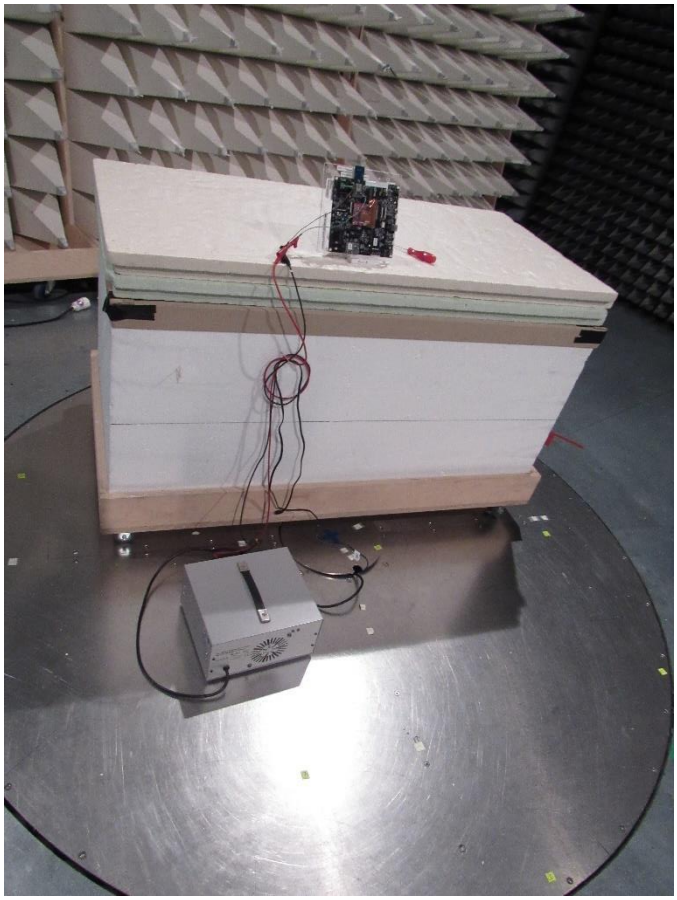
Setup for measurements above 1 GHz-Antenna 1


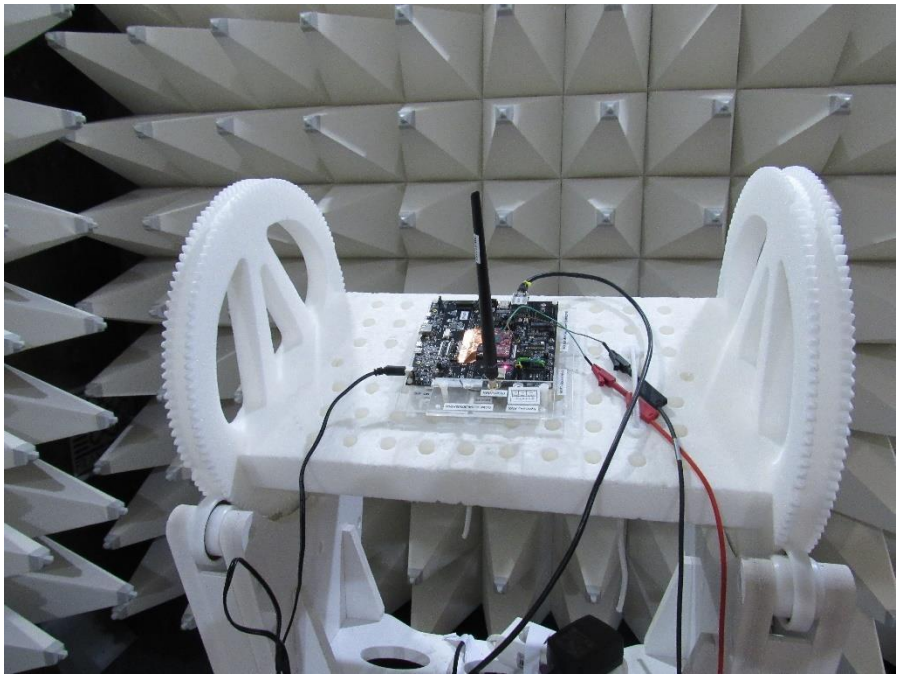
Setup for measurements above 1 GHz-Antenna 2


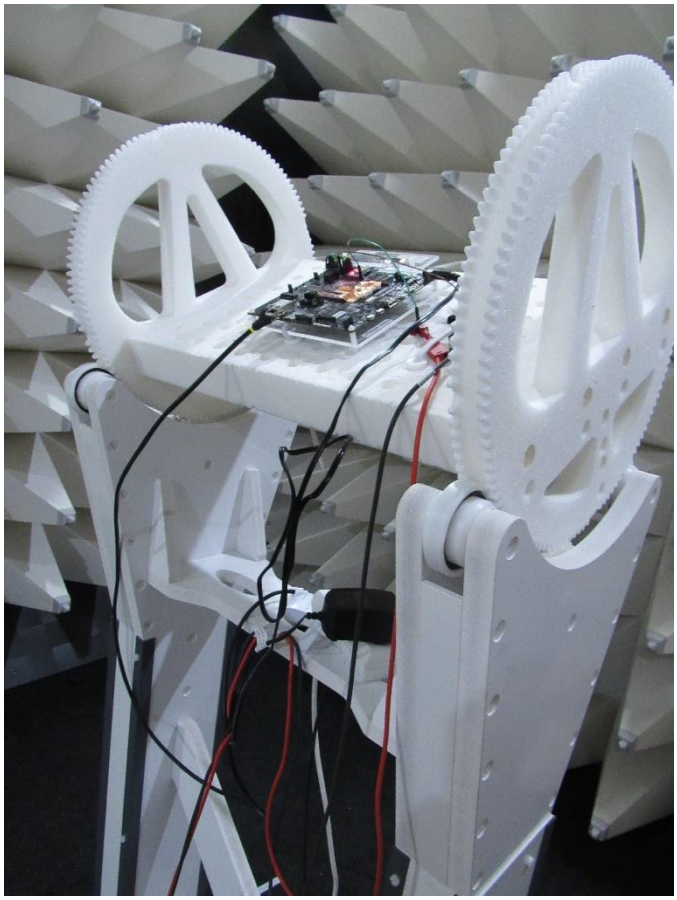
Setup for measurements above 1 GHz-Antenna 3


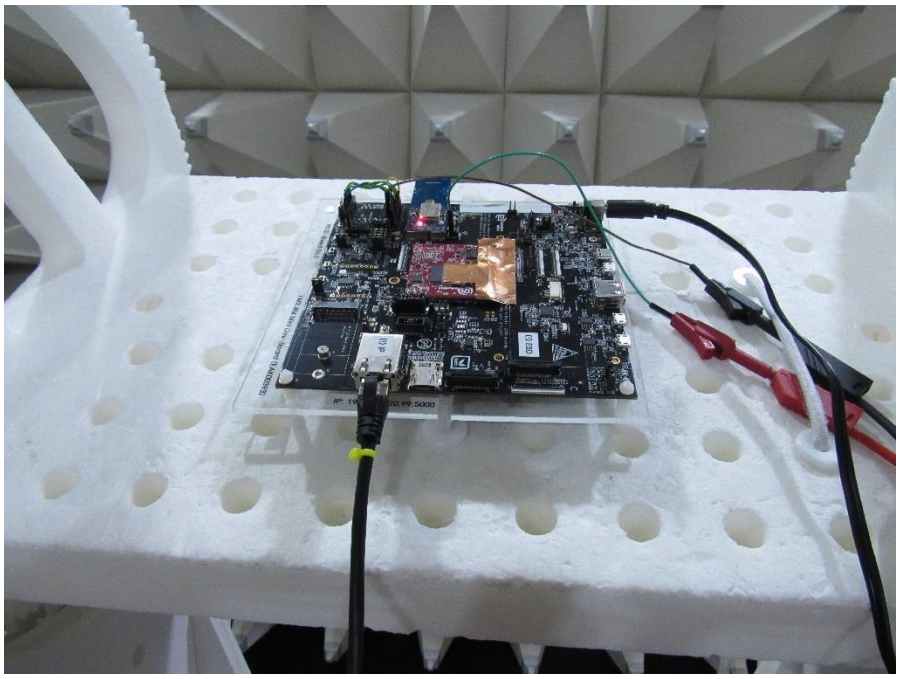
EUT Test Setup below 1 GH- Antenna 1


EUT Test Setup below 1 GH- Antenna 2


EUT Test Setup below 1 GH- Antenna 3


EUT Test Setup above 1 GHz-Antenna 1


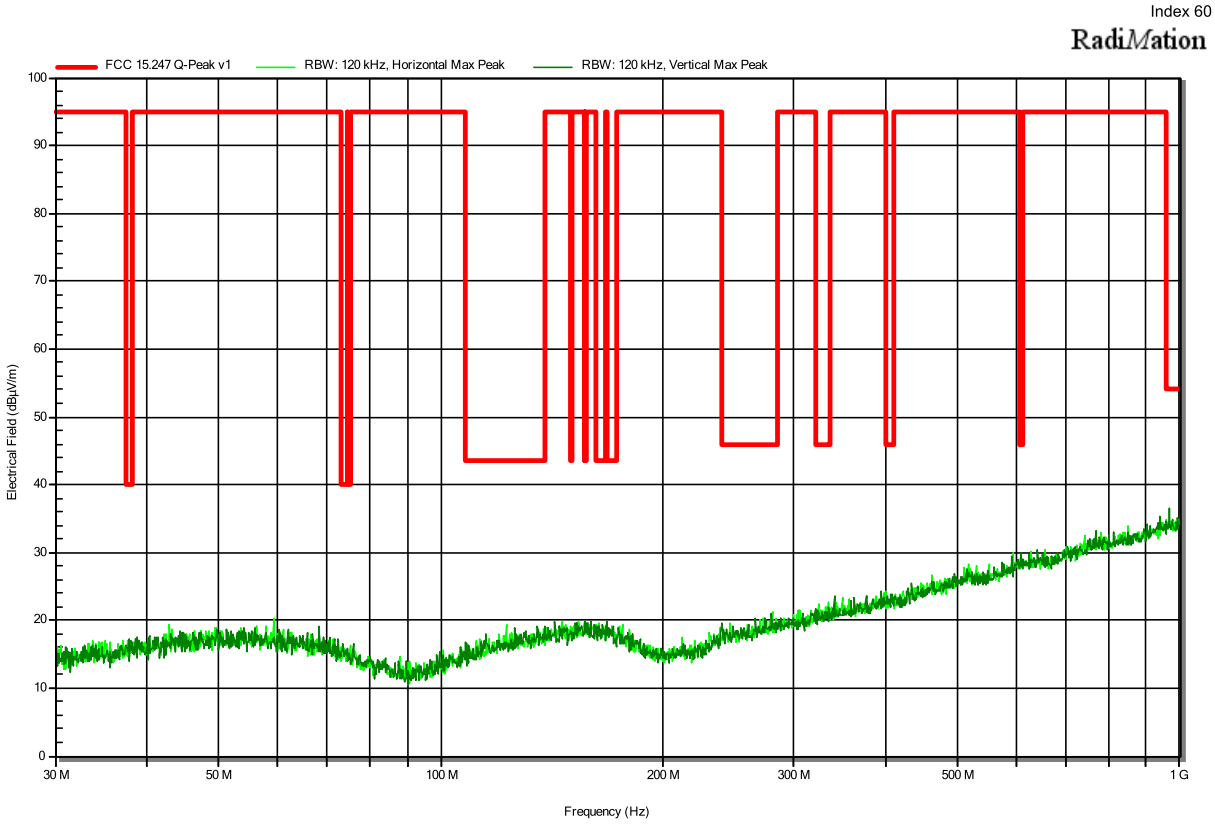
EUT Test Setup above 1 GHz-Antenna 2


EUT Test Setup above 1 GHz-Antenna 3


ANNEX A Transmitter spurious emissions in the spurious domain with Antenna 1 (External, ANT-Taoglas-GW.51.5153)

Radiated Spurious Emissions according to 47 CFR Part 15.247

Project Number:	G0M-2309-2215
Applicant:	Panasonic Industrial Devices Europe GmbH
Model Description:	Wi-Fi 6 Dual Band 2.4 GHz/5 GHz, Bluetooth® and 802.15.4 Module
Model:	ENWF9511C1KF
Test Sample ID:	46850
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Siddique
Measurement software:	RadiMation, version 2020.1.8
Test Conditions:	Tnom: 21 °Celsius, Vnom:
Antenna:	Schwarzbeck VULB 9168
Measurement distance:	3 m
Mode:	Tx; IEEE 802.11ax, 2422 MHz, HE40,RU-484,Index 65
Test Date:	2024-02-29



Radiated Spurious Emissions according to 47 CFR Part 15.247

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Applicant:	Panasonic Industrial Devices Europe GmbH
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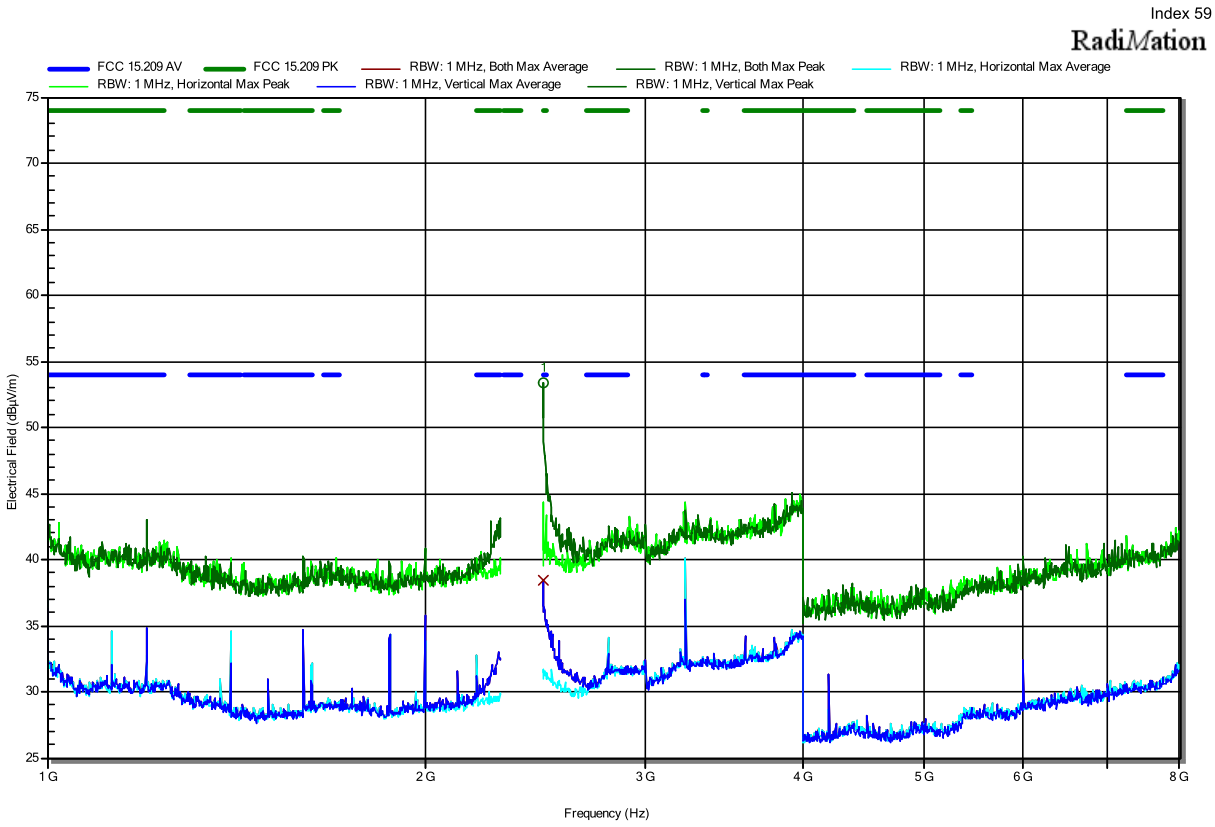
Model:	ENWF9511C1KF
Test Sample ID:	46850
Test Site:	Eurofins Product Service GmbH
Operator:	Mr. Siddique
Measurement software:	RadiMation, version 2020.1.8
Test Conditions:	Tnom: 21 °Celsius, Vnom:
Antenna:	Schwarzbeck BBHA 9120B
Measurement distance:	3 m
Mode:	Tx; IEEE 802.11ax, 2422 MHz, HE40,RU-484,Index 65
Test Date:	2024-03-01



Frequency	Peak	Peak Limit	Peak Difference	Peak Status	Polarization
2.4836 GHz	53.33 dBµV/m	74 dBµV/m	-20.67 dB	Pass	Vertical

Frequency	Average	Average Limit	Average Difference	Average Status	Polarization
2.4836 GHz	38.41 dBµV/m	54 dBµV/m	-15.59 dB	Pass	Vertical