



N° 1-6736
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TEST REPORT

EUT Description	2x2 PCIe M.2 1216 adapter card
Brand Name	Intel®
Model Name	BE211D2W / BE211D2W M
Date of Test Start/End	2025-07-01 / 2025-07-04
Features	2x2 Wi-Fi + Bluetooth® (see section 5)

Applicant	Intel Corporation SAS
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Reference Standards	ETSI EN 300 440 v2.2.1 (see section 1)
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Test Report identification	250522-02.TR07
Revision Control	Rev. 00 This test report revision replaces any previous test report revision (see section 8)

The test results relate only to the samples tested.
Reference to accreditation shall be used only by full reproduction of test report.

Issued by

Reviewed by

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1. Standards, reference documents and applicable test methods

1. ETSI EN 300 440 v2.2.1 Short Range Devices (SRD). Radio equipment to be used in the 1 GHz to 40 GHz frequency range. Harmonised Standard for access to radio spectrum.

2. General conditions, competences and guarantees

- ✓ Intel Corporation SAS Wireless RF Lab (Intel WRF Lab) is an ISO/IEC 17025:2017 testing laboratory accredited by the French Committee for Accreditation (Cofrac) with the certificate number 1-6736.
- ✓ Intel WRF Lab only provides testing services and is committed to providing reliable, unbiased test results and interpretations.
- ✓ Intel WRF Lab is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.
- ✓ Intel WRF Lab has developed calibration and proficiency programs for its measurement equipment to ensure correlated and reliable results to its customers.
- ✓ This report is only referred to the item that has undergone the test.
- ✓ This report does not imply an approval of the product by the Certification Bodies or competent Authorities

3. Environmental Conditions

- ✓ At the site where the measurements were performed the following limits were not exceeded during the tests:

Temperature	Min.	22.37°C
	Max.	24.97°C
	Average	23.15°C
Humidity	Min.	35.59%rh
	Max.	59.18%rh
	Average	51.25%rh

4. Test samples

Sample	Control #	Description	Model	Serial #	Date of receipt	Note
#01	250528-01.S01	Module	BE211D2W	289200F964C4	2025-05-28	Used for all RF Conducted tests
	240000-01.S03	Extender MotherBoard	PCB00887-008_A	2202207569	2024-12-12	
	210916-09.S03	Laptop	HP HSN-I45C	000176090Y	2021-12-10	
#02	250528-01.S07	Module	BE211D2W	289200F96596	2025-05-28	Used for Radiated Spurious Emissions tests
	200803-01.S01	Extender	ADEXELEC	139245	2020-08-31	
	170000-01.S57	Adapter	BNJ C0 V3	ASS00959-00-0C	2025-03-24	
	200611-03.S30	Test PC	Latitude 5401	6DJLK13	2020-08-19	
	230223-02.S48	Triband Antenna	-	006	2023-04-20	
	230526-09.S08	Triband Antenna	-	016	2023-07-06	
#03	250528-01.S07	Module	BE211D2W	289200F96596	2025-05-28	Used for Radiated Spurious Emissions tests
	200904-01.S14	Extender	ADEXELEC	12	2023-06-22	
	170000-01.S56	Adapter	BNJ C0 V3	E1578726888186A	2025-03-24	
	170000-01.S55	Test PC	LATITUDE 5530	004250000000002AA521	2025-03-24	
	230526-09.S06	Triband Antenna	-	014	2023-07-06	
	230526-09.S05	Triband Antenna	-	013	2023-07-06	
#04	250528-01.S07	Module	BE211D2W	289200F96596	2025-05-28	Used for Rx Radiated Spurious Emission tests
	170000-01.S57	Adapter	BNJ C0 V3	ASS00959-00-0C	2025-03-24	
	200615-05.S06	Test PC (Host)	Dell Latitude 7940	63QRMQ2	2020-06-12	

5. EUT Features

The herein information is provided by the customer.

Intel WRF Lab declines any responsibility for the accuracy of the stated customer provided information, especially if it has any impact on the correctness of test results presented in this report.

Brand Name	Intel®		
Model Name	BE211D2W / BE211D2W M		
Software Version	DRTU.08798.99.0.99		
Driver Version	99.0.99.2		
Supported Radios	802.11b/g/n/ax/be 2.4GHz 802.11a/n/ac/ax/be 5.2GHz 5.3GHz 5.6GHz 5.8GHz 6.0GHz 802.11ax/be Bluetooth 2.4GHz		
Antenna Information	Transmitter	Chain A(1)	Chain B(2)
	Manufacturer	Intel WRF Lab	Intel WRF Lab
	Antenna type	PIFA	PIFA
	Part number	WRF-Tri Band-Antenna	WRF-Tri Band-Antenna
	Antenna peak gain (dBi)	+5.0	+5.0

6. Remarks and comments

1. According to the standard ETSI EN 300 440 v2.2.1 , and the applicant declaration, the device BE211D2W / BE211D2W M operating in 802.11a/n/ac/ax mode is considered as a receiver category 1.
2. At customer request, the LBT test 4.4.2 of EN 300 440 was not tested as not required per ECC REC70-03 on non-specific SRD Annex 1 (J) : spectrum access and mitigation requirements N/A
3. At customer request, all normal condition tests were carried out at tune up power (+0.5dB) Vs device setting

7. Test Verdicts summary

The statement of conformity to applicable standards in the table below are based on the measured values, without taking into account the measurement uncertainties.

7.1. 802.11 a/n/ac/ax/be

EN 300 440	Test name	Verdict
4.2.2	Transmitter: Equivalent Isotropically radiated power (e.i.r.p.)	P
4.2.3	Transmitter: Permitted range of operating frequencies	P
4.2.4	Transmitter: Unwanted Emissions in the spurious domain (radiated)	P
4.3.4	Blocking or desensitization	P
4.3.5	Receiver: Spurious emissions (radiated)	P
4.4.2	Listen Before Talk (LBT)	NA

P: Pass

F: Fail

NM: Not Measured

NA: Not Applicable

8. Document Revision History

Revision #	Modified by	Revision Details
Rev. 00	T .GAMAIN	First Issue

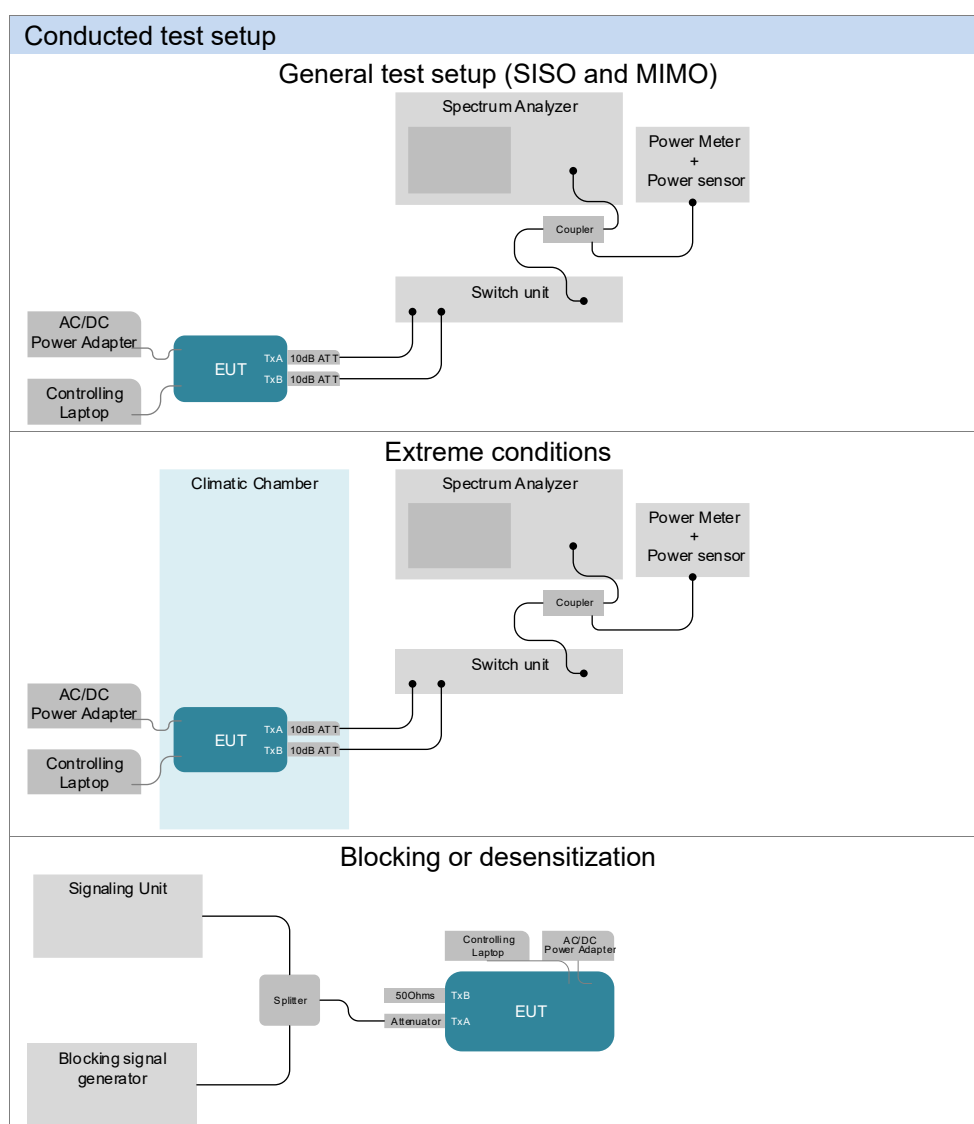
Annex A. Test & System Description

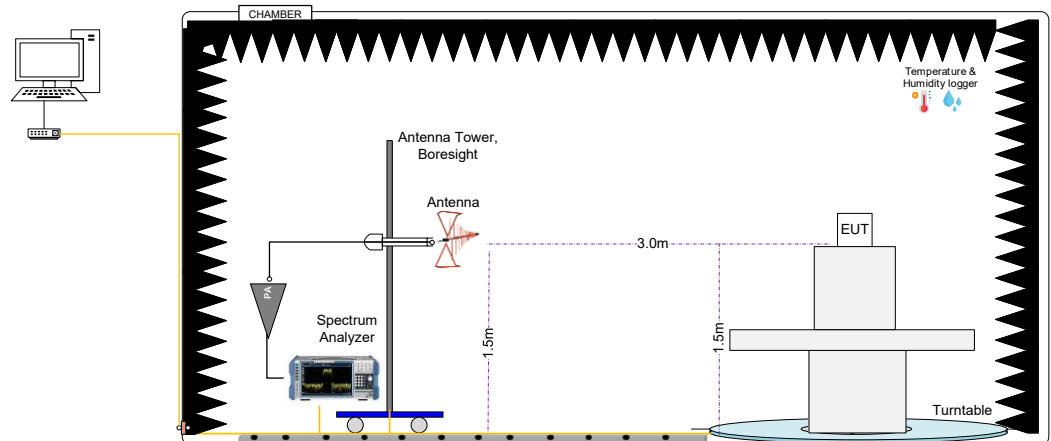
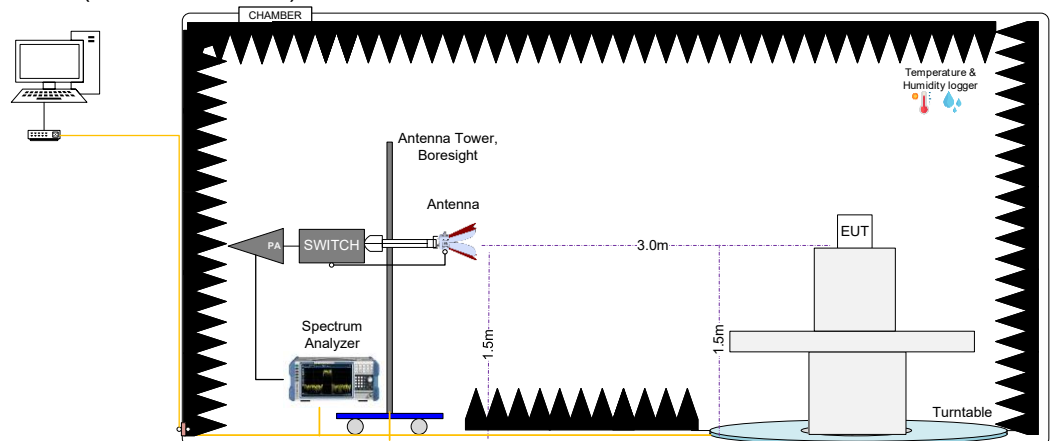
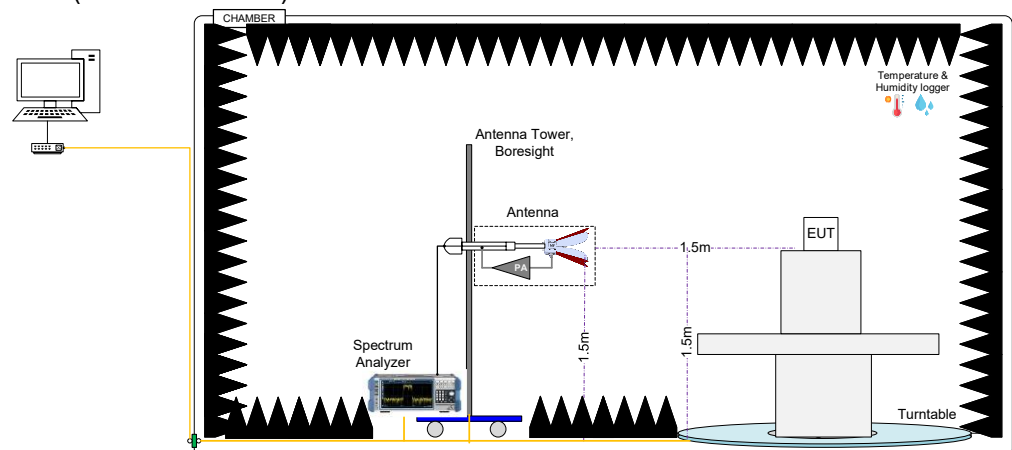
A.1 Measurement System

Measurements were performed using the following setups, made in accordance to the general provisions of ETSI EN 300 440 v2.2.1.

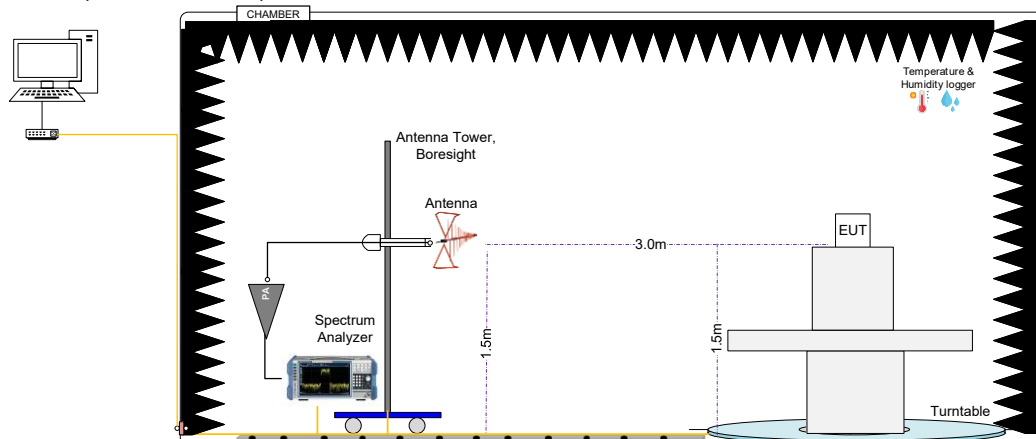
The DUT was installed in a test fixture and this test fixture is connected to a laptop computer and AC/DC power adapter. The laptop computer was used to configure the EUT to continuously transmit at a specified output power using all different modes and modulation schemes, using the Intel proprietary tool DRTU.

Setups for conducted and radiated measurements are shown below.

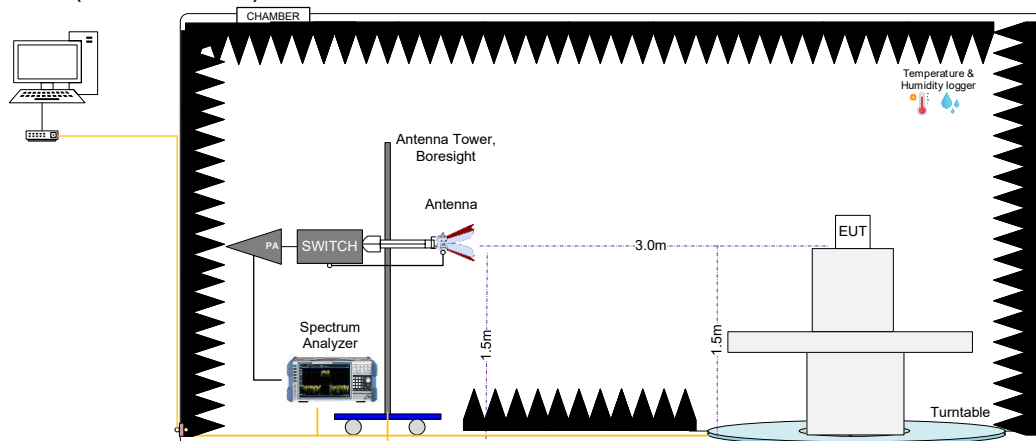


Radiated test setup**Radiated Setup 25 MHz - 1 GHz (Transmitter tests)****Radiated Setup 1 GHz – 11 GHz (Transmitter tests)****Radiated Setup 11 GHz - 40 GHz (Transmitter tests)**

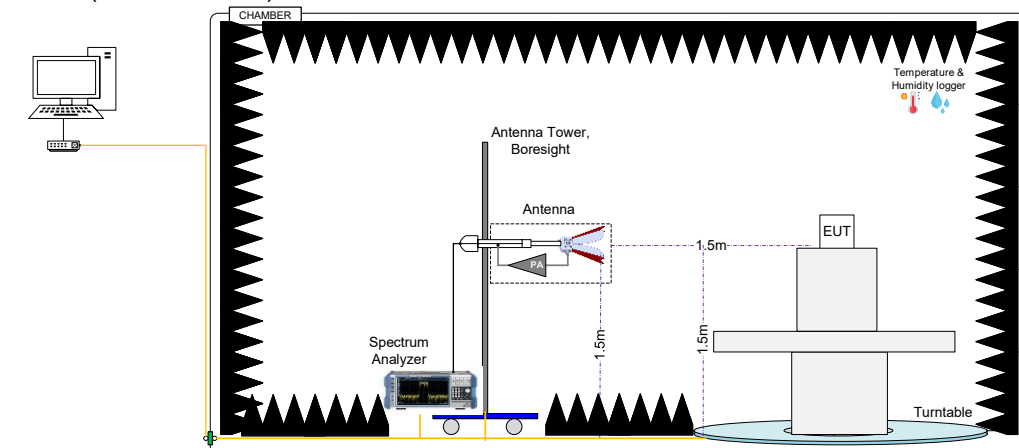
Radiated Setup 25 MHz – 1 GHz (Receiver tests)



Radiated Setup 1 GHz - 11 GHz (Receiver tests)



Radiated Setup 11 GHz - 40 GHz (Receiver tests)



A.2 Test Equipment List

Conducted Setup

ID#	Device	Type/Model	Serial #	Manufacturer	Cal. Date	Cal. Due
017-038	Spectrum analyzer	FSVA3013	102344	Rohde & Schwarz	2024-05-29	2026-05-29
019-003	SMA-SMA 100cm Cable	FLC-1M-SMSM+	21112742	Mini-Circuits	2025-02-20	2026-02-20
019-004	Attenuator 10dB + SMA-MH4	3M-6	3M-6	WEINSCHEL	2025-02-20	2026-02-20
133-000	Oscilloscope	RTE1052	101135	Rohde & Schwarz	2024-04-03	2026-04-03
094-004	Temp & Humidity Logger	RMS-HCD-S	24050483	Rotronic	2024-09-02	2026-09-02
413-000	Measurement SW v1.5.4.2	Octopi	N/A	Step AT	N/A	N/A
304-000	DC Power supply	E3614A	MY40000800	Agilent	N/A	N/A
299-000	Multimeter	34401A	US360546853146A00597	HPAgilent	2024-03-14	2026-03-14
311-000	Climatic chamber	SLT34/40	56746020930010	Secasi	2023-12-20	2025-12-20
281-000	Thermometer	t3000FC	46320036	Fluke	2024-04-17	2026-04-17

N/A: Not Applicable

Receiver blocking Setup

ID#	Device	Type/Model	Serial #	Manufacturer	Cal. Date	Cal. Due Date
125-000	Communication tester	CMW500	129337	Rohde & Schwarz	2025-05-28	2027-05-28
098-000	Signal generator	SMW200A	103732	Rohde & Schwarz	2023-07-26	2025-07-26
018-005	SMA-SMA 45cm RF Cable	FMC020285-18	-	Fairview Microwave	2025-02-21	2026-02-21
094-004	Temp & Humidity Logger	RMS-HCD-S	24050483	Rotronic	2024-09-02	2026-09-02
018-000	2 Way SMA Power Divider	PE2084	-	Pasternack	2025-02-21	2026-02-21
016-003	SMA-SMA 45cm RF Cable	FMC0202085-18	-	Fairview Microwave	2025-02-21	2026-02-21
018-006	SMA-SMA 45cm RF Cable	FMC0202085-18	-	Fairview Microwave	2025-02-21	2026-02-21

N/A: Not Applicable

Radiated Setup #1

ID#	Device	Type/Model	Serial #	Manufacturer	Cal. Date	Cal. Due Date
006-000	Anechoic Chamber	FACT3	5720	ETS-Lindgren	2024-01-17	2026-01-17
006-001	Turn Table	ETS	-	ETS-Lindgren	N/A	N/A
094-002	Temp & Humidity Logger	RMS-HCD-S	24050486	Rotronic	2024-09-02	2026-09-02
006-011	Boresight antenna mast	BAM 4.0-P	P/278/2890.01	Maturo	N/A	N/A
006-002	Switch & Positioning systems	EMCenter	00159757	ETS-Lindgren	N/A	N/A
147-000	Spectrum analyzer	FSW43	101847	Rohde & Schwarz	2025-03-07	2027-03-07
006-008	Measurement SW, v11.3	EMC32	100623	Rohde & Schwarz	N/A	N/A
301-000	Amplifier 9kHz-1300MHz	8447F	3113A07440	HP	2025-02-11	2026-02-11
006-067	Low Pass Filter 1.6GHz	LPM17671	G002	Micro-Tronics	2025-02-11	2026-02-11
007-034	Broadband RF Power Amplifier 0.5-40.0GHz	DEPA0540-43	2024A02	Diamond Engineering	2025-02-11	2026-02-11
189-000	Double Horn Ridged antenna 10GHz-40GHz	3116C	227716	ETS-Lindgren	2024-05-29	2026-05-29
057-000	Double ridged horn antenna (1GHz to 18GHz)	ETS-Lindgren-3117	167062	ETS-Lindgren	2024-07-23	2026-07-23
006-061	Bi-Log Periodic antenna	CBL6143A	61382	Teseq	2024-11-13	2026-11-13
006-068	RF Switch DC-40GHz	LPM17671	G002	Mini-Circuits	2025-02-11	2026-02-11
261-000	RF Amplifier Used for 1 GHz-11GHz	ETS-Lindgren-3117-PA	00157993	ETS-Lindgren	2025-02-11	2026-02-11
009-007	Filter HPF 11GHz	Mini-Circuits-ZHSS-k11G+	84931831830	Mini-Circuits	2025-02-11	2026-02-11
098-000	generator	SMW200A	1037732	Rohde & Schwarz	2024-10-08	2026-08-10
291-000	Multimeter	2000	4009301	KEITHLEY	2024-03-04	2026-03-04
006-015	Biconical antenna	3110C	161548	ETS-Lindgren	2024-12-04	2026-12-04
006-017*	Log-Periodic antenna	3148B	166243	ETS-Lindgren	2023-07-14	2025-07-14
056-000	Double Horn Ridged antenna	3116C	157736	ETS-Lindgren	2024-03-06	2026-03-06
006-051	RF Cable 1.0m	CBL-1.5M-SMSM+	202879	Mini-Circuits	2025-03-12	2026-03-12
006-066	Cable 7m – 25MHz to 40GHz	R286304174	20.46.370	Radiall	2025-02-10	2026-02-10
006-063	Cable 30cm – 1GHz to 40GHz	PE371-12	-	Pasternack	2025-02-10	2026-02-10
006-064	Cable 30cm – 1GHz to 40GHz	PE371-12	-	Pasternack	2025-02-10	2026-02-10
006-065	Cable 60cm – 25MHz to 1GHz	PE300-24	-	Pasternack	2025-02-10	2026-02-10

*Used within the calibration period

Radiated Setup #2

ID#	Device	Type/Model	Serial #	Manufacturer	Cal. Date	Cal. Due Date
007-000	Anechoic chamber	RFD-FA-100	5996	ETS Lindgren	2024-01-18	2026-01-18
138-000	Spectrum Analyzer	FSV40**	101556	Rohde & Schwarz	2024-02-27	2026-02-27
137-000	Spectrum Analyzer	FSW67*	103266	Rohde & Schwarz	2025-02-11	2027-02-11
007-007	Double Ridge Horn Antenna (1- 18GHz)	3117	00152266	ETS Lindgren	2024-03-26	2026-03-26
059-000	Double-ridged horn antenna + PA (1 GHz to 18 GHz)	3117-PA	201542	ETS-Lindgren	2023-09-26	2025-09-26
026-008	Low noise amplifier 1-18GHz	LA1018N3209	J10100000407	A-INFO	2025-02-19	2026-02-19
007-004	Switch & Positioner	EMCenter	00162359	ETS Lindgren	N/A	N/A
007-006	EMControl & EMSwitch	EMCenter	00151232	ETS Lindgren	N/A	N/A
007-036	SMA-SMA 6.5m Cable	140-8500-11-51-001	001	Atem	2025-03-12	2026-03-12
007-005	Measurement SW, v11.30.00	EMC32	100401	Rohde & Schwarz	N/A	N/A
007-001	Styrofoam Column, 151mm	-	-	-	N/A	N/A
007-002	Turntable	-	-	ETS Lindgren	N/A	N/A
007-003	Antenna Tower	2171B-3.0M	00150123	ETS Lindgren	N/A	N/A
007-015	N-SMA 1.5m Cable	-	-	Spirent	2025-02-19	2026-02-19
007-018	SMA-SMA 1.2m Cable	0500990991200KE	-	Radiall	2025-02-19	2026-02-19
007-022	N-SMA 1.5m Cable	0501050991500GX	19.23.493	Radiall	2025-02-10	2026-02-10
094-001	Temp & Humidity Logger	RMS-HCD-S	24050487	Rotronic	2024-09-02	2026-09-02

Shared Radiated Equipment

ID#	Device	Type/Model	Serial #	Manufacturer	Cal. Date	Cal. Due Date
412-000	DRTU Power finder V2.1	-	-	Intel	NA	NA
139-000	Power Sensor	NRP-Z81	104383	Rohde & Schwarz	2025-05-20	2027-05-20
140-000	Power Sensor	NRP-Z81	104382	Rohde & Schwarz	2024-04-04	2026-04-04

A.3 Measurement Uncertainty Evaluation

The system uncertainty evaluation is shown in the table below with a coverage factor of $k = 2$ to indicate a 95% level of confidence:

Measurement type	Uncertainty	Limit	Unit
Frequency Stability	± 6.18	± 10	ppm
RF Output Power, (conducted)	± 0.99	± 1.5	dB
Radiated emission of transmitter < 1GHz	± 4.03	± 6	dB
Radiated emission of transmitter 1GHz - 40 GHz	± 5.09	± 8	dB
Radiated emission of receiver < 1GHz	± 4.03	± 6	dB
Radiated emission of receiver 1GHz - 40 GHz	± 5.09	± 8	dB
Temperature	± 0.23	± 1	°C
Humidity	1.99	± 5	%

Annex B. Test Results

The herein test results were performed by:

Test case measurement	Test Personnel
Transmitter: Equivalent Isotropically radiated power (e.i.r.p.)	T.Gamain
Transmitter: Permitted range of operating frequencies	T.Gamain
Transmitter: Unwanted Emissions in the spurious domain (radiated)	K.RIDA
Blocking or desensitization	T.Gamain
Receiver: Spurious emissions (radiated)	K.RIDA

B.1 Test Conditions

For 802.11a mode the EUT can transmit at both CHAIN A and CHAIN B RF outputs individually, but not simultaneously.

For 802.11n20, 802.11ax/be20 (20 MHz channel bandwidth), 802.11n40, 802.11ax/be40 (40MHz channel bandwidth), 802.11ac80, 802.11ax/be80 (80MHz channel bandwidth) modes the EUT can transmit at both CHAIN A and CHAIN B RF outputs individually, and also simultaneously.

The following data rates were selected based on preliminary testing that identified those rates as the worst cases for output power and spurious levels at the band edges:

Transmission	Mode	Bandwidth (MHz)	Worst Case Data Rate
SISO	802.11a	20	6Mbps
	802.11n	20	HT0
		40	HT0
	802.11ac	80	VHT0
	802.11ax/be	20	MCS0
		40	MCS0
		80	MCS0
MIMO	802.11n	20/40	HT8
	802.11ac	80	VHT0
	802.11ax/be	20/40/80	MCS0

B.2 Test results

B.2.1 Transmitter: Equivalent Isotropically radiated power (e.i.r.p.)

Test limits

EN 300 440	Limits					
4.2.2.4	The transmitter maximum e.i.r.p. under normal and extreme test conditions is provided in table 2.					
	Table 2 : Maximum radiated power (e.i.r.p.)					
	<table><tr><th>Frequency Band [MHz]</th><th>Mean e.i.r.p. [dBm]</th><th>Application</th></tr><tr><td>5 725 to 5 875</td><td>25 mW e.i.r.p (13.98 dBm)</td><td>Non-specific short range devices</td></tr></table>	Frequency Band [MHz]	Mean e.i.r.p. [dBm]	Application	5 725 to 5 875	25 mW e.i.r.p (13.98 dBm)
Frequency Band [MHz]	Mean e.i.r.p. [dBm]	Application				
5 725 to 5 875	25 mW e.i.r.p (13.98 dBm)	Non-specific short range devices				

Test procedure

The conducted setups shown in section *Test & System Description* were used to measure the RF output power at the highest power. The antenna terminal of the EUT is connected to the power meter through an attenuator and a cable. The power meter reading is compensated to include the RF path loss.

Antenna gain is taken into account and added to the measurement. The EIRP power (dBm) is calculated by adding the declared maximum antenna gain to the measured conducted power.

The measurement is performed in normal and extreme conditions (temperature and voltage).

Results tables

EIRP Nominal voltage:3.3V						Normal Condition Ambient temperature +23°C		Extreme Condition High temperature +50°C		Extreme Condition Low temperature -10°C	
Mode	Meas Duty cycle %	Rate	#Ch	Freq [MHz]	Antenna	Measured Conducted [dBm]	EIRP [dBm]	Measured Conducted [dBm]	EIRP [dBm]	Measured Conducted [dBm]	EIRP [dBm]
802.11a		6Mbps	149	5745	SISO A	8.97	13.97	8.37	13.37	8.52	13.52
					SISO B	8.92	13.92	7.92	12.92	8.06	13.06
			161	5805	SISO A	8.95	13.95	8.09	13.09	8.21	13.21
					SISO B	8.91	13.91	7.98	12.98	6.62	11.62
			173	5865	SISO A	4.42	9.42	3.72	8.72	3.78	8.78
					SISO B	4.78	9.78	4.14	9.14	2.93	7.93
802.11n20		HT0	149	5745	SISO A	8.76	13.76	7.99	12.99	8.04	13.04
					SISO B	8.65	13.65	7.97	12.97	6.60	11.60
			161	5805	SISO A	8.80	13.80	8.02	13.02	8.12	13.12
					SISO B	8.84	13.84	7.89	12.89	6.51	11.51
			173	5865	SISO A	4.37	9.37	3.65	8.65	3.72	8.72
					SISO B	4.69	9.69	4.07	9.07	2.86	7.86
		HT8	149	5745	MIMO A+B	8.86	13.86	8.15	13.15	7.61	12.61
			161	5805	MIMO A+B	8.77	13.77	8.06	13.06	7.55	12.55
			173	5865	MIMO A+B	7.03	12.03	6.34	11.34	5.88	10.88
802.11n40		HT0	151	5755	SISO A	8.81	13.81	8.01	13.01	8.13	13.13
					SISO B	8.70	13.70	7.92	12.92	6.47	11.47
			167	5835	SISO A	8.82	13.82	8.00	13.00	8.10	13.10
					SISO B	8.74	13.74	7.95	12.95	6.66	11.66
		HT8	151	5755	MIMO A+B	8.92	13.92	8.17	13.17	7.68	12.68
			167	5835	MIMO A+B	8.84	13.84	8.12	13.12	7.62	12.62
802.11ac80		VHT0	155	5775	SISO A	8.86	13.86	8.07	13.07	8.21	13.21
					SISO B	8.69	13.69	7.90	12.90	6.54	11.54
					MIMO A+B	8.91	13.91	8.14	13.14	7.63	12.63
802.11ax/be20		MCS0	149	5745	SISO A	8.89	13.89	8.08	13.08	8.22	13.22
					SISO B	8.93	13.93	8.00	13.00	6.64	11.64
			161	5805	SISO A	8.68	13.68	7.89	12.89	8.00	13.00
					SISO B	8.90	13.90	7.91	12.91	6.62	11.62
			173	5865	SISO A	4.25	9.25	3.51	8.51	3.60	8.60
					SISO B	4.58	9.58	3.96	8.96	2.79	7.79
			149	5745	MIMO A+B	8.83	13.83	8.06	13.06	7.53	12.53
			161	5805	MIMO A+B	8.87	13.87	8.10	13.10	7.60	12.60
802.11ax/be40		MCS0	151	5755	SISO A	8.79	13.79	8.01	13.01	8.15	13.15
					SISO B	8.90	13.90	7.95	12.95	6.61	11.61
			167	5835	SISO A	8.82	13.82	8.03	13.03	8.16	13.16
					SISO B	8.97	13.97	7.95	12.95	6.74	11.74
			151	5755	MIMO A+B	8.83	13.83	8.06	13.06	7.54	12.54
			167	5835	MIMO A+B	8.87	13.87	8.15	13.15	7.67	12.67
802.11ax/be80		MCS0	155	5775	SISO A	8.83	13.83	8.00	13.00	8.16	13.16
					SISO B	8.95	13.95	7.92	12.92	6.64	11.64
					MIMO A+B	8.87	13.87	8.05	13.05	7.56	12.56

EIRP Ambient temperature: +23°C						Extreme Condition High Voltage V _{max} = +3.465 V		Extreme Condition Low Voltage V _{min} = +3.135 V	
Mode	Meas Duty cycle %	Rate	#Ch	Freq [MHz]	Antenna	Measured Conducted [dBm]	EIRP [dBm]	Measured Conducted [dBm]	EIRP [dBm]
802.11a		6Mbps	149	5745	SISO A	8.72	13.72	7.75	12.75
					SISO B	8.51	13.51	7.45	12.45
			161	5805	SISO A	8.23	13.23	7.50	12.50
					SISO B	8.51	13.51	7.40	12.40
			173	5865	SISO A	4.14	9.14	3.05	8.05
					SISO B	4.58	9.58	3.52	8.52
802.11n20		HT0	149	5745	SISO A	8.44	13.44	7.31	12.31
					SISO B	8.50	13.50	7.42	12.42
			161	5805	SISO A	8.46	13.46	7.34	12.34
					SISO B	8.39	13.39	7.32	12.32
			173	5865	SISO A	4.06	9.06	2.99	7.99
					SISO B	4.51	9.51	3.44	8.44
		HT8	149	5745	MIMO A+B	8.69	13.69	7.50	12.50
			161	5805	MIMO A+B	8.54	13.54	7.52	12.52
			173	5865	MIMO A+B	6.86	11.86	7.49	12.49
802.11n40		HT0	151	5755	SISO A	8.48	13.48	7.38	12.38
					SISO B	8.40	13.40	7.33	12.33
			167	5835	SISO A	8.49	13.49	7.33	12.33
					SISO B	8.42	13.42	7.35	12.35
		HT8	151	5755	MIMO A+B	8.71	13.71	5.73	10.73
			167	5835	MIMO A+B	8.64	13.64	7.52	12.52
802.11ac80		VHT0	155	5775	SISO A	8.59	13.59	7.46	12.46
					SISO B	8.42	13.42	7.30	12.30
					MIMO A+B	8.67	13.67	7.49	12.49
802.11ax/be20		MCS0	149	5745	SISO A	8.57	13.57	7.45	12.45
					SISO B	8.51	13.51	7.41	12.41
			161	5805	SISO A	8.38	13.38	7.25	12.25
					SISO B	8.41	13.41	7.32	12.32
			173	5865	SISO A	3.98	8.98	2.87	7.87
					SISO B	4.42	9.42	3.32	8.32
			149	5745	MIMO A+B	8.58	13.58	7.51	12.51
161	5805	MIMO A+B	8.61	13.61	7.39	12.39			
173	5865	MIMO A+B	6.12	11.12	7.43	12.43			
802.11ax/be40		MCS0	151	5755	SISO A	8.51	13.51	7.39	12.39
					SISO B	8.44	13.44	7.32	12.32
			167	5835	SISO A	8.51	13.51	7.37	12.37
					SISO B	8.45	13.45	7.34	12.34
			151	5755	MIMO A+B	8.62	13.62	4.98	9.98
167	5835	MIMO A+B	8.69	13.69	7.48	12.48			
802.11ax/be80		MCS0	155	5775	SISO A	8.53	13.53	7.40	12.40
					SISO B	8.46	13.46	7.34	12.34
					MIMO A+B	8.60	13.60	7.53	12.53

B.2.2 Transmitter: Permitted range of operating frequencies

Test limits

EN 300 440	Limits
4.2.3.5	The width of the power spectrum envelope is $f_H - f_L$ for a given operating frequency. In equipment that allows adjustment or selection of different operating frequencies, the power envelope takes up different positions in the allowed band. The frequency range is determined by the lowest value of f_L and the highest value of f_H resulting from the adjustment of the equipment to the lowest and highest operating frequencies. The occupied bandwidth (i.e. the bandwidth in which 99 % of the wanted emission is contained) of the transmitter shall fall within the assigned frequency band. The frequency band must be comprised between 5725 MHz to 5875 MHz

Test procedure

The conducted setups shown in section *Test & System Description* were used to verify the range of operating frequency of the EUT.

The f_L (Frequency Low) and the f_H (Frequency High) are searched with marker function; 30 kHz resolution bandwidth has been used. The antenna terminal of the EUT is connected to the spectrum through an attenuator and the spectrum analyzer reading is compensated to include the RF path loss.

Results tables

Nominal Voltage: 3.3V						Normal Condition Ambient temperature +23°C			Extreme Condition High temperature +50°C			Extreme Condition Low temperature -10°C		
Chain	Mode	Rate	Ant	#Ch	Freq (MHz)	f _L [MHz]	f _H [MHz]	f _H - f _L [MHz]	f _L [MHz]	f _H [MHz]	f _H - f _L [MHz]	f _L [MHz]	f _H [MHz]	f _H - f _L [MHz]
A	802.11a	6Mbps	SISO	149	5745	5733.73	NA	NA	5733.73	NA	NA	5733.77	NA	NA
				173	5865	NA	5874.66	140.93	NA	5874.41	140.68	NA	5874.41	140.64
	802.11n20	HT0	SISO	149	5745	5733.74	NA	NA	5733.73	NA	NA	5734.09	NA	NA
				173	5865	NA	5874.65	140.91	NA	5874.63	140.90	NA	5874.64	140.55
		HT8	MIMO	149	5745	5734.36	NA	NA	5735.00	NA	NA	5734.39	NA	NA
				173	5865	NA	5874.62	140.25	NA	5874.43	139.43	NA	5874.44	140.06
	802.11n40	HT0	SISO	151	5755	5735.93	NA	NA	5735.91	NA	NA	5736.04	NA	NA
				167	5835	NA	5854.05	118.12	NA	5854.01	118.09	NA	5853.84	117.80
		HT8	MIMO	151	5755	5736.23	NA	NA	5736.25	NA	NA	5736.50	NA	NA
				167	5835	NA	5853.52	117.29	NA	5853.52	117.27	NA	5853.55	117.04
	802.11ac80	VHT0	SISO	155	5775	5736.47	5736.47	0.00	5736.48	5736.48	0.00	5736.52	5736.52	0.00
			MIMO	155	5775	5736.68	5736.68	0.00	5736.71	5736.71	0.00	5736.73	5736.73	0.00
	802.11ax/be20	MCS0	SISO	149	5745	5733.68	NA	NA	5733.66	NA	NA	5733.63	NA	NA
				173	5865	NA	5874.76	141.08	NA	5874.78	141.12	NA	5874.77	141.14
			MIMO	149	5745	5734.55	NA	NA	5735.03	NA	NA	5734.86	NA	NA
				173	5865	NA	5874.77	140.23	NA	5874.65	139.62	NA	5874.74	139.88
	802.11ax/be40	MCS0	SISO	151	5755	5735.51	NA	NA	5735.68	NA	NA	5735.51	NA	NA
				167	5835	NA	5854.59	119.09	NA	5854.60	118.93	NA	5854.61	119.11
			MIMO	151	5755	5735.80	NA	NA	5735.84	NA	NA	5735.86	NA	NA
				167	5835	NA	5854.16	118.36	NA	5854.18	118.34	NA	5854.20	118.34
	802.11ax/be80	MCS0	SISO	155	5775	5735.83	5735.83	0.00	5735.87	5735.87	0.00	5735.90	5735.90	0.00
			MIMO	155	5775	5735.87	5735.87	0.00	5735.89	5735.89	0.00	5735.92	5735.92	0.00
B	802.11a	6Mbps	SISO	149	5745	5733.72	NA	NA	5733.75	NA	NA	5733.77	NA	NA
				173	5865	NA	5874.65	140.92	NA	5874.43	140.68	NA	5874.06	140.29
	802.11n20	HT0	SISO	149	5745	5733.49	NA	NA	5733.39	NA	NA	5733.77	NA	NA
				173	5865	NA	5874.75	141.26	NA	5874.68	141.29	NA	5874.64	140.87
		HT8	MIMO	149	5745	5734.35	NA	NA	5734.74	NA	NA	5735.39	NA	NA
				173	5865	NA	5874.76	140.41	NA	5874.63	139.90	NA	5874.66	139.27
	802.11n40	HT0	SISO	151	5755	5735.96	NA	NA	5736.20	NA	NA	5736.27	NA	NA
				167	5835	NA	5854.01	118.05	NA	5854.00	117.79	NA	5853.82	117.55
		HT8	MIMO	151	5755	5736.45	NA	NA	5736.48	NA	NA	5736.52	NA	NA
				167	5835	NA	5853.64	117.19	NA	5853.52	117.04	NA	5853.55	117.03
	802.11ac80	VHT0	SISO	155	5775	5736.47	5736.47	0.00	5736.45	5736.45	0.00	5736.71	5736.71	0.00
			MIMO	155	5775	5736.48	5736.48	0.00	5736.70	5736.70	0.00	5736.75	5736.75	0.00
	802.11ax/be20	MCS0	SISO	149	5745	5733.81	NA	NA	5734.00	NA	NA	5734.18	NA	NA
				173	5865	NA	5874.76	140.95	NA	5874.72	140.72	NA	5874.76	140.58
			MIMO	149	5745	5734.36	NA	NA	5734.77	NA	NA	5735.25	NA	NA
				173	5865	NA	5874.85	140.49	NA	5874.78	140.01	NA	5874.70	139.45
	802.11ax/be40	MCS0	SISO	151	5755	5735.54	NA	NA	5735.73	NA	NA	5735.69	NA	NA
				167	5835	NA	5854.67	119.13	NA	5854.34	118.61	NA	5854.32	118.63
			MIMO	151	5755	5735.82	NA	NA	5735.83	NA	NA	5735.87	NA	NA
				167	5835	NA	5854.23	118.41	NA	5854.17	118.35	NA	5854.19	118.32
	802.11ax/be80	MCS0	SISO	155	5775	5735.83	5735.83	0.00	5735.87	5735.87	0.00	5735.91	5735.91	0.00
			MIMO	155	5775	5735.88	5735.88	0.00	5735.89	5735.89	0.00	5735.93	5735.93	0.00

Ambient temperature +23°C						Extreme Condition High Voltage $V_{\max} = +3.465 \text{ V}$			Extreme Condition Low Voltage $V_{\min} = +3.135 \text{ V}$		
Chain	Mode	Rate	Ant	#Ch	Freq (MHz)	f_L [MHz]	f_H [MHz]	$f_H - f_L$ [MHz]	f_L [MHz]	f_H [MHz]	$f_H - f_L$ [MHz]
A	802.11a	6Mbps	SISO	149	5745	5733.73	NA	NA	5733.73	NA	NA
				173	5865	NA	5874.75	141.02	NA	5874.05	140.32
	802.11n20	HT0	SISO	149	5745	5733.70	NA	NA	5733.74	NA	NA
				173	5865	NA	5874.63	140.93	NA	5874.64	140.90
		HT8	MIMO	149	5745	5734.61	NA	NA	5735.33	NA	NA
				173	5865	NA	5874.61	140.01	NA	5874.40	139.08
	802.11n40	HT0	SISO	151	5755	5735.96	NA	NA	5736.21	NA	NA
				167	5835	NA	5854.00	118.04	NA	5854.03	117.82
		HT8	MIMO	151	5755	5736.24	NA	NA	5736.47	NA	NA
				167	5835	NA	5853.52	117.28	NA	5853.71	117.24
	802.11ac80	VHT0	SISO	155	5775	5736.45	5736.45	0.00	5736.50	5736.50	0.00
			MIMO		5775	5736.68	5736.68	0.00	5736.70	5736.70	0.00
	802.11ax/be20	MCS0	SISO	149	5745	5733.81	NA	NA	5733.52	NA	NA
				173	5865	NA	5874.71	140.90	NA	5874.70	141.18
			MIMO	149	5745	5735.05	NA	NA	5734.91	NA	NA
				173	5865	NA	5874.64	139.59	NA	5874.64	139.74
	802.11ax/be40	MCS0	SISO	151	5755	5735.42	NA	NA	5735.76	NA	NA
				167	5835	NA	5854.68	119.25	NA	5854.26	118.50
			MIMO	151	5755	5735.83	NA	NA	5735.87	NA	NA
				167	5835	NA	5854.17	118.35	NA	5854.15	118.29
	802.11ax/be80	MCS0	SISO	155	5775	5735.86	5735.86	0.00	5735.87	5735.87	0.00
			MIMO		5775	5735.88	5735.88	0.00	5735.89	5735.89	0.00
B	802.11a	6Mbps	SISO	149	5745	5733.73	NA	NA	5734.35	NA	NA
				173	5865	NA	5874.67	140.94	NA	5874.64	140.28
	802.11n20	HT0	SISO	149	5745	5733.73	NA	NA	5734.37	NA	NA
				173	5865	NA	5874.74	141.01	NA	5874.40	140.03
		HT8	MIMO	149	5745	5734.62	NA	NA	5735.02	NA	NA
				173	5865	NA	5874.74	140.13	NA	5874.75	139.73
	802.11n40	HT0	SISO	151	5755	5735.91	NA	NA	5736.23	NA	NA
				167	5835	NA	5854.01	118.10	NA	5854.01	117.78
		HT8	MIMO	151	5755	5736.47	NA	NA	5736.48	NA	NA
				167	5835	NA	5853.75	117.29	NA	5853.52	117.03
	802.11ac80	VHT0	SISO	155	5775	5736.46	5736.46	0.00	5736.49	5736.49	0.00
			MIMO		5775	5736.67	5736.67	0.00	5736.70	5736.70	0.00
	802.11ax/be20	MCS0	SISO	149	5745	5733.84	NA	NA	5733.74	NA	NA
				173	5865	NA	5874.78	140.94	NA	5874.72	140.98
			MIMO	149	5745	5734.83	NA	NA	5735.07	NA	NA
				173	5865	NA	5874.70	139.87	NA	5874.68	139.62
	802.11ax/be40	MCS0	SISO	151	5755	5735.67	NA	NA	5735.76	NA	NA
				167	5835	NA	5854.33	118.66	NA	5854.30	118.54
			MIMO	151	5755	5735.79	NA	NA	5735.86	NA	NA
				167	5835	NA	5854.23	118.43	NA	5854.19	118.33
	802.11ax/be80	MCS0	SISO	155	5775	5735.83	5735.83	0.00	5735.84	5735.84	0.00
			MIMO		5775	5735.88	5735.88	0.00	5735.89	5735.89	0.00

B.2.3 Transmitter: Unwanted Emissions in the spurious domain (radiated)

Standard references

EN 300 440	Limits			
4.2.4.4	The maximum power limits of any unwanted emissions in the spurious domain are given in table below			
	Frequency ranges	47 MHz to 74 MHz 87.5 MHz to 108 MHz 174 MHz to 230 MHz 470 MHz to 862 MHz	Other frequencies ≤ 1 000 MHz	Frequencies > 1 000 MHz
	State			
	Operating	4 nW (-54 dBm)	250 nW (-36 dBm)	1 µW (-30 dBm)
	Standby	2 nW (-57 dBm)	2 nW (-57 dBm)	20 nW (-47 dBm)
	Note: the Standby mode correspond to the receiver mode			

Test procedure

The radiated setups shown in section *Test & System Description* were used to measure the transmission spurious emissions. Depending of the frequency range and bands being tested, different antennas and filters were used, in consequence different setups are employed.

The final measurement is done by varying the antenna height, the EUT azimuth over 360° and for both Vertical and Horizontal polarizations.

The radiated spurious emission was measured on the worst case configuration on one channel for each transmission mode.

According to ETSI EN 300 440, the device under test shall be configured to operate under its worst-case condition. In order to determine the worst case, a comprehensive evaluation was performed by varying all available bandwidths and operational modes. The results indicated that the narrowest bandwidth (20 MHz) represents the worst case, as it resulted in the lowest margins to the applicable spurious emission limits. Radiated spurious emissions were measured on the lowest and highest channels.

For the 20 MHz bandwidth, only the operational modes identified as worst-case were retained and reported in this test report.

Test Results**Tx Spurious Emissions - 25 MHz – 1 GHz****Tx Spurious Emissions – All modes**

Frequency	Level	Detector	Limit (e.i.r.p)	Margin	Polar
769.9	-64.1	Quasi-Peak	-51.9	12.2	V

Note 1: The spurious signals detected do not depend on either the operating channel or the modulation mode.

Tx Spurious Emissions – 1 GHz to 40 GHz**Tx Spurious Emissions – 802.11n20 (SISO A), CH169**

Frequency	Level	Detector	Limit	Margin	Polar
MHz	dBm	---	dBm	dB	---
10440.0	-45.2	RMS	-27.9	17.3	V
11689.7	-56.2	RMS	-27.9	28.3	V
23370.0	-53.0	RMS	-27.9	25.1	V

Tx Spurious Emissions – 802.11ax/be20 (SISO B), CH157

Frequency	Level	Detector	Limit	Margin	Polar
MHz	dBm	---	dBm	dB	---
10647.5	-45.1	RMS	-27.9	17.2	V
23107.0	-43.6	RMS	-27.9	15.7	V
23107.0	-45.6	RMS	-27.9	17.7	V

Tx Spurious Emissions – 802.11ax/be20 (MIMO A+B), CH157

Frequency	Level	Detector	Limit	Margin	Polar
MHz	dBm	---	dBm	dB	---
10580.0	-46.0	RMS	-27.9	18.1	V
23107.5	-51.1	RMS	-27.9	23.2	V

B.2.4 Adjacent channel selectivity

Test limits

EN 300 440	Limits
4.3.4.4	The adjacent channel selectivity of the equipment under specified conditions shall not be less than -30 dBm + k. The correction factor, k, is as follows: $k = -20\log f - 10\log BW$ Where: - f is the frequency in GHz; - BW is the channel bandwidth in MHz. The factor k is limited within the following: - - 40dB < k < 0 dB. The measured adjacent channel selectivity shall be stated in the test report.

Test conditions

The test has been conducted in normal test condition.

The general performance criteria for the receiver shall produce after demodulation, a message acceptance ratio of 80 %.

Test procedure

The adjacent channel selectivity setup shown in section *Test & System Description* was used to measure adjacent channel selectivity signal. The signaling Unit in our case is the CMW500.

The packet error rate (PER) is measured with CMW500. The blocking signal is emulated by the Signal generator SMW200A.

Result tables

Configuration tested: 802.11a, Chain A, Channel 149 (5745MHz), 6Mbps.

• **Minimum performance result without interferer**

Wanted signal mean power from companion device: Pmin [dBm]	PER [%]
-87.00	9.70

• **Minimum performance results with interferer**

Wanted signal mean power from companion device:

✓ Pmin [dBm] + 3dB = -84.00 dBm

Blocking signal Frequency (MHz)	Minimum Blocking signal power (dBm)	PER (%)	Maximum Blocking signal power (dBm)	PER (%)	Verdict
5805	-53.29	0.00	-35.00	10.40	PASS
5765	-53.23	0.00	-35.100	15.60	PASS

B.2.5 Blocking or desensitization

Test limits

EN 300 440	Limits								
4.3.4.4	The blocking level, for any frequency within the specified ranges, shall not be less than the values given in table 6, except at frequencies on which spurious responses are found.								
	Table 6: Limits for blocking desensitization								
	<table><tr><th>Receiver category</th><th>Limit</th></tr><tr><td>1</td><td>-30 dBm + k</td></tr><tr><td>2</td><td>-45 dBm + k</td></tr><tr><td>3</td><td>-60 dBm + k</td></tr></table>	Receiver category	Limit	1	-30 dBm + k	2	-45 dBm + k	3	-60 dBm + k
	Receiver category	Limit							
	1	-30 dBm + k							
	2	-45 dBm + k							
	3	-60 dBm + k							
	The correction factor, <i>k</i> , is as follows:								
	$k = -20\log f - 10\log BW$								
	Where:								
- <i>f</i> is the frequency in GHz; - <i>BW</i> is the channel bandwidth in MHz.									
The factor k is limited within the following:									
- - 40dB < <i>k</i> < 0 dB.									
The measured blocking level shall be stated in the test report.									

Test conditions

The test has been conducted in normal test condition.

The General performance criteria for the receiver shall produce after demodulation, a message acceptance ratio of 80 %.

Test procedure

The receiver blocking setup shown in section *Test & System Description* was used to measure receiver blocking signal. The signaling Unit in our case is the CMW500.

The packet error rate (PER) is measured with CMW500. The blocking signal is emulated by the Signal generator SMW200.

Result tables

Configuration tested: 802.11a, Chain A, Channel 157 (5785MHz), 6Mbps.

- Minimum performance result without interfering**

Wanted signal mean power from companion device: Pmin [dBm]	PER [%]
-87.00	9.70

- Minimum performance results with interferer**

Wanted signal mean power from companion device:

✓ Pmin [dBm] + 3dB = -84.00dBm

Blocking signal Frequency (MHz)	Minimum Blocking signal power (dBm)	PER (%)	Maximum Blocking signal power (dBm)	PER (%)	Verdict
4775	-51.59	0.00	-17.00	19.50	PASS
5375	-52.62	0.00	-25.00	11.50	PASS
5575	-52.94	0.30	-26.00	5.40	PASS
5995	-53.57	0.20	-26.00	7.00	PASS
6195	-53.85	0.20	-23.00	10.70	PASS
6795	-54.65	0.20	-19.00	8.20	PASS

B.2.6 Receiver: Spurious emissions (radiated)

Test limits

EN 300 440	Limits		
4.3.5.4	The power of any spurious emission shall not exceed the following values given in table below		
	Frequency ranges	Other frequencies 25 MHz to 1 000 MHz	Frequencies > 1 000 MHz
	State		
	Limit	2 nW (-57 dBm)	20 nW (-47 dBm)

Test procedure

The radiated setups shown in section *Test & System Description* were used to measure the receiver spurious emissions. Depending of the frequency range and bands being tested, different antennas and filters were used; in consequence different setups are employed.

The final measurement is done by varying the antenna height, the EUT azimuth over 360° and for both Vertical and Horizontal polarizations.

The radiated spurious emission was measured on the worst-case configuration on one channel for each transmission mode.

Test Results Rx**Rx Spurious Emissions – 25 MHz to 40GHz****Rx Spurious Emissions – 802.11a/n20 (MIMO), Chain A+B, CH169**

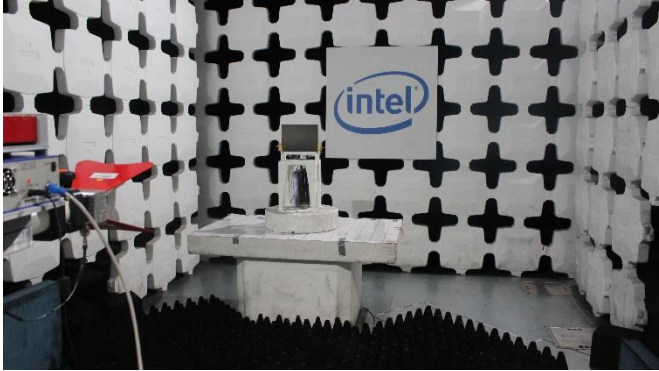
Frequency	Level	Detector	Limit	Margin	Polar
MHz	dBm	---	dBm	dB	---
423.9	-66.3	Quasi-Peak	-54.9	11.4	H

Rx Spurious Emissions – 802.11a/n20 (MIMO), Chain A+B, CH169

Frequency	Level	Detector	Limit	Margin	Polar
MHz	dBm	---	dBm	dB	---
10733.7	-58.2	RMS	-44.9	13.3	V
23380.0	-4840.0	RMS	-44.9	3.1	V

Annex C. Photographs

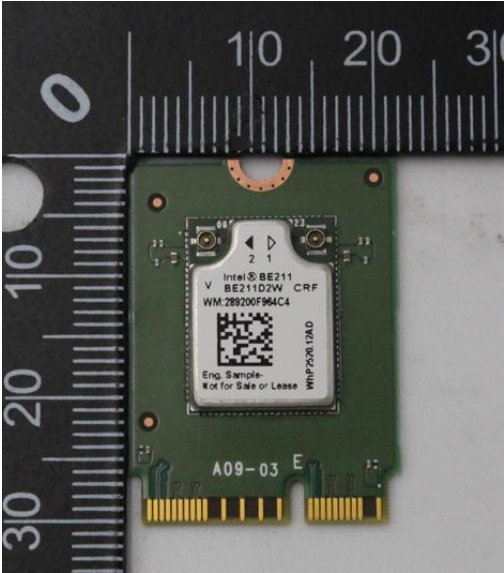
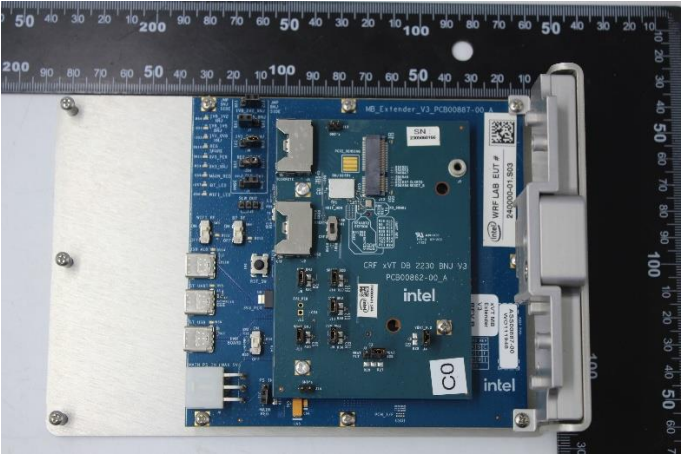
C.1 Test Setup

Radiated Setup 25 MHz – 1 GHz (Transmitter tests) 	Radiated Setup 1 GHz – 11 GHz (Transmitter tests) 
Radiated Setup 11 GHz – 40 GHz (Transmitter tests) 	

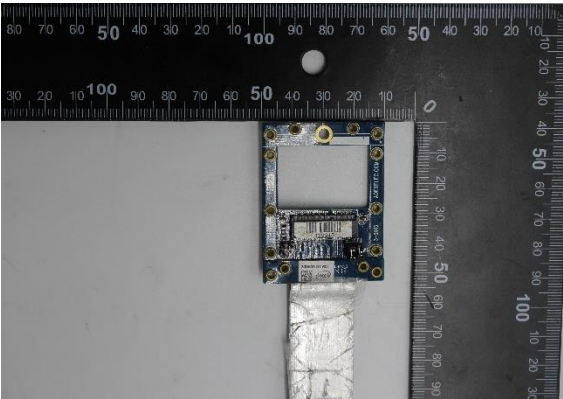
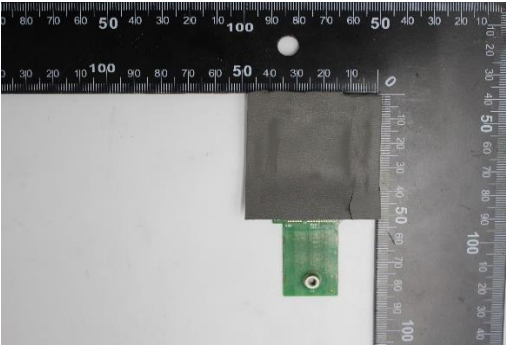
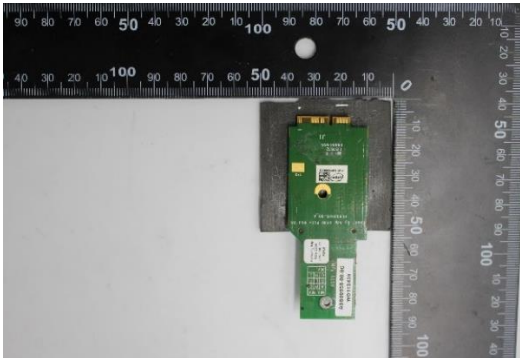
Radiated Setup 25 MHz – 1 GHz (Receiver tests)  A photograph of a test chamber interior. The walls are covered with white, cross-shaped electromagnetic absorbers. A blue and white antenna is mounted on a stand in the center. An orange safety cage is visible on the right side. The Intel logo is on the back wall.	Radiated Setup 1 GHz – 11 GHz (Receiver tests)  A photograph of a test chamber interior, similar to the first one. It shows the same white cross-shaped absorbers and the Intel logo on the back wall. A different antenna setup is visible, and a red object is on the left.
Radiated Setup 11 GHz – 40 GHz (Receiver tests)  A photograph of a test chamber interior. The walls are covered with white, cross-shaped electromagnetic absorbers. A blue antenna is mounted on a stand in the center. The Intel logo is on the back wall.	

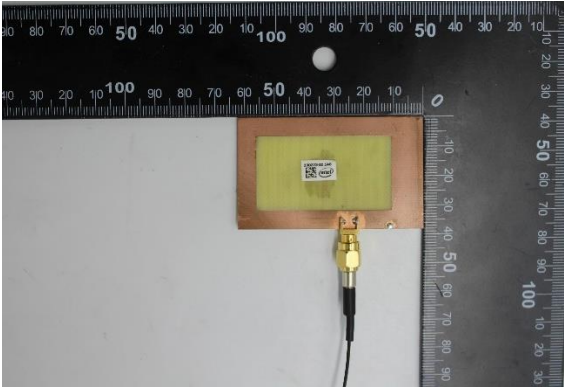
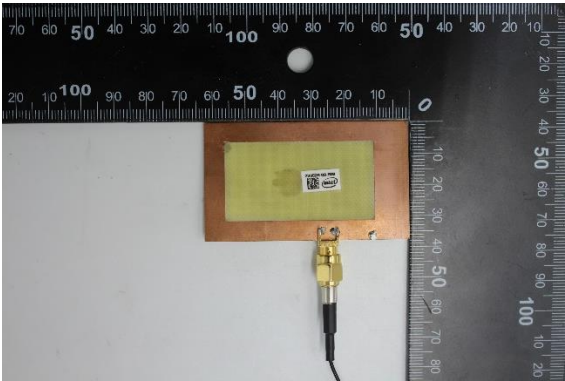
C.2 Test Sample

Sample #01

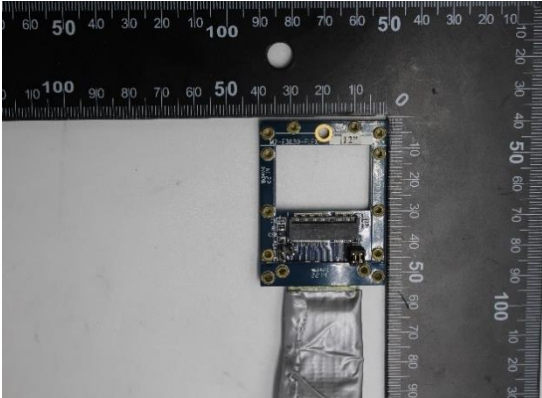
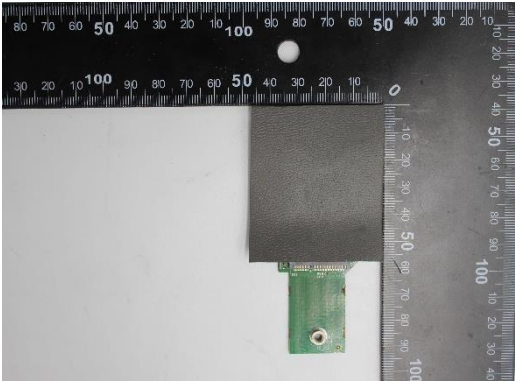
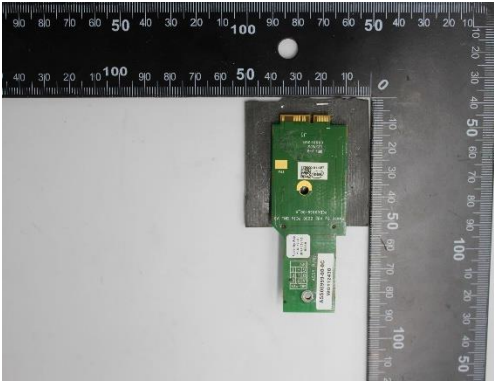
Module Front	Module Back
	
Extender board	Laptop
	

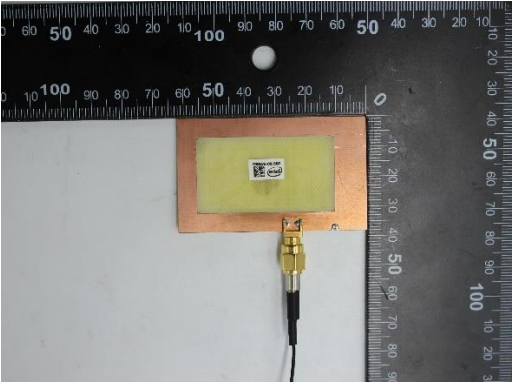
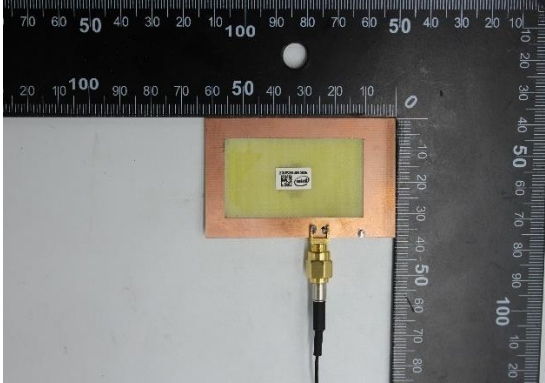
Sample #02

Module Front	Module Back
	
Extender board	Laptop
	
Adaptor Front	Adaptor Back
	

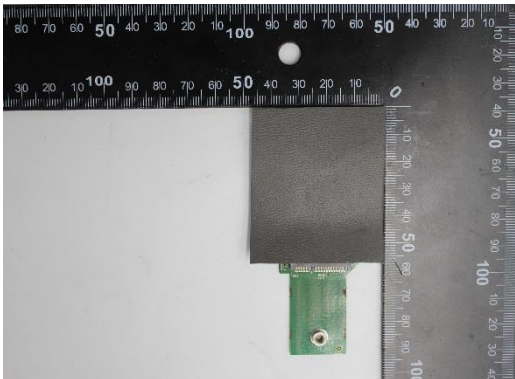
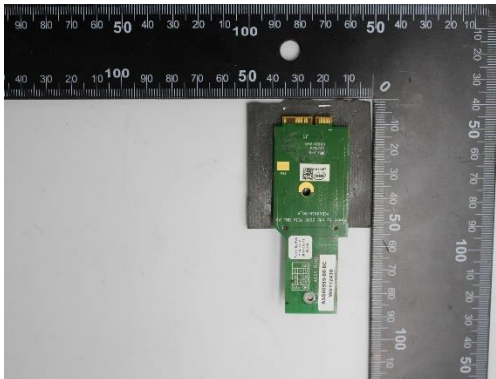
PIFA antenna (Main)	PIFA antenna (Aux)
	

Sample #03

Module Front	Module Back
	
Extender board	Laptop
	
Adaptor Front	Adaptor Back
	

PIFA antenna (Main)	PIFA antenna (Aux)
	

Sample #04

Module Front	Module Back
	
Adaptor Front	Adaptor Back
	
Laptop Rx (Host)	
	

End of the report

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