



N° 1-6736  
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# PARTIAL TEST REPORT

|                        |                                                                  |
|------------------------|------------------------------------------------------------------|
| EUT Description        | WLAN and BT, 2x2 PCIe M.2 2230 adapter card                      |
| Brand Name             | Intel® Wi-Fi 6 AX201                                             |
| Model Name             | AX201NGW                                                         |
| Date of Test Start/End | 2024-07-24 / 2024-08-09                                          |
| Features               | 802.11ax, Dual Band, 2x2 Wi-Fi + Bluetooth® 5<br>(see section 5) |

|                      |                                                      |
|----------------------|------------------------------------------------------|
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|                     |                                           |
|---------------------|-------------------------------------------|
| Reference Standards | ETSI EN 300 440 v2.2.1<br>(see section 1) |
|---------------------|-------------------------------------------|

|                            |                                                                                                    |
|----------------------------|----------------------------------------------------------------------------------------------------|
| Test Report identification | 231218-04.TR01                                                                                     |
| Revision Control           | Rev. 01<br>This test report revision replaces any previous test report revision<br>(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.

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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 | 24.6°C ± 2.6°C |
| Humidity    | 45% ± 10%      |

#### 4. Test samples

| Sample | Control #     | Description        | Model          | Serial #     | Date of receipt | Note                                       |
|--------|---------------|--------------------|----------------|--------------|-----------------|--------------------------------------------|
| #01    | 201210-02.S17 | WiFi 6 Module      | AX201NGW       | 3413E8E4EF8A | 2021-01-18      | Conducted Tests                            |
|        | 180717-03.S15 | EXTENDER           | PCB00651_01    | 6510818-127  | 2018-08-21      |                                            |
|        | 210903-02.S52 | Laptop             | DELL E5450     | GTXV562      | 2021-06-10      |                                            |
| #02    | 201210-02.S14 | RF Module          | AX201NGW       | 3413E8E4FED0 | 21-01-2021      | Used for Radiated Spurious Emissions tests |
|        | 220225-03.S07 | Microwave Absorber | Eccosorb BSR-1 | -            | 2022-03-14      |                                            |
|        | 200928-02.S11 | Adaptor            | M2 Adaptor     | 6961919-172  | 2020-10-27      |                                            |
|        | 220915-09.S01 | Extender           | ADEXELEC       | -            | 2022-04-06      |                                            |
|        | 200611-03.S30 | Laptop             | Latitude 5401  | 6DJLK13      | 2020-08-19      |                                            |
|        | 230223-02.S47 | Triband Antenna    | -              | 005          | 2023-04-20      |                                            |
|        | 230223-02.S48 | Triband Antenna    | -              | 006          | 2023-04-20      |                                            |

## 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® Wi-Fi 6 AX201                                                                                                               |                      |                      |
| Model Name          | AX201NGW                                                                                                                           |                      |                      |
| Software Version    | DRTU.22.21040.0.0-OEM.DRTU.11758                                                                                                   |                      |                      |
| Driver Version      | 99.0.62.2                                                                                                                          |                      |                      |
| Supported Radios    | <div>802.11b/g/n/ax 2.4GHz</div> <div>802.11a/n/ac/ax 5.2GHz</div> <div>5.6GHz</div> <div>5.8GHz</div> <div>Bluetooth 2.4GHz</div> |                      |                      |
| Antenna Information | Transmitter                                                                                                                        | Main/Chain A/Chain1  | Aux/Chain B/Chain 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                   | +5                   |

## 6. Remarks and comments

1. According to the standard ETSI EN 300 440 v2.2.1 , and the applicant declaration, the device AX201NGW operating in 802.11a/n/ac/ax mode is considered as a receiver category 2.
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 tests except Equivalent Isotropically radiated power (e.i.r.p.) (4.2.2) were carried out at higher Tx Power: +8dB vs nominal declared power.
4. At customer request, all normal condition tests were carried out at tune up power (+0.5dB) Vs device setting
5. At customer request, only channels 161, 167, and 173 were tested.

## 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

| 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<br>R. LUCIANI | First Issue                                 |
| Rev. 01    | Z.OUACHICHA             | Remove 802.11be mode, upon customer request |

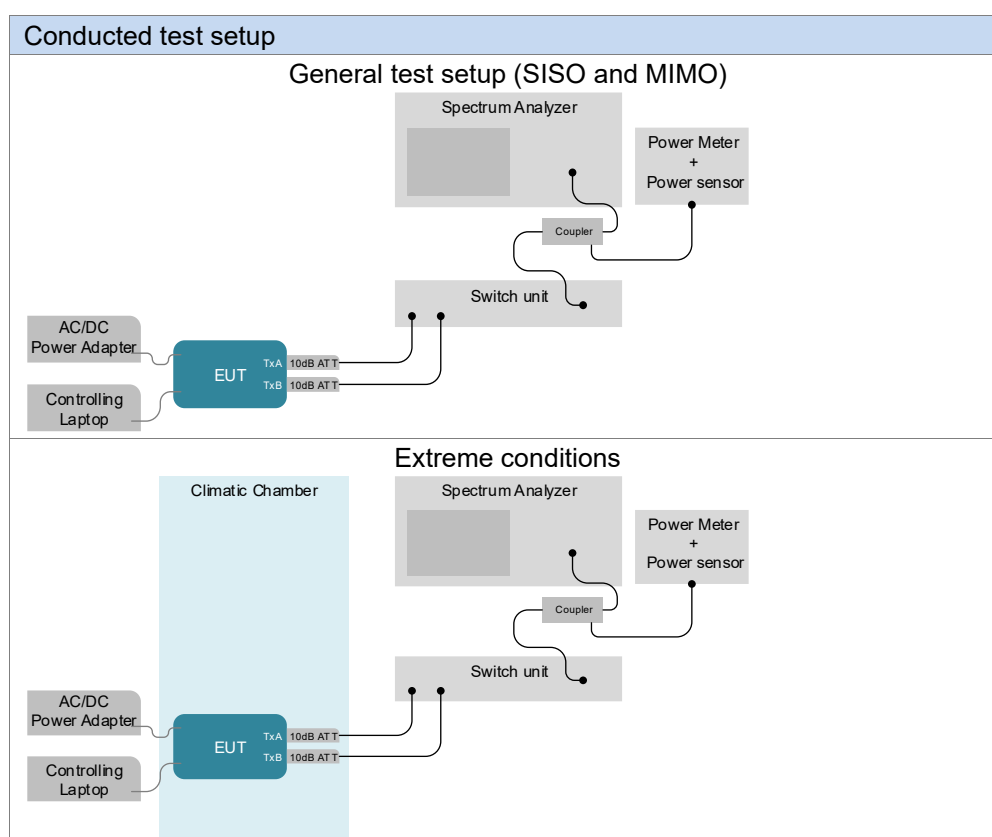
# Annex A. Test & System Description

## 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.

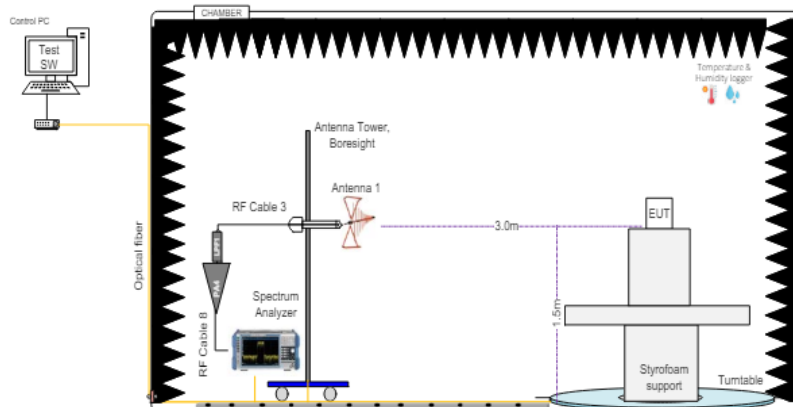
The DUT was installed in a test fixture and this test fixture is connected to a laptop computer and AC/DC power adapter. The laptop computer was used to configure the EUT to continuously transmit at a specified output power using all different modes and modulation schemes, using the Intel proprietary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

Setups for conducted and radiated measurements are shown below.

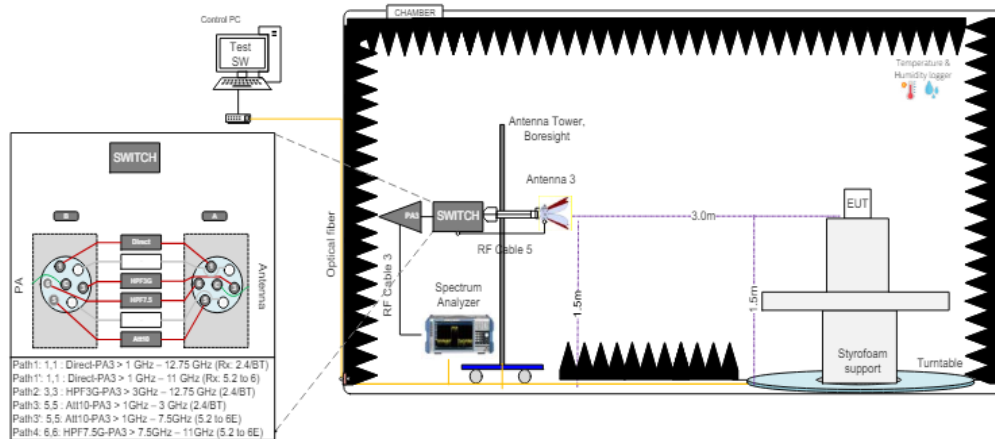


## Radiated test setup

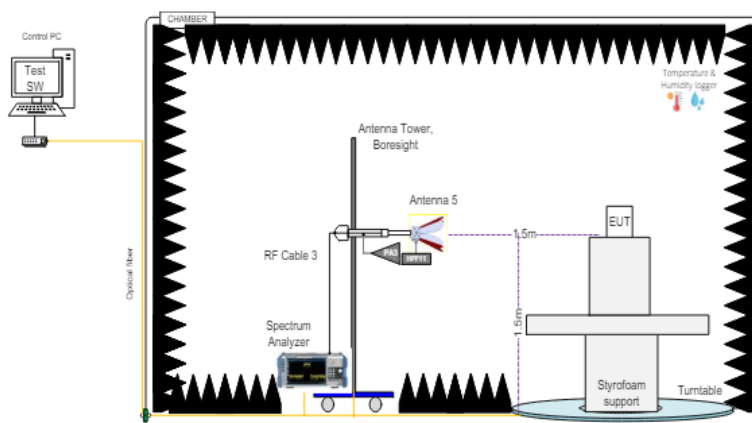
### Radiated Setup 25 MHz - 1 GHz



### Radiated Setup 1 GHz – 11 GHz



### Radiated Setup 11 GHz – 40GHz



## A.2 Test Equipment List

Conducted Setup

| ID#     | Device                    | Type/Model    | Serial #     | Manufacturer    | Cal. Date  | Cal. Due Date |
|---------|---------------------------|---------------|--------------|-----------------|------------|---------------|
| 134-000 | Spectrum Analyzer         | FSV30         | 103308       | Rohde & Schwarz | 2023-07-26 | 2025-07-26    |
| 019-003 | SMA-SMA 100cm Cable       | FLC-1M-SMSM+  | 21112742     | Mini-Circuits   | 2024-02-21 | 2025-02-21    |
| 019-004 | Attenuator 10dB + SMA-MH4 | 3M-6          | 3M-6         | WEINSCHL        | 2024-02-21 | 2025-02-21    |
| 133-000 | Oscilloscope              | RTE1052       | 101135       | Rohde & Schwarz | 2024-03-04 | 2026-03-04    |
| 363-000 | Temp & Humidity Logger    | RA12E-TH1-RAS | RA12-D0EB1A  | AVITECH         | 2023-09-28 | 2025-09-28    |
| 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           |
| 060-000 | Digital Multimeter        | 34401A        | US36054685   | HP              | 2022-11-29 | 2024-11-29    |
| 122-000 | Climatic chamber          | LHU-113       | 1012-00-5753 | ESPEC           | 2022-09-14 | 2024-09-14    |
| 281-000 | Thermometer               | t3000FC       | 46320036     | Fluke           | 2024-04-17 | 2026-04-17    |

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    |
| 006-008 | Measurement SW, v11.30     | EMC32         | 100623        | Rohde & Schwarz     | N/A        | N/A           |
| 349-000 | Temp & Humidity Logger     | RA12E-TH1-RAS | RA12-D4F8C3   | Avtech              | 2023-11-30 | 2025-11-30    |
| 006-001 | Turn Table                 | ETS           | -             | ETS-Lindgren        | N/A        | N/A           |
| 006-011 | Boresight antenna mast     | BAM 4.0-P     | P/278/2890.01 | Maturo              | N/A        | N/A           |
| 057-000 | Double Horn Ridged antenna | 3117          | 167062        | ETS-Lindgren        | 2024-07-23 | 2026-07-23    |
| 058-000 | Double Horn Ridged antenna | 3116C         | 157511        | ETS-Lindgren        | 2022-10-21 | 2024-10-21    |
| 147-000 | Spectrum analyzer          | FSW43         | 101847        | Rohde & Schwarz     | 2022-11-30 | 2024-11-30    |
| 261-000 | Amplifier 1GHz-18GHz       | 3117-PA       | 00157993      | ETS-Lindgren        | 2024-03-14 | 2025-03-14    |
| 502-006 | Amplifier 0.5GHz-40GHz     | DEPA0540-43   | 2023A05       | Diamond Engineering | 2024-03-19 | 2025-03-19    |
| 009-007 | RF Filter                  | ZHSS-k11G+    | 8493 1831830  | Mini-Circuits       | 2024-03-19 | 2025-03-19    |
| 006-068 | RF Switch                  | RC-2SP6T-40   | 02112090061   | Micro-Circuits      | 2024-03-14 | 2025-03-14    |
| 006-066 | Cable 7m – 25MHz to 40GHz  | R286304174    | 20.46.370     | Radiall             | 2024-03-14 | 2025-03-14    |
| 006-063 | Cable 30cm – 1GHz to 40GHz | PE371-12      | -             | Pasternack          | 2024-03-14 | 2025-03-14    |
| 006-064 | Cable 30cm – 1GHz to 40GHz | PE371-12      | -             | Pasternack          | 2024-03-14 | 2025-03-14    |
| 006-065 | Cable 60cm – 25MHz to 1GHz | PE300-24      | -             | Pasternack          | 2024-03-12 | 2025-03-12    |
| 098-000 | generator                  | SMW200A       | 1037732       | Rohde & Schwarz     | 2022-09-14 | 2024-09-14    |
| 291-000 | Multimeter                 | 2000          | 4009301       | KEITHLEY            | 2024-04-03 | 2026-04-03    |
| 006-015 | Biconical antenna          | 3110C         | 161548        | ETS-Lindgren        | 2023-03-03 | 2025-03-03    |
| 006-017 | Log-Periodic antenna       | 3148B         | 166243        | ETS-Lindgren        | 2023-07-14 | 2025-07-14    |
| 007-007 | Double Ridge Horn          | 3117          | 00152266      | ETS Lindgren        | 2024-03-26 | 2026-03-26    |
| 054-000 | Horn Antenna               | 3116C         | 146357        | ETS Lindgren        | 2024-03-26 | 2026-03-26    |

## 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 | 2023-04-21 | 2025-04-21    |
| 061-000 | Power Sensor           | NRP-Z81    | 104386   | Rohde & Schwarz | 2024-04-09 | 2026-04-09    |
| 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                            | $\pm 6.18$  | $\pm 10$  | ppm  |
| RF Output Power, (conducted)                   | $\pm 0.99$  | $\pm 1.5$ | dB   |
| Radiated emission of transmitter < 1GHz        | $\pm 4.03$  | $\pm 6$   | dB   |
| Radiated emission of transmitter 1GHz - 40 GHz | $\pm 5.09$  | $\pm 8$   | dB   |
| Radiated emission of receiver < 1GHz           | $\pm 4.03$  | $\pm 6$   | dB   |
| Radiated emission of receiver 1GHz - 40 GHz    | $\pm 5.09$  | $\pm 8$   | dB   |
| Temperature                                    | $\pm 0.3$   | $\pm 1$   | °C   |
| Humidity                                       | $\pm 2.3$   | $\pm 5$   | %    |

# 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) | R. SIMONINI    |
| Blocking or desensitization                                       | A. SANGONO     |
| Receiver: Spurious emissions (radiated)                           | R. SIMONINI    |

## 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, 802.11ax20 (20 MHz channel bandwidth), 802.11n40, 802.11ax40(40MHz channel bandwidth), 802.11ac80, 802.11ax80 (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 | 20              | MCS0                 |
|              |          | 40              | MCS0                 |
|              |          | 80              | MCS0                 |
| MIMO         | 802.11n  | 20/40           | HT8                  |
|              | 802.11ac | 80              | VHT0                 |
|              | 802.11ax | 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) | Non-specific short range devices |
|                | 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<br>Nominal voltage:3.3V |                            |      |     |               |             | Normal Condition<br>Ambient<br>temperature<br>+23°C |               | Extreme Condition<br>High temperature<br>+70°C |               | Extreme Condition<br>Low temperature<br>-10°C |               |
|------------------------------|----------------------------|------|-----|---------------|-------------|-----------------------------------------------------|---------------|------------------------------------------------|---------------|-----------------------------------------------|---------------|
| Mode                         | Meas<br>Duty<br>cycle<br>% | Rate | #Ch | Freq<br>[MHz] | Antenna     | Measured<br>Conducted<br>[dBm]                      | EIRP<br>[dBm] | Measured<br>Conducted<br>[dBm]                 | EIRP<br>[dBm] | Measured<br>Conducted<br>[dBm]                | EIRP<br>[dBm] |
| 802.11a                      | 97.8                       | 6    | 161 | 5805          | SISO A      | 8.85                                                | 13.85         | 8.24                                           | 13.24         | 8.53                                          | 13.53         |
|                              |                            |      |     |               | SISO B      | 8.85                                                | 13.85         | 8.37                                           | 13.37         | 8.53                                          | 13.53         |
|                              |                            |      | 173 | 5865          | SISO A      | 5.27                                                | 10.27         | 4.71                                           | 9.71          | 5.12                                          | 10.12         |
|                              |                            |      |     |               | SISO B      | 5.46                                                | 10.46         | 4.85                                           | 9.85          | 5.12                                          | 10.12         |
| 802.11n20                    | 98.8                       | HT0  | 161 | 5805          | SISO A      | 8.86                                                | 13.86         | 8.30                                           | 13.30         | 8.61                                          | 13.61         |
|                              |                            |      |     |               | SISO B      | 8.84                                                | 13.84         | 8.34                                           | 13.34         | 8.61                                          | 13.61         |
|                              |                            |      | 173 | 5865          | SISO A      | 5.06                                                | 10.06         | 4.47                                           | 9.47          | 4.98                                          | 9.98          |
|                              |                            |      |     |               | SISO B      | 5.22                                                | 10.22         | 4.57                                           | 9.57          | 4.98                                          | 9.98          |
|                              | 99.4                       | HT8  | 161 | 5805          | MIMO<br>A+B | 8.89                                                | 13.89         | 8.39                                           | 13.39         | 8.60                                          | 13.60         |
|                              |                            |      | 173 | 5865          | MIMO<br>A+B | 5.14                                                | 10.14         | 4.66                                           | 9.66          | 4.75                                          | 9.75          |
| 802.11n40                    | 98.8                       | HT0  | 167 | 5835          | SISO A      | 8.94                                                | 13.94         | 8.40                                           | 13.40         | 8.60                                          | 13.60         |
|                              |                            |      |     |               | SISO B      | 8.83                                                | 13.83         | 8.24                                           | 13.24         | 8.60                                          | 13.60         |
|                              | 98.8                       | HT8  | 167 | 5835          | MIMO<br>A+B | 8.80                                                | 13.80         | 8.37                                           | 13.37         | 8.26                                          | 13.26         |
| 802.11ax20                   | 98.8                       | MCS0 | 161 | 5805          | SISO A      | 8.76                                                | 13.76         | 8.39                                           | 13.39         | 8.64                                          | 13.64         |
|                              |                            |      |     |               | SISO B      | 8.87                                                | 13.87         | 8.30                                           | 13.30         | 8.64                                          | 13.64         |
|                              |                            |      | 173 | 5865          | SISO A      | 4.93                                                | 9.93          | 4.33                                           | 9.33          | 4.82                                          | 9.82          |
|                              |                            |      |     |               | SISO B      | 4.97                                                | 9.97          | 4.36                                           | 9.36          | 4.82                                          | 9.82          |
|                              | 99.4                       |      | 161 | 5805          | MIMO<br>A+B | 8.82                                                | 13.82         | 8.34                                           | 13.34         | 8.37                                          | 13.37         |
|                              |                            |      | 173 | 5865          | MIMO<br>A+B | 4.54                                                | 9.54          | 4.25                                           | 9.25          | 4.14                                          | 9.14          |
| 802.11ax40                   | 98.8                       | MCS0 | 167 | 5835          | SISO A      | 8.89                                                | 13.89         | 8.37                                           | 13.37         | 8.65                                          | 13.65         |
|                              |                            |      |     |               | SISO B      | 8.85                                                | 13.85         | 8.28                                           | 13.28         | 8.65                                          | 13.65         |
|                              | 98.8                       |      | 167 | 5835          | MIMO<br>A+B | 8.91                                                | 13.91         | 8.45                                           | 13.45         | 8.38                                          | 13.38         |

| EIRP<br>Ambient Temperature: +23°C |                            |      |     |               |             | Extreme Condition<br>High Voltage<br>Vmax = +3.465V |               | Extreme Condition<br>Low voltage<br>Vmin = +3.135V |               |
|------------------------------------|----------------------------|------|-----|---------------|-------------|-----------------------------------------------------|---------------|----------------------------------------------------|---------------|
| Mode                               | Meas<br>Duty<br>cycle<br>% | Rate | #Ch | Freq<br>[MHz] | Antenna     | Measured<br>Conducted<br>[dBm]                      | EIRP<br>[dBm] | Measured<br>Conducted<br>[dBm]                     | EIRP<br>[dBm] |
| 802.11a                            | 97.8                       | 6    | 161 | 5805          | SISO A      | 8.41                                                | 13.41         | 8.51                                               | 13.51         |
|                                    |                            |      |     |               | SISO B      | 8.92                                                | 13.92         | 8.92                                               | 13.92         |
|                                    |                            |      | 173 | 5865          | SISO A      | 3.81                                                | 8.81          | 3.83                                               | 8.83          |
|                                    |                            |      |     |               | SISO B      | 5.44                                                | 10.44         | 5.44                                               | 10.44         |
| 802.11n20                          | 98.8                       | HT0  | 161 | 5805          | SISO A      | 8.51                                                | 13.51         | 8.51                                               | 13.51         |
|                                    |                            |      |     |               | SISO B      | 8.83                                                | 13.83         | 8.83                                               | 13.83         |
|                                    |                            |      | 173 | 5865          | SISO A      | 3.73                                                | 8.73          | 3.83                                               | 8.83          |
|                                    |                            |      |     |               | SISO B      | 5.13                                                | 10.13         | 5.13                                               | 10.13         |
|                                    | 99.4                       | HT8  | 161 | 5805          | MIMO<br>A+B | 8.37                                                | 13.37         | 8.33                                               | 13.33         |
|                                    |                            |      | 173 | 5865          | MIMO<br>A+B | 4.89                                                | 9.89          | 4.84                                               | 9.84          |
| 802.11n40                          | 98.8                       | HT0  | 167 | 5835          | SISO A      | 8.43                                                | 13.43         | 8.44                                               | 13.44         |
|                                    |                            |      |     |               | SISO B      | 8.88                                                | 13.88         | 8.88                                               | 13.88         |
|                                    | 98.8                       | HT8  | 167 | 5835          | MIMO<br>A+B | 8.31                                                | 13.31         | 8.27                                               | 13.27         |
| 802.11ax20                         | 98.8                       | MCS0 | 161 | 5805          | SISO A      | 8.39                                                | 13.39         | 8.39                                               | 13.39         |
|                                    |                            |      |     |               | SISO B      | 8.88                                                | 13.88         | 8.88                                               | 13.88         |
|                                    |                            |      | 173 | 5865          | SISO A      | 3.44                                                | 8.44          | 3.39                                               | 8.39          |
|                                    |                            |      |     |               | SISO B      | 4.70                                                | 9.70          | 4.70                                               | 9.70          |
|                                    | 99.4                       |      | 161 | 5805          | MIMO<br>A+B | 8.25                                                | 13.25         | 8.26                                               | 13.26         |
|                                    |                            |      | 173 | 5865          | MIMO<br>A+B | 4.43                                                | 9.43          | 4.46                                               | 9.46          |
| 802.11ax40                         | 98.8                       | MCS0 | 167 | 5835          | SISO A      | 8.54                                                | 13.54         | 8.55                                               | 13.55         |
|                                    |                            |      |     |               | SISO B      | 8.84                                                | 13.84         | 8.84                                               | 13.84         |
|                                    | 98.8                       |      | 167 | 5835          | MIMO<br>A+B | 8.24                                                | 13.24         | 8.25                                               | 13.25         |

## B.2.2 Transmitter: Permitted range of operating frequencies

### Test limits

| EN 300 440 | Limits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4.2.3.5    | <p>The width of the power spectrum envelope is <math>f_H - f_L</math> 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 <math>f_L</math> and the highest value of <math>f_H</math> resulting from the adjustment of the equipment to the lowest and highest operating frequencies.</p> <p>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.</p> <p>The frequency band must be comprised between 5725 MHz to 5875 MHz</p> |

### 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<br>Ambient Temperature<br>+23°C |                                      | Extreme Condition<br>High Temperature<br>+70°C |                                      | Extreme Condition<br>Low Temperature<br>-10°C |                                      |
|-----------------------|------------|---------|-------|------|---------------|--------------------------------------------------|--------------------------------------|------------------------------------------------|--------------------------------------|-----------------------------------------------|--------------------------------------|
| Chain                 | Mode       | Rate    | Ant   | #Ch  | Freq<br>(MHz) | f <sub>H</sub><br>[MHz]                          | f <sub>H</sub> -f <sub>L</sub> [MHz] | f <sub>H</sub><br>[MHz]                        | f <sub>H</sub> -f <sub>L</sub> [MHz] | f <sub>H</sub><br>[MHz]                       | f <sub>H</sub> -f <sub>L</sub> [MHz] |
| A                     | 802.11a    | 6       | SISO  | 173  | 5865          | 5874.01                                          | 143.85                               | 5874.01                                        | 144.82                               | 5874.01                                       | 143.21                               |
|                       | 802.11n20  | HT0     | SISO  | 173  | 5865          | 5874.7                                           | 143.93                               | 5874.37                                        | 143.95                               | 5874.36                                       | 142.64                               |
|                       |            | HT8     | MIMO  | 173  | 5865          | 5874.13                                          | 138.36                               | 5874.14                                        | 140.59                               | 5874.44                                       | 140.84                               |
|                       | 802.11n40  | HT0     | SISO  | 167  | 5835          | 5872.47                                          | 139.82                               | 5856.27                                        | 123.34                               | 5867.51                                       | 134.23                               |
|                       |            | HT8     | MIMO  | 167  | 5835          | 5855.06                                          | 118.44                               | 5855.06                                        | 118.49                               | 5855.6                                        | 118.94                               |
|                       | 802.11ax20 | MCS0    | SISO  | 173  | 5865          | 5874.7                                           | 146.4                                | 5874.7                                         | 148.06                               | 5874.7                                        | 145.18                               |
|                       |            |         | MIMO  | 173  | 5865          | 5874.64                                          | 142.11                               | 5856.48                                        | 121.28                               | 5874.56                                       | 141.48                               |
|                       | 802.11ax40 |         | SISO  | 167  | 5835          | 5872.48                                          | 141.39                               | 5874.64                                        | 143.55                               | 5858.75                                       | 127.61                               |
|                       |            |         | MIMO  | 167  | 5835          | 5855.54                                          | 119.74                               | 5855.54                                        | 119.77                               | 5855.93                                       | 121.53                               |
|                       | B          | 802.11a | 6Mbps | SISO | 173           | 5865                                             | 5874.22                              | 141.9                                          | 5874.01                              | 141.99                                        | 5874.13                              |
| 802.11n20             |            | HT0     | SISO  | 173  | 5865          | 5874.59                                          | 142.27                               | 5874.41                                        | 142.11                               | 5874.38                                       | 141.73                               |
|                       |            | HT8     | MIMO  | 173  | 5865          | 5874.35                                          | 140.81                               | 5874.38                                        | 140.82                               | 5874.12                                       | 140.54                               |
| 802.11n40             |            | HT0     | SISO  | 167  | 5835          | 5857.49                                          | 132.36                               | 5855.95                                        | 129.26                               | 5874.37                                       | 140.42                               |
|                       |            | HT8     | MIMO  | 167  | 5835          | 5857.16                                          | 122.96                               | 5855.31                                        | 120.46                               | 5855.6                                        | 120.16                               |
| 802.11ax20            |            | MCS0    | SISO  | 173  | 5865          | 5874.82                                          | 144.18                               | 5874.71                                        | 144                                  | 5874.84                                       | 143.15                               |
|                       |            |         | MIMO  | 173  | 5865          | 5874.61                                          | 141.66                               | 5874.64                                        | 139.41                               | 5874.61                                       | 141.53                               |
| 802.11ax40            |            |         | SISO  | 167  | 5835          | 5867.48                                          | 136.3                                | 5873.6                                         | 146.7                                | 5873.74                                       | 141.51                               |
|                       |            |         | MIMO  | 167  | 5835          | 5858.74                                          | 127.06                               | 5858.8                                         | 122.97                               | 5858.99                                       | 124.41                               |

At customer request, only f<sub>H</sub> on channels 167 and 173 were tested. In order to report f<sub>L</sub>-f<sub>H</sub>, values for corresponding f<sub>L</sub> channels are taken from full test report 180717-02.TR17.

| Ambient Temperature: +23°C |            |         |       |      |               | Extreme Condition<br>High Voltage:<br>V <sub>max</sub> = 3.465V |                                      | Extreme Condition<br>Low Voltage:<br>V <sub>min</sub> = 3.135V |                                      |
|----------------------------|------------|---------|-------|------|---------------|-----------------------------------------------------------------|--------------------------------------|----------------------------------------------------------------|--------------------------------------|
| Chain                      | Mode       | Rate    | Ant   | #Ch  | Freq<br>(MHz) | f <sub>H</sub><br>[MHz]                                         | f <sub>H</sub> -f <sub>L</sub> [MHz] | f <sub>H</sub><br>[MHz]                                        | f <sub>H</sub> -f <sub>L</sub> [MHz] |
| A                          | 802.11a    | 6       | SISO  | 173  | 5865          | 5873.99                                                         | 142.61                               | 5873.98                                                        | 142.59                               |
|                            | 802.11n20  | HT0     | SISO  | 173  | 5865          | 5874.39                                                         | 143.33                               | 5874.39                                                        | 143.62                               |
|                            |            | HT8     | MIMO  | 173  | 5865          | 5874.09                                                         | 140.57                               | 5874.09                                                        | 138.32                               |
|                            | 802.11n40  | HT0     | SISO  | 167  | 5835          | 5873.35                                                         | 140.42                               | 5872.48                                                        | 139.22                               |
|                            |            | HT8     | MIMO  | 167  | 5835          | 5855.88                                                         | 119.26                               | 5855.96                                                        | 119.36                               |
|                            | 802.11ax20 | MCS0    | SISO  | 173  | 5865          | 5874.68                                                         | 147.08                               | 5874.68                                                        | 146.13                               |
|                            |            |         | MIMO  | 173  | 5865          | 5874.6                                                          | 141.78                               | 5874.6                                                         | 141.54                               |
|                            | 802.11ax40 |         | SISO  | 167  | 5835          | 5872.47                                                         | 142.07                               | 5873.57                                                        | 141.45                               |
|                            |            |         | MIMO  | 167  | 5835          | 5857.49                                                         | 121.7                                | 5857.5                                                         | 122.99                               |
|                            | B          | 802.11a | 6Mbps | SISO | 173           | 5865                                                            | 5874.03                              | 141.72                                                         | 5874                                 |
| 802.11n20                  |            | HT0     | SISO  | 173  | 5865          | 5874.6                                                          | 142.29                               | 5874.47                                                        | 142.19                               |
|                            |            | HT8     | MIMO  | 173  | 5865          | 5874.35                                                         | 140.47                               | 5874.34                                                        | 140.78                               |
| 802.11n40                  |            | HT0     | SISO  | 167  | 5835          | 5857.49                                                         | 131.42                               | 5873.34                                                        | 139.43                               |
|                            |            | HT8     | MIMO  | 167  | 5835          | 5858.42                                                         | 124.24                               | 5855.9                                                         | 121.09                               |
| 802.11ax20                 |            | MCS0    | SISO  | 173  | 5865          | 5874.68                                                         | 143.67                               | 5874.42                                                        | 143.01                               |
|                            |            |         | MIMO  | 173  | 5865          | 5874.61                                                         | 141.96                               | 5874.61                                                        | 139.3                                |
| 802.11ax40                 |            |         | SISO  | 167  | 5835          | 5860.59                                                         | 130.3                                | 5874.92                                                        | 144.29                               |
|                            |            |         | MIMO  | 167  | 5835          | 5868.32                                                         | 134.73                               | 5858.98                                                        | 123.18                               |

At customer request, only  $f_H$  on channels 167 and 173 were tested. In order to report  $f_L - f_H$ , values for corresponding  $f_L$  channels are taken from full test report 180717-02.TR17.

**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<br>87.5 MHz to 108 MHz<br>174 MHz to 230 MHz<br>470 MHz to 862 MHz | Other frequencies<br>≤ 1 000 MHz | Frequencies<br>> 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.

**Test Results****Tx Spurious Emissions – 25MHz to 40GHz****Tx Spurious Emissions – 802.11a (SISO A), CH161**

| Frequency | Level | Detector   | Limit | Margin | Polar |
|-----------|-------|------------|-------|--------|-------|
| MHz       | dBm   | ---        | dBm   | dB     | ---   |
| 101.9     | -56.1 | Quasi-Peak | -51.9 | 4.2    | V     |
| 10767.6   | -45.0 | RMS        | -27.9 | 17.1   | H     |
| 11608.5   | -55.0 | RMS        | -27.9 | 27.1   | H     |
| 23219.6   | -52.1 | RMS        | -27.9 | 24.2   | H     |

**Tx Spurious Emissions – 802.11a (SISO B), CH161**

| Frequency | Level | Detector   | Limit | Margin | Polar |
|-----------|-------|------------|-------|--------|-------|
| MHz       | dBm   | ---        | dBm   | dB     | ---   |
| 62.4      | -62.1 | Quasi-Peak | -51.9 | 10.2   | V     |
| 101.8     | -60.4 | Quasi-Peak | -51.9 | 8.5    | V     |
| 10801.8   | -45.2 | RMS        | -27.9 | 17.3   | V     |
| 11607.5   | -56.9 | RMS        | -27.9 | 29.0   | H     |
| 23219.6   | -49.6 | RMS        | -27.9 | 21.7   | H     |

**Tx Spurious Emissions – 802.11a (SISO A), CH173**

| Frequency | Level | Detector   | Limit | Margin | Polar |
|-----------|-------|------------|-------|--------|-------|
| MHz       | dBm   | ---        | dBm   | dB     | ---   |
| 98.4      | -58.2 | Quasi-Peak | -51.9 | 6.3    | V     |
| 10806.7   | -45.0 | RMS        | -27.9 | 17.1   | H     |
| 11735.1   | -52.8 | RMS        | -27.9 | 24.9   | H     |
| 23459.8   | -53.3 | RMS        | -27.9 | 25.4   | V     |

**Tx Spurious Emissions – 802.11a (SISO B), CH173**

| Frequency | Level | Detector   | Limit | Margin | Polar |
|-----------|-------|------------|-------|--------|-------|
| MHz       | dBm   | ---        | dBm   | dB     | ---   |
| 101.9     | -57.1 | Quasi-Peak | -51.9 | 5.2    | V     |
| 10315.8   | -45.6 | RMS        | -27.9 | 17.7   | H     |
| 11732.7   | -59.1 | RMS        | -27.9 | 31.2   | H     |
| 23459.8   | -52.8 | RMS        | -27.9 | 24.9   | V     |

## B.2.4 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.   |                   |       |   |             |   |             |   |             |
|                                                                                                                                          | <b>Table 6: Limits for blocking desensitization</b>                                                                                                                                   |                   |       |   |             |   |             |   |             |
|                                                                                                                                          | <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:                                                                                                                                                                                |                   |       |   |             |   |             |   |             |
| <ul style="list-style-type: none"><li>- <i>f</i> is the frequency in GHz;</li><li>- <i>BW</i> is the channel bandwidth in MHz.</li></ul> |                                                                                                                                                                                       |                   |       |   |             |   |             |   |             |
| The factor k is limited within the following:                                                                                            |                                                                                                                                                                                       |                   |       |   |             |   |             |   |             |
| <ul style="list-style-type: none"><li>- - 40dB &lt; <i>k</i> &lt; 0 dB.</li></ul>                                                        |                                                                                                                                                                                       |                   |       |   |             |   |             |   |             |
| 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 the CMW500. The blocking signal is emulated by the Signal generator SMB100A.

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**Result tables**

Results are available at Annex B.2.5 in report 180717-02.TR17

**B.2.5 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<br>25 MHz to 1 000 MHz | Frequencies<br>> 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, CH161**

| Frequency | Level | Detector | Limit | Margin | Polar |
|-----------|-------|----------|-------|--------|-------|
| MHz       | dBm   | ---      | dBm   | dB     | ---   |
| 81.2      | -58.5 | Peak     | -54.9 | 3.6    | V     |
| 138.4     | -68.1 | Peak     | -54.9 | 13.2   | H     |
| 1331.7    | -59.1 | RMS      | -47.0 | 12.1   | H     |
| 23219.6   | -50.0 | RMS      | -44.9 | 5.1    | V     |

**Rx Spurious Emissions – 802.11a/n20 (MIMO), Chain A+B, CH173**

| Frequency | Level | Detector | Limit | Margin | Polar |
|-----------|-------|----------|-------|--------|-------|
| MHz       | dBm   | ---      | dBm   | dB     | ---   |
| 62.5      | -56.4 | Peak     | -54.9 | 1.5    | V     |
| 81.2      | -58.3 | Peak     | -54.9 | 3.4    | V     |
| 138.4     | -67.9 | Peak     | -54.9 | 13.0   | H     |
| 1124.9    | -61.9 | RMS      | -47.0 | 14.9   | V     |
| 23459.8   | -52.9 | RMS      | -44.9 | 8.0    | V     |

# Annex C. Photographs

## C.1 Test Setup

Radiated Setup  
25 MHz – 1 GHz



Radiated Setup  
1 GHz – 11 GHz

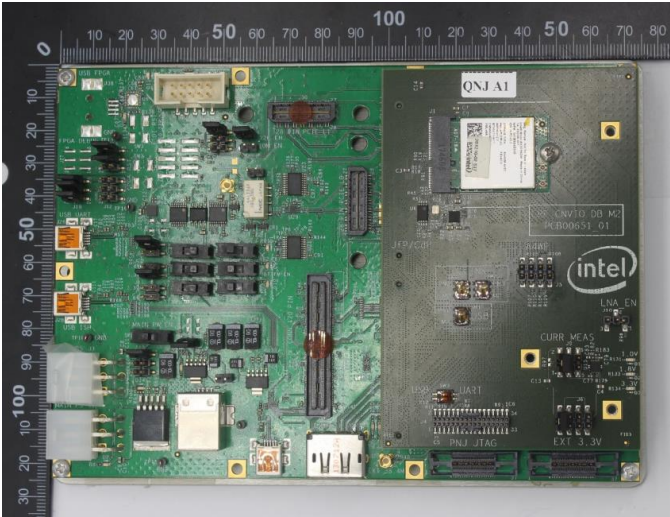


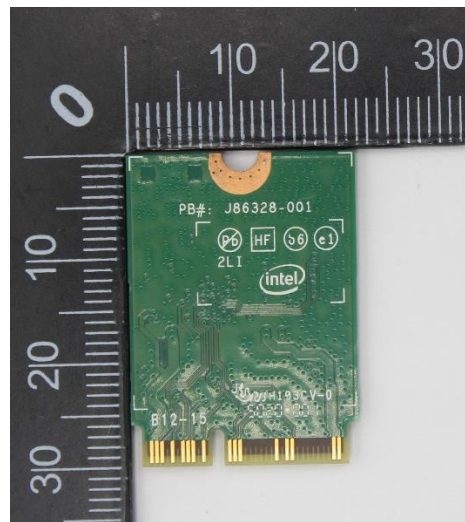
Radiated Setup  
11 GHz – 40 GHz



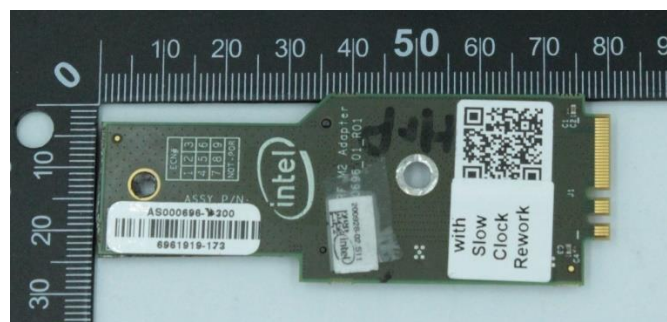
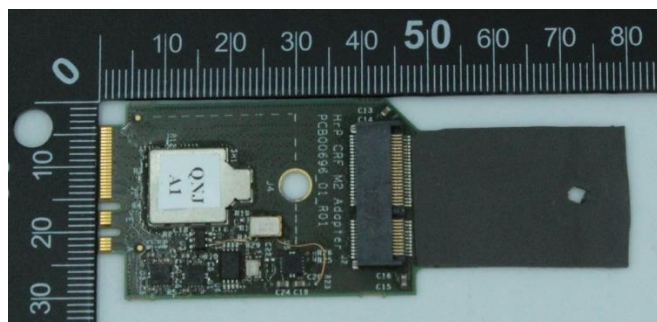
C.2 Test Sample

Sample #01

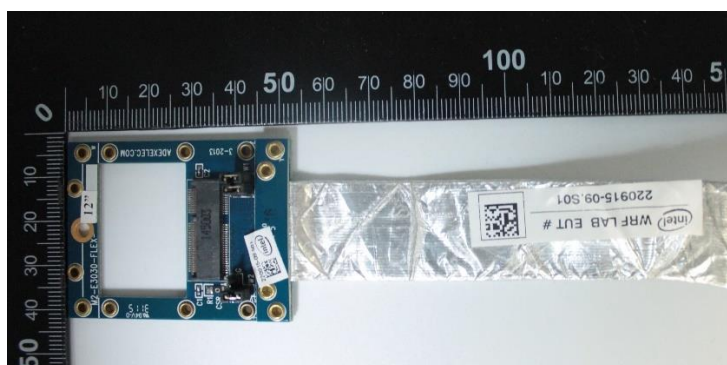
| Module Front                                                                      | Module Back                                                                         |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  |   |
| Extender board                                                                    | Laptop                                                                              |
|  |  |

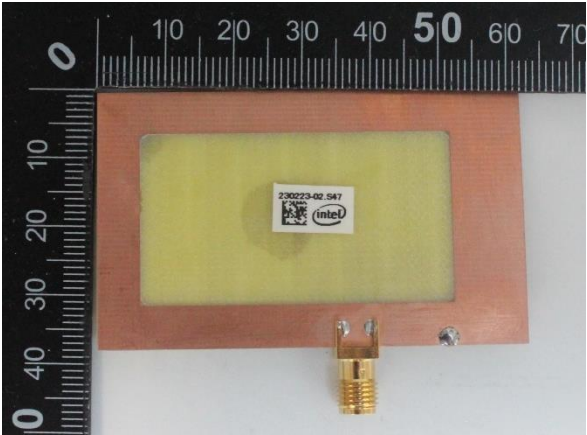
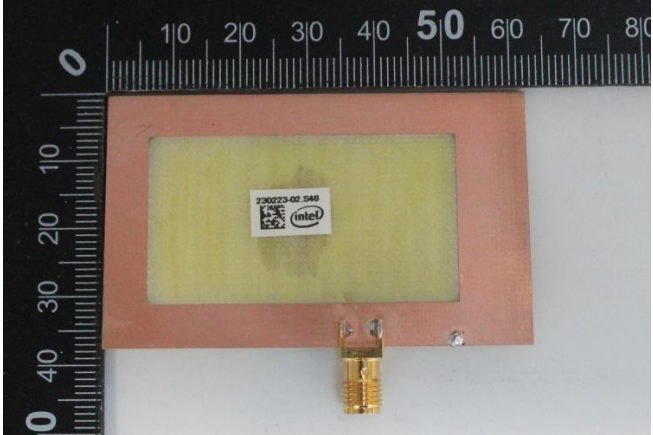
[Module Back](#)

## Adapter Back



Laptop



| Antennas                                                                          | Antennas                                                                           |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
|  |  |

### **End of the report**

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