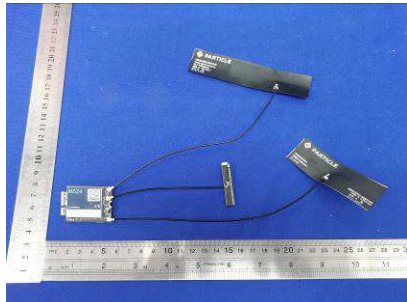


# TEST REPORT



|           |   |
|-----------|---|
| Applicant | Particle Industries, Inc                              |
| Address   | 325 9th St, San Francisco, CA 94103 USA, 415-319-1553 |

|                                     |   |   |
|-------------------------------------|---|---|
| Manufacturer or Supplier            | Particle Industries, Inc                              |  |
| Address                             | 325 9th St, San Francisco, CA 94103 USA, 415-319-1553 |   |
| Product                             | M SoM   |   |
| Brand Name                          | Particle  |   |
| Model                               | M524  |   |
| Additional Model & Model Difference | N/A   |   |
| Date of tests                       | Jan. 11, 2024 ~ Feb. 23, 2024                         |   |

The submitted sample of the above equipment has been tested according to the requirements of the following standard:

EN 300 440 V2.2.1 (2018-07)

**CONCLUSION: The submitted sample was found to COMPLY with the test requirement**

|   |  |
|---|--|
| <p>Tested by Lucas Chen<br/>Project Engineer / EMC Department</p>                   | <p>Approved by Glyn He<br/>Assistant Manager / EMC Department</p>                    |
|  |  |
| <p>Date: Mar. 05, 2024</p>  |  |

This report is governed by, and incorporates by reference, the Conditions of Testing as posted at the date of issuance of this report at <http://www.bureauveritas.com/home/about-us/our-business/cps/about-us/terms-conditions/> and is intended for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. Measurement uncertainty is only provided upon request for accredited tests. Statements of conformity are based on simple acceptance criteria without taking measurement uncertainty into account, unless otherwise requested in writing. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence or if you require measurement uncertainty; provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents.



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**BUREAU  
VERITAS**

**Test Report No.: RE2312WDG0148-5**

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**BUREAU  
VERITAS**

Test Report No.: RE2312WDG0148-5

## RELEASE CONTROL RECORD

| ISSUE NO.       | REASON FOR CHANGE | DATE ISSUED   |
|-----------------|-------------------|---------------|
| RE2312WDG0148-5 | Original release  | Mar. 05, 2024 |



## 1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

| APPLIED STANDARD: EN 300 440 V2.2.1 (2018-07) |   |        |                |
|---|---|--------|----------------|
| Standard Subclause                            | Test Type and Limit                       | Result | Remark         |
|   | <b>TRANSMITTER PARAMETERS</b>             |        |                |
| 4.2.2   | Equivalent Isotropic Radiated Power       | PASS   | Applicable     |
| 4.2.3   | Permitted range of operating frequency    | PASS   | Applicable     |
| 4.2.4   | Unwanted emissions in the spurious domain | PASS   | Applicable     |
| 4.2.5   | Duty Cycle                                | N/A    | Not Applicable |
|   | <b>RECEIVER PARAMETERS</b>                |        |                |
| 4.3.3   | Adjacent channel selectivity              | N/A    | Not Applicable |
| 4.3.4   | Blocking or desensitization               | PASS   | Applicable     |
| 4.3.5   | Radiated spurious emission                | PASS   | Applicable     |



## Receiver categories

| Receiver category | Relevant receiver clauses | Risk assessment of receiver performance   | The EUT Category |
|-------------------|---------------------------|---|------------------|
| 1                 | 4.3.3, 4.3.4 and 4.3.5    | Highly reliable SRD communication media; e.g. serving human life inherent systems (may result in a physical risk to a person).      | -                |
| 2                 | 4.3.4 and 4.3.5           | Medium reliable SRD communication media e.g. causing inconvenience to persons, which cannot simply be overcome by other means.      | -                |
| 3                 | 4.3.4 and 4.3.5           | Standard reliable SRD communication media e.g. Inconvenience to persons, which can simply be overcome by other means (e.g. manual). | √                |

If receiver category 1 or 2 is selected, this shall be stated in both the test report and in the user's manual for the equipment.



## 1.1 TEST INSTRUMENTS

| Equipment                            | Manufacturer  | Model No.                     | Serial No.  | Next Cal.   |
|--------------------------------------|---------------|-------------------------------|-------------|-------------|
| EMI Test Receiver                    | Rohde&Schwarz | ESU40                         | 100449      | Jan. 02, 25 |
| Signal and Spectrum Analyzer         | Rohde&Schwarz | FSV40                         | 101094      | Jan. 01, 25 |
| Trilog-Broadband Antenna             | SCHWARZBECK   | VULB 9168                     | 9168-554    | Jan. 08, 25 |
| Horn Antenna                         | ETS-Lindgren  | 3117                          | 00062558    | Apr.01, 24  |
| GPS Generator+ Antenna               | TOJOIN        | GNSS-5000A                    | E1-010119   | N/A         |
| 3m Semi-anechoic Chamber             | ETS-LINDGREN  | 9m*6m*6m                      | NSEMC003    | May. 20, 24 |
| Test Software                        | ADT           | ADT_Radiated_V7.6.15.9.2      | N/A         | N/A         |
| Test software                        | ADT           | ADT_RF Test Software V6.6.5.3 | N/A         | N/A         |
| Horn Antenna (15GHz-40GHz)           | SCHWARZBECK   | BBHA 9170                     | BBHA9170147 | Apr. 01, 24 |
| Amplifier                            | Burgeon       | BPA-530                       | 100220      | Mar. 06, 24 |
| Broadband Pre-amplifier (1GHz~18GHz) | SCHWARZBECK   | BBV9718                       | 305         | Apr. 24, 24 |
| Pre-Amplifier (18GHz-40GHz)          | EMCI          | EMC 184045                    | 980102      | Jan. 02 25  |
| Power Sensor                         | Keysight      | U2021XA                       | MY57320002  | May. 11, 24 |
| Humid & Temp Programmable Tester     | Haida         | HD-225T                       | 1108072001  | Oct. 15, 24 |
| Oscilloscope                         | Agilent       | DSO9254A                      | MY51260160  | Jul. 11, 24 |
| Signal and Spectrum Analyzer         | Rohde&Schwarz | FSV7                          | 102331      | Apr 05, 24  |
| Spectrum Analyzer                    | Keysight      | N9020A                        | MY55400499  | Jan. 01, 25 |
| MXG-B RF Vector Signal Generator     | Keysight      | N5182B                        | MY56200288  | Jul. 11, 24 |
| Wireless Connectivity Tester         | Rohde&Schwarz | CMW270                        | 102426      | Apr. 05, 24 |
| Vector Signal Generator              | Rohde&Schwarz | SMBV100A                      | 257579      | Oct. 15, 24 |
| Attenuator                           | MINI          | BW-S10W2+                     | S130129FGE2 | N/A         |

**NOTES:**

1. The test was performed in 966 Chamber and RF Oven room.
2. The calibration interval of the above test instruments is 12 months, and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
3. The horn antenna is used only for the measurement of emission frequency above 1GHz if tested.



**For Receiver Blocking test and Adjacent channel selectivity test:**

| <b>Equipment</b>                 | <b>Manufacturer</b> | <b>Model No.</b>      | <b>Serial No.</b> | <b>Next Cal.</b> |
|----------------------------------|---------------------|-----------------------|-------------------|------------------|
| Wireless Connectivity Tester     | Rohde&Schwarz       | CMW270                | 102426            | Apr. 05, 24      |
| Signal Analyzer                  | Rohde&Schwarz       | FSV7                  | 102331            | Apr. 05, 24      |
| Spectrum Analyzer                | Keysight            | N9020A                | MY55400499        | Jan. 01, 25      |
| Signal Generator                 | Agilent             | N5183A                | MY50140980        | Jul. 23, 24      |
| MXG-B RF Vector Signal Generator | Keysight            | N5182B                | MY56200288        | Jul. 11, 24      |
| Power Sensor                     | Keysight            | U2021XA               | MY57320002        | May. 11, 24      |
| Vector Signal Generator          | Rohde&Schwarz       | SMBV100A              | 257579            | Oct. 15, 24      |
| Agile Signal Generator           | Agilent             | 8645A                 | Agilent           | N/A              |
| Shield Box                       | TOJOIN              | MS4345-C              | SZA18A 3038       | N/A              |
| Attenuator                       | TOJOIN              | CHB-8-90-1-B<br>50SMA | 0803002           | N/A              |
| COM Power Splitter               | TOJOIN              | PS-TX-2B              | 020801            | N/A              |
| COM Power Splitter               | TOJOIN              | PS-TX-2B              | 020802            | N/A              |
| Test software                    | TonScend            | JS1120-3-1            | V2.6.88.0330      | N/A              |

**NOTES:**

1. The test was performed in RF Oven room.
2. The calibration interval of the above test instruments is 12 months, and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.





### 1.2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT:

| Parameter   | Uncertainty               |
|---|---------------------------|
| Radio frequency   | $\pm 1.06 \times 10^{-8}$ |
| RF power (conducted)  | $\pm 0.56$ dB             |
| Radiated emission of transmitter, valid up to 26.5GHz             | $\pm 4.84$ dB             |
| Radiated emission of transmitter, valid between 26.5GHz and 66GHz | $\pm 4.96$ dB             |
| Radiated emission of receiver, valid up to 26.5GHz                | $\pm 4.84$ dB             |
| Radiated emission of receiver, valid between 26.5GHz and 66GHz    | $\pm 4.96$ dB             |
| Temperature   | $\pm 0.23$ °C             |
| Humidity  | $\pm 0.3$ %               |
| Voltages(DC)  | $\pm 0.1$ %               |
| Voltages(AC, <10kHz)  | $\pm 0.22$ %              |

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

### 1.3 MAXIMUM MEASUREMENT UNCERTAINTY

For the test methods, according to ETSI EN 300 440 standard, the measurement uncertainty figures shall be calculated in accordance with TR 100 028 [7] and shall correspond to an expansion factor (coverage factor) k = 1,96 or k = 2 (which provide confidence levels of respectively 95 % and 95,45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)).

| Parameter   | Uncertainty            |
|---|------------------------|
| Radio frequency   | $\pm 1 \times 10^{-7}$ |
| RF power (conducted)  | $\pm 1.5$ dB           |
| Radiated emission of transmitter, valid up to 26.5GHz             | $\pm 6.0$ dB           |
| Radiated emission of transmitter, valid between 26.5GHz and 66GHz | $\pm 8.0$ dB           |
| Radiated emission of receiver, valid up to 26.5GHz                | $\pm 6.0$ dB           |
| Radiated emission of receiver, valid between 26.5GHz and 66GHz    | $\pm 8.0$ dB           |
| Temperature   | $\pm 1$ °C             |
| Humidity  | $\pm 5.0$ %            |
| Voltages(DC)  | $\pm 1.0$ %            |
| Voltages(AC, <10kHz)  | $\pm 2.0$ %            |



## 2 GENERAL INFORMATION

### 2.1 GENERAL DESCRIPTION OF EUT

|                                    |   |                                     |  |
|------------------------------------|---|-------------------------------------|--|
| <b>PRODUCT</b>                     | M SoM                                     |                                     |  |
| <b>MODEL NO.</b>                   | M524                                      |                                     |  |
| <b>ADDITIONAL MODEL</b>            | N/A                                       |                                     |  |
| <b>NOMINAL VOLTAGE</b>             | VCC: 3.8V. 3V3:3.3V                       |                                     |  |
| <b>OPERATING VOLTAGE RANGE</b>     | Vnom=3.8V <sub>dc</sub>                   | Vmin= 3.3V <sub>dc</sub>            | Vmax=4.3V <sub>dc</sub>                        |
| <b>OPERATING TEMPERATURE RANGE</b> | -35 ~ +75°C                               |                                     |  |
| <b>MODULATION TECHNOLOGY</b>       | OFDM                                      |                                     |  |
| <b>MODULATION TYPE</b>             | 256QAM, 64QAM, 16QAM, QPSK, BPSK for OFDM |                                     |  |
| <b>OPERATING FREQUENCY</b>         | 5745MHz ~ 5825MHz                         |                                     |  |
| <b>EIRP (MAX.)</b>                 | 13.62dBm                                  |                                     |  |
| <b>ANTENNA TYPE</b>                | PCB antenna with 6.8dBi gain              |                                     |  |
| <b>CABLE SUPPLIED</b>              | N/A                                       |                                     |  |
| <b>RECEIVER CATEGORY</b>           | <input type="checkbox"/> Category 1       | <input type="checkbox"/> Category 2 | <input checked="" type="checkbox"/> Category 3 |

#### NOTES:

1. For a more detailed features description, please refer to the manufacturer’s specifications or the user’s manual.
2. For the test results, the EUT had been tested with all conditions, but only the worst case was shown in test report.
3. Please refer to the EUT photo document (Reference No.: W7L-P23120016) for detailed product photo.
4. The EUT provides completed transmitters and receivers, the EUT uses only one antenna at any time.

| MODULATION MODE                 | TX FUNCTION |
|---------------------------------|-------------|
| 802.11a                         | 1TX/1RX     |
| 802.11n (HT20) 802.11ac (VHT20) | 1TX/1RX     |
| 802.11n (HT40) 802.11ac (VHT40) | 1TX/1RX     |

\* The modulation and bandwidth are similar for 802.11n mode for HT20 / HT40 and 802.11ac mode for VHT20 / VHT40, they have all been fully tested, except the EIRP test item, other test items only the worst case (802.11n mode for HT20 / HT40) record in the report.



## 2.2 DESCRIPTION OF TEST MODES

### WLAN 5.745 ~ 5.825GHz

5 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

| CHANNEL | FREQUENCY | CHANNEL | FREQUENCY |
|---------|-----------|---------|-----------|
| 149     | 5745MHz   | 161     | 5805MHz   |
| 153     | 5765MHz   | 165     | 5825MHz   |
| 157     | 5785MHz   |         |           |

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

| CHANNEL | FREQUENCY | CHANNEL | FREQUENCY |
|---------|-----------|---------|-----------|
| 151     | 5755MHz   | 159     | 5795MHz   |

## 2.3 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF Product, according to the specifications of the manufacturers; it must comply with the requirements of the following standards:

### EN 300 440 V2.2.1 (2018-07)

All test items have been performed and recorded as per the above standards.

## 2.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

| NO. | PRODUCT                 | BRAND    | MODEL NO.        | SERIAL NO. | FCC ID |
|-----|-------------------------|----------|------------------|------------|--------|
| 1   | Notebook                | DELL     | Inspiron 13-7378 | GMSJZD2    | N/A    |
| 2   | Wireless Router         | TP-LINK  | TL-WVR1200G      | N/A        | N/A    |
| 3   | SOM Mini SYS test board | N/A      | V0.8             | N/A        | N/A    |
| 4   | DC Source               | Keysight | E3642A           | MY56146098 | N/A    |

| NO. | SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS                            |
|-----|--|
| 1   | AC Line: Unshielded, Detachable 0.8m; DC Line: Unshielded, Non-detachable 1.8m |
| 2   | AC Line: Unshielded, Detachable 1.0m   |
| 3   | USB Cable: Shielded, Detachable, 0.5m  |
| 4   | AC Line: Unshielded, Detachable 1.0m   |



### 3 TEST TYPES AND RESULTS

#### TRANSMITTER PARAMETERS

##### 3.1 EQUIVALENT ISOTROPIC RADIATED POWER

###### 3.1.1 LIMITS OF EQUIVALENT ISOTROPIC RADIATED POWER

| Condition                       | Limit (e.i.r.p)       |
|---------------------------------|-----------------------|
| Generic use(5725MHz to 5875MHz) | 25 mW e.i.r.p.(14dBm) |

For Extreme temperature ranges:

| Category                              | Temperature range | The EUT Category |
|---------------------------------------|-------------------|------------------|
| I (General)                           | -20°C to +55°C    | -                |
| II (Portable)                         | -10°C to +55°C    | -                |
| III (Equipment for normal indoor use) | 5°C to +35°C      | -                |
| Declared by client                    | -35°C to +75°C    | √                |

###### 3.1.2 TEST PROCEDURES

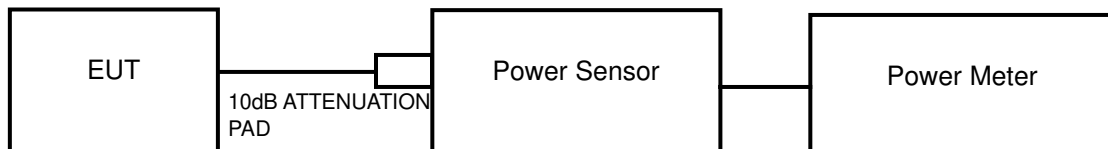
Refer to chapter 4.2.2.3 of EN 300 440 V2.2.1 (2018-07).

###### 3.1.3 DEVIATION FROM TEST STANDARD

No deviation.

###### 3.1.4 TEST SETUP

1. Ran a test program to control EUT transmit at specific channel
2. A power meter was used to read the response of the power sensor.
3. Record the power level.
4. EIRP = antenna gain + power level of step 3.





### 3.1.5 TEST RESULTS

#### 802.11a

| TEST CONDITION        |     |                      | EQUIVALENT ISOTROPIC RADIATED POWER (dBm) |                     |                     |
|-----------------------|-----|----------------------|---|---------------------|---------------------|
|                       |     |                      | (CH-149)<br>5745MHz                       | (CH-157)<br>5785MHz | (CH-165)<br>5825MHz |
| T <sub>nom</sub> (°C) | 25  | V <sub>nom</sub> (V) | 12.91                                     | 13.20               | 12.88               |
| T <sub>min</sub> (°C) | -35 | V <sub>min</sub> (V) | 13.35                                     | 13.36               | 13.00               |
|                       |     | V <sub>max</sub> (V) | 13.37                                     | 13.37               | 12.96               |
| T <sub>max</sub> (°C) | +75 | V <sub>min</sub> (V) | 12.56                                     | 12.75               | 12.63               |
|                       |     | V <sub>max</sub> (V) | 12.51                                     | 12.71               | 12.66               |

#### 802.11n (20MHz)

| TEST CONDITION        |     |                      | EQUIVALENT ISOTROPIC RADIATED POWER (dBm) |                     |                     |
|-----------------------|-----|----------------------|---|---------------------|---------------------|
|                       |     |                      | (CH-149)<br>5745MHz                       | (CH-157)<br>5785MHz | (CH-165)<br>5825MHz |
| T <sub>nom</sub> (°C) | 25  | V <sub>nom</sub> (V) | 13.17                                     | 13.07               | 13.18               |
| T <sub>min</sub> (°C) | -35 | V <sub>min</sub> (V) | 13.60                                     | 13.30               | 13.61               |
|                       |     | V <sub>max</sub> (V) | <b>13.62</b>                              | 13.31               | 13.59               |
| T <sub>max</sub> (°C) | +75 | V <sub>min</sub> (V) | 12.98                                     | 12.94               | 12.69               |
|                       |     | V <sub>max</sub> (V) | 12.98                                     | 12.92               | 12.72               |

#### 802.11n (40MHz)

| TEST CONDITION        |     |                      | EQUIVALENT ISOTROPIC RADIATED POWER (dBm) |                     |
|-----------------------|-----|----------------------|---|---------------------|
|                       |     |                      | (CH-151)<br>5755MHz                       | (CH-159)<br>5795MHz |
| T <sub>nom</sub> (°C) | 25  | V <sub>nom</sub> (V) | 12.95                                     | 12.93               |
| T <sub>min</sub> (°C) | -35 | V <sub>min</sub> (V) | 13.14                                     | 13.13               |
|                       |     | V <sub>max</sub> (V) | 13.16                                     | 13.10               |
| T <sub>max</sub> (°C) | +75 | V <sub>min</sub> (V) | 12.45                                     | 12.56               |
|                       |     | V <sub>max</sub> (V) | 12.50                                     | 12.56               |



**802.11ac (20MHz)**

| TEST CONDITION        |     |                      | EQUIVALENT ISOTROPIC RADIATED POWER (dBm) |                     |                     |
|-----------------------|-----|----------------------|---|---------------------|---------------------|
|                       |     |                      | (CH-149)<br>5745MHz                       | (CH-157)<br>5785MHz | (CH-165)<br>5825MHz |
| T <sub>nom</sub> (°C) | 25  | V <sub>nom</sub> (V) | 13.04                                     | 12.92               | 13.05               |
| T <sub>min</sub> (°C) | -35 | V <sub>min</sub> (V) | 13.42                                     | 13.10               | 13.43               |
|                       |     | V <sub>max</sub> (V) | 13.44                                     | 13.11               | 13.41               |
| T <sub>max</sub> (°C) | +75 | V <sub>min</sub> (V) | 12.88                                     | 12.82               | 12.59               |
|                       |     | V <sub>max</sub> (V) | 12.88                                     | 12.80               | 12.62               |

**802.11ac (40MHz)**

| TEST CONDITION        |     |                      | EQUIVALENT ISOTROPIC RADIATED POWER (dBm) |                     |
|-----------------------|-----|----------------------|---|---------------------|
|                       |     |                      | (CH-151)<br>5755MHz                       | (CH-159)<br>5795MHz |
| T <sub>nom</sub> (°C) | 25  | V <sub>nom</sub> (V) | 12.81                                     | 12.78               |
| T <sub>min</sub> (°C) | -35 | V <sub>min</sub> (V) | 13.09                                     | 12.87               |
|                       |     | V <sub>max</sub> (V) | 13.10                                     | 12.91               |
| T <sub>max</sub> (°C) | +75 | V <sub>min</sub> (V) | 12.29                                     | 12.54               |
|                       |     | V <sub>max</sub> (V) | 12.34                                     | 12.51               |



### 3.2 PERMITTED RANGE OF OPERATING FREQUENCIES

#### 3.2.1 LIMITS OF PERMITTED RANGE OF OPERATING FREQUENCIES

The width of the power envelope is  $f_H - f_L$  for a give operating frequency. In equipment that allow adjustment or selection of different frequencies, the power envelope take 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 frequency.

| CONDITION                 | LIMIT  |
|---------------------------|--|
| Under all test conditions | $F_L > 5725.0\text{MHz}$<br>$F_H < 5875.0\text{MHz}$ |

#### 3.2.2 TEST PROCEDURES

Refer to chapter 4.2.3.3 of EN 300 440 V2.2.1 (2018-07).

#### 3.2.3 DEVIATION FROM TEST STANDARD

No deviation.

#### 3.2.4 TEST SETUP

The EUT and probe antenna were placed into the temperature oven. The probe has to be connected with spectrum analyzer. The power source of the EUT has to be connected with the power supply for voltage change. The frequency has to be recorded for the right and left end above threshold of highest and lowest channel respectively.



### 3.2.5 TEST RESULTS

#### 802.11a

| TEST CONDITION                          |     |                      | FREQUENCY (MHz) |              |
|---|-----|----------------------|-----------------|--------------|
|   |     |                      | LOWEST          | HIGHEST      |
| T <sub>nom</sub> (°C)                   | 25  | V <sub>nom</sub> (V) | 5734.94         | 5835.06      |
| T <sub>min</sub> (°C)                   | -35 | V <sub>min</sub> (V) | 5734.87         | 5835.13      |
|   |     | V <sub>max</sub> (V) | 5734.85         | 5835.12      |
| T <sub>max</sub> (°C)                   | +75 | V <sub>min</sub> (V) | 5735.03         | 5835.01      |
|   |     | V <sub>max</sub> (V) | 5735.01         | 5835.05      |
| Measured frequency (lowest and highest) |     |                      | FL = 5734.85    | FH = 5835.13 |

#### 802.11n (20MHz)

| TEST CONDITION                          |     |                      | FREQUENCY (MHz) |              |
|---|-----|----------------------|-----------------|--------------|
|   |     |                      | LOWEST          | HIGHEST      |
| T <sub>nom</sub> (°C)                   | 25  | V <sub>nom</sub> (V) | 5734.62         | 5835.46      |
| T <sub>min</sub> (°C)                   | -35 | V <sub>min</sub> (V) | 5734.53         | 5835.53      |
|   |     | V <sub>max</sub> (V) | 5734.56         | 5835.55      |
| T <sub>max</sub> (°C)                   | +75 | V <sub>min</sub> (V) | 5734.74         | 5835.33      |
|   |     | V <sub>max</sub> (V) | 5734.69         | 5835.32      |
| Measured frequency (lowest and highest) |     |                      | FL = 5734.53    | FH = 5835.55 |





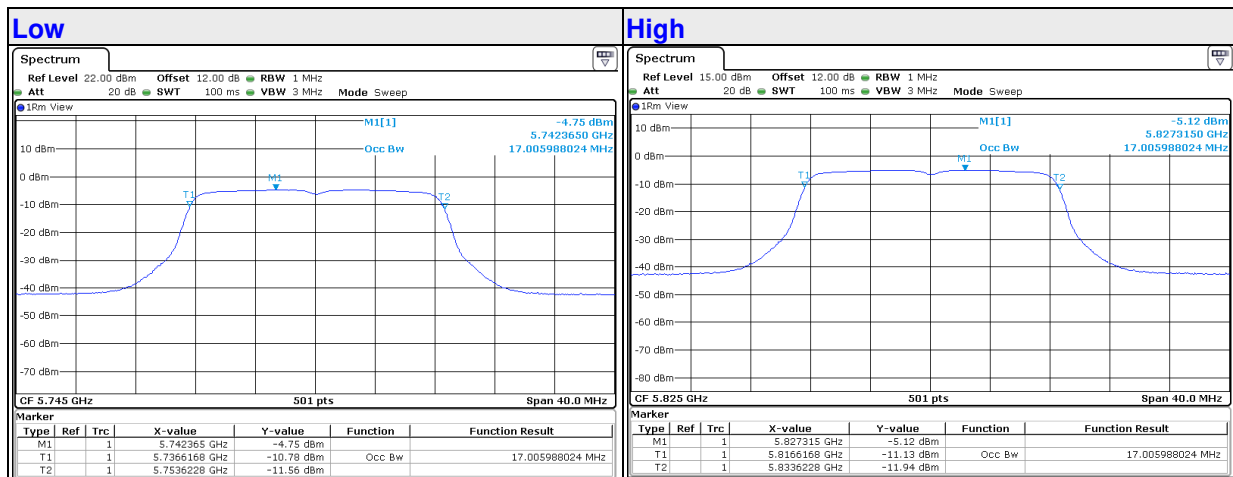
802.11n (40MHz)

| TEST CONDITION                          |     |                      | FREQUENCY (MHz) |              |
|---|-----|----------------------|-----------------|--------------|
|   |     |                      | LOWEST          | HIGHEST      |
| T <sub>nom</sub> (°C)                   | 25  | V <sub>nom</sub> (V) | 5735.68         | 5814.48      |
| T <sub>min</sub> (°C)                   | -35 | V <sub>min</sub> (V) | 5735.59         | 5814.63      |
|   |     | V <sub>max</sub> (V) | 5735.60         | 5814.59      |
| T <sub>max</sub> (°C)                   | +75 | V <sub>min</sub> (V) | 5735.84         | 5814.35      |
|   |     | V <sub>max</sub> (V) | 5735.80         | 5814.38      |
| Measured frequency (lowest and highest) |     |                      | FL = 5735.59    | FH = 5814.63 |

OCCUPIED BANDWIDTH (FOR REFERENCE)

For 802.11a

| CHANNEL | CHANNEL FREQUENCY (MHz) | OCCUPIED BANDWIDTH (MHz) |
|---------|-------------------------|--------------------------|
| CH149   | 5745                    | 17.0060                  |
| CH165   | 5825                    | 17.0060                  |



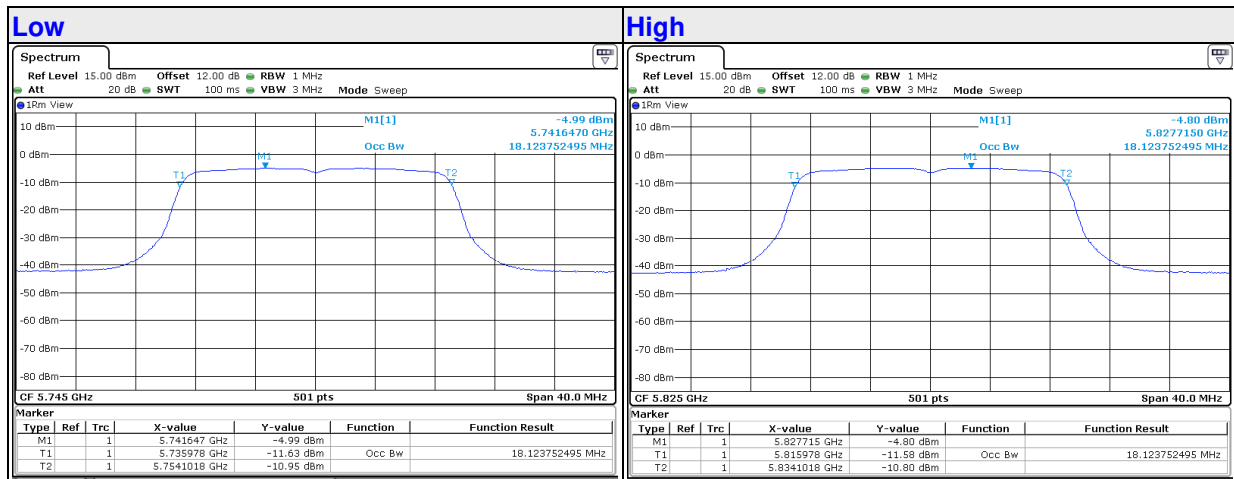


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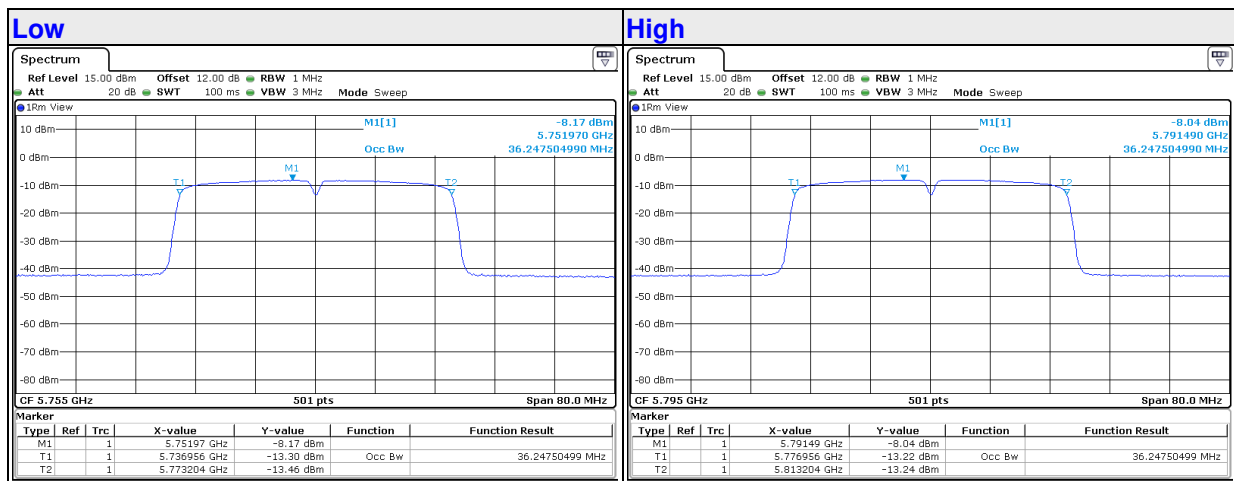
**For 802.11n 20MHz**

| CHANNEL | CHANNEL FREQUENCY (MHz) | OCCUPIED BANDWIDTH (MHz) |
|---------|-------------------------|--------------------------|
| CH149   | 5745                    | 18.1238                  |
| CH165   | 5825                    | 18.1238                  |



**For 802.11n 40MHz**

| CHANNEL | CHANNEL FREQUENCY (MHz) | OCCUPIED BANDWIDTH (MHz) |
|---------|-------------------------|--------------------------|
| CH149   | 5755                    | 36.2475                  |
| CH165   | 5795                    | 36.2475                  |





### 3.3 MEASUREMENT RADIATED SPURIOUS EMISSION

#### 3.3.1 LIMITS OF MEASUREMENT RADIATED SPURIOUS EMISSION

| Frequency Range   | 47MHz to 74MHz<br>87.5MHz to 108MHz<br>174MHz to 230MHz<br>470MHz to 862MHz | Other Frequencies<br>Below 1GHz | >1GHz              |
|-------------------|---|---------------------------------|--------------------|
| Limit (Operating) | 4nW (-54dBm)  | 250nW (-36dBm)                  | 1 $\mu$ W (-30dBm) |
| Limit (Standby)   | 2nW (-57dBm)  | 2nW (-57dBm)                    | 20nW (-47dBm)      |

#### 3.3.2 TEST PROCEDURES

Refer to chapter 4.2.4.3 of EN 300 440 V2.2.1 (2018-07).

#### 3.3.3 DEVIATION FROM TEST STANDARD

No deviation.

#### 3.3.4 TEST SETUP

1. For the actual test configuration, please refer to the related Item in this test report (Photographs of the Test Configuration).
2. The test setup has been constructed as the normal use condition. Controlling software (provided by manufacturer) has been activated to set the EUT on specific status.

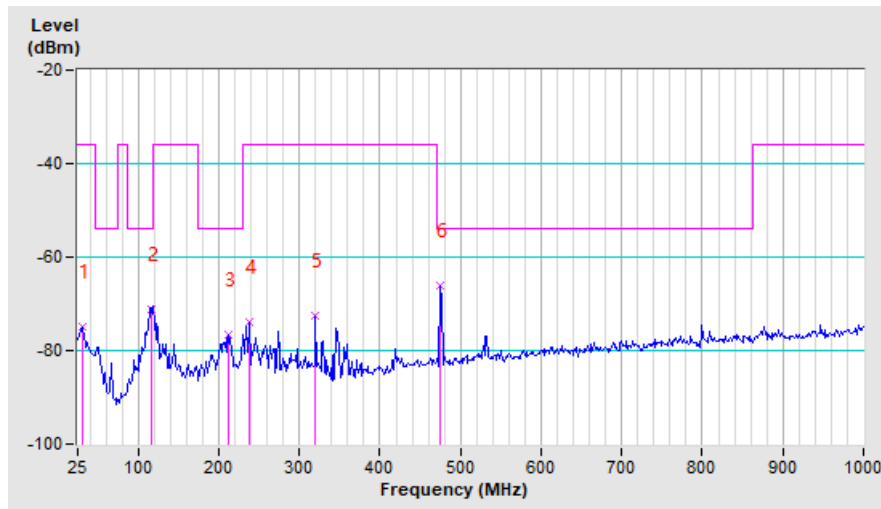


### 3.3.5 TEST RESULTS

**TX BELOW 1GHz WORST-CASE DATA: 802.11a**

|  |              |                          |     |
|--|--------------|--------------------------|-----|
| <b>SPURIOUS EMISSION FREQUENCY RANGE</b> | 25MHz ~ 1GHz | <b>OPERATING CHANNEL</b> | 149 |
|--|--------------|--------------------------|-----|

| SPURIOUS EMISSION LEVEL |                      |               |               |               |
|-------------------------|----------------------|---------------|---------------|---------------|
| Frequency (MHz)         | Antenna Polarization | Level (dBm)   | Limit (dBm)   | Margin (dB)   |
| 31.25                   | H                    | -74.97        | -36.00        | -38.97        |
| 117.19                  | H                    | -71.06        | -54.00        | -17.06        |
| 212.50                  | H                    | -76.45        | -54.00        | -22.45        |
| 237.50                  | H                    | -73.79        | -36.00        | -37.79        |
| 320.31                  | H                    | -72.43        | -36.00        | -36.43        |
| <b>475.00</b>           | <b>H</b>             | <b>-66.10</b> | <b>-54.00</b> | <b>-12.10</b> |



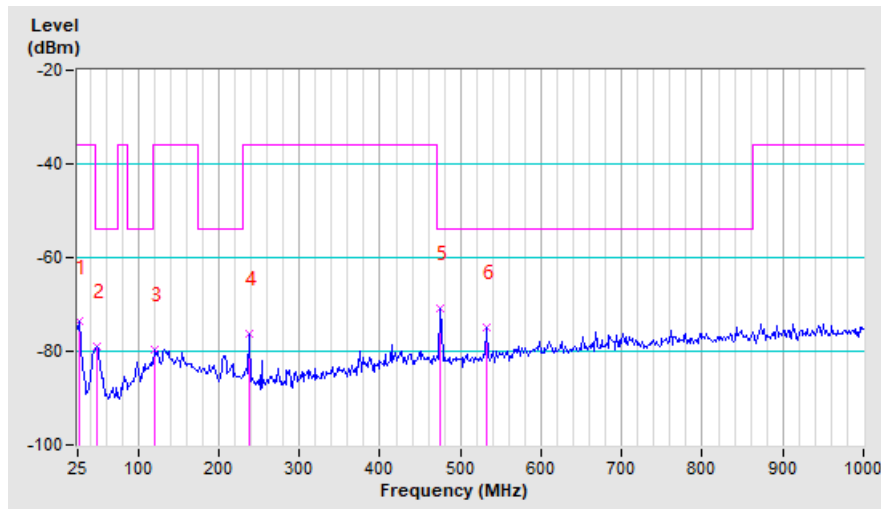


**BUREAU  
VERITAS**

**Test Report No.: RE2312WDG0148-5**

|  |              |                          |     |
|--|--------------|--------------------------|-----|
| <b>SPURIOUS EMISSION<br/>FREQUENCY RANGE</b> | 25MHz ~ 1GHz | <b>OPERATING CHANNEL</b> | 149 |
|--|--------------|--------------------------|-----|

| <b>SPURIOUS EMISSION LEVEL</b> |                                 |                        |                        |                        |
|--------------------------------|---------------------------------|------------------------|------------------------|------------------------|
| <b>Frequency<br/>(MHz)</b>     | <b>Antenna<br/>Polarization</b> | <b>Level<br/>(dBm)</b> | <b>Limit<br/>(dBm)</b> | <b>Margin<br/>(dB)</b> |
| 26.56                          | V                               | -73.66                 | -36.00                 | -37.66                 |
| 48.44                          | V                               | -79.04                 | -54.00                 | -25.04                 |
| 120.31                         | V                               | -79.59                 | -36.00                 | -43.59                 |
| 237.50                         | V                               | -76.19                 | -36.00                 | -40.19                 |
| 475.00                         | V                               | -70.90                 | -54.00                 | -16.90                 |
| 532.81                         | V                               | -74.87                 | -54.00                 | -20.87                 |





**ABOVE 1GHz DATA: 802.11a**

|  |              |                          |          |
|--|--------------|--------------------------|----------|
| <b>SPURIOUS EMISSION FREQUENCY RANGE</b> | 1GHz ~ 40GHz | <b>OPERATING CHANNEL</b> | 149, 165 |
|--|--------------|--------------------------|----------|

| SPURIOUS EMISSION LEVEL |                 |                      |               |               |              |
|-------------------------|-----------------|----------------------|---------------|---------------|--------------|
| Channel                 | Frequency (MHz) | Antenna Polarization | Level (dBm)   | Limit (dBm)   | Margin (dB)  |
| 149                     | 11490.00        | H                    | -47.16        | -30.00        | -17.16       |
|                         | 11490.00        | V                    | -47.81        | -30.00        | -17.81       |
|                         | 17235.00        | H                    | -41.04        | -30.00        | -11.04       |
|                         | 17235.00        | V                    | -40.00        | -30.00        | -10.00       |
| 165                     | 11650.00        | H                    | -45.89        | -30.00        | -15.89       |
|                         | 11650.00        | V                    | -45.72        | -30.00        | -15.72       |
|                         | 17475.00        | H                    | -43.17        | -30.00        | -13.17       |
|                         | <b>17475.00</b> | <b>V</b>             | <b>-39.28</b> | <b>-30.00</b> | <b>-9.28</b> |

**802.11n (20MHz)**

|  |              |                          |          |
|--|--------------|--------------------------|----------|
| <b>SPURIOUS EMISSION FREQUENCY RANGE</b> | 1GHz ~ 40GHz | <b>OPERATING CHANNEL</b> | 149, 165 |
|--|--------------|--------------------------|----------|

| SPURIOUS EMISSION LEVEL |                 |                      |             |             |             |
|-------------------------|-----------------|----------------------|-------------|-------------|-------------|
| Channel                 | Frequency (MHz) | Antenna Polarization | Level (dBm) | Limit (dBm) | Margin (dB) |
| 149                     | 11490.00        | H                    | -46.00      | -30.00      | -16.00      |
|                         | 11490.00        | V                    | -46.10      | -30.00      | -16.10      |
|                         | 17235.00        | H                    | -41.71      | -30.00      | -11.71      |
|                         | 17235.00        | V                    | -41.69      | -30.00      | -11.69      |
| 165                     | 11650.00        | H                    | -44.96      | -30.00      | -14.96      |
|                         | 11650.00        | V                    | -45.91      | -30.00      | -15.91      |
|                         | 17475.00        | H                    | -44.72      | -30.00      | -14.72      |
|                         | 17475.00        | V                    | -43.97      | -30.00      | -13.97      |



802.11n (40MHz)

|  |              |                          |          |
|--|--------------|--------------------------|----------|
| <b>SPURIOUS EMISSION<br/>FREQUENCY RANGE</b> | 1GHz ~ 40GHz | <b>OPERATING CHANNEL</b> | 151, 159 |
|--|--------------|--------------------------|----------|

| SPURIOUS EMISSION LEVEL |                    |                         |                |                |                |
|-------------------------|--------------------|-------------------------|----------------|----------------|----------------|
| Channel                 | Frequency<br>(MHz) | Antenna<br>Polarization | Level<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
| 151                     | 11510.00           | H                       | -46.51         | -30.00         | -16.51         |
|                         | 11510.00           | V                       | -46.99         | -30.00         | -16.99         |
|                         | 17265.00           | H                       | -42.82         | -30.00         | -12.82         |
|                         | 17265.00           | V                       | -40.18         | -30.00         | -10.18         |
| 159                     | 11590.00           | H                       | -43.86         | -30.00         | -13.86         |
|                         | 11590.00           | V                       | -45.86         | -30.00         | -15.86         |
|                         | 17385.00           | H                       | -44.62         | -30.00         | -14.62         |
|                         | 17385.00           | V                       | -40.62         | -30.00         | -10.62         |



### **3.4 DUTY CYCLE (NOT APPLY)**

#### **3.4.1 LIMITS OF DUTY CYCLE**

| <b>Frequency Band</b>  | <b>Duty Cycle</b>            | <b>Application</b>                                  |
|------------------------|------------------------------|---|
| 2400MHz to 2483.5MHz   | No Restriction               | Generic use   |
| 2400MHz to 2483.5MHz   | No Restriction               | Detection, movement and alert applications          |
| (a) 2446MHz to 2454MHz | No Restriction               | RFID  |
| (b) 2446MHz to 2454MHz | 15%                          | RFID  |
| 5725MHz to 5875MHz     | No Restriction               | Generic use   |
| 9200MHz to 9500MHz     | No Restriction               | Detection, movement and alert applications          |
| 9500MHz to 9975MHz     | No Restriction               | Detection, movement and alert applications          |
| 10.5GHz to 10.6GHz     | No Restriction               | Detection, movement and alert applications          |
| 13.4GHz to 14.0GHz     | No Restriction               | Detection, movement and alert applications          |
| 17.1GHz to 17.3GHz     | DDA or equivalent techniques | GBSAR detecting and movement and alert applications |
| 24.00GHz to 24.25GHz   | No Restriction               | Detection, movement and alert applications          |

#### **3.4.2 TEST PROCEDURES**

Refer to chapter 4.2.5.3 of EN 300 440 V2.2.1 (2018-07).

#### **3.4.3 DEVIATION FROM TEST STANDARD**

No deviation.

#### **3.4.4 TEST SETUP**

The test setup has been constructed as the normal use condition. Controlling software (provided by manufacturer) has been activated to set the EUT on specific status.

#### **3.4.5 TEST RESULTS**

This product does not apply.





## RECEIVER PARAMETERS

### 3.5 LIMITES OF ADJACENT CHANNEL SELECTIVITY

The adjacent channel selectivity of the equipment under specified conditions shall not be less than  $-30 \text{ dBm} + k$

| Receiver category | Limit               |
|-------------------|---------------------|
| 1                 | $-30\text{dBm} + K$ |

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:

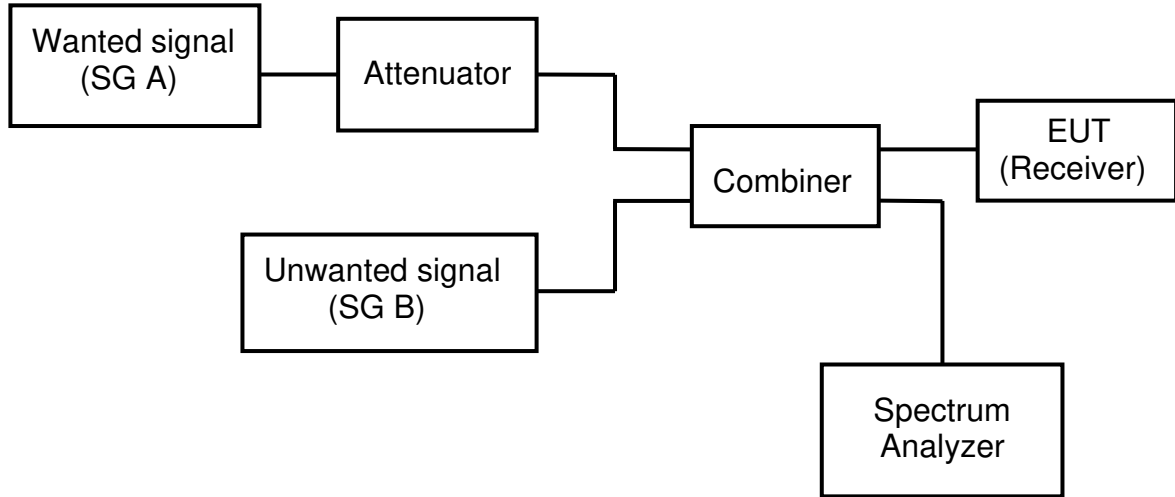
$$-40 \text{ dB} < k < 0 \text{ dB}$$

#### 3.5.1 TEST PROCEDURES

Refer to chapter 4.3.3.3 of EN 300 440 V2.2.1 (2018-07).



### 3.5.2 TEST SETUP



### 3.5.3 TEST RESULTS

This product does not apply.



### 3.6 BLOCKING OR DESENSITIZATION

#### 3.6.1 LIMITES OF RECEIVER BLOCKING

The blocking level shall not be less than the values given in table.

| Receiver category | Limit      |
|-------------------|------------|
| 1                 | -30dBm + K |
| 2                 | -45dBm + K |
| 3                 | -60dBm + 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.

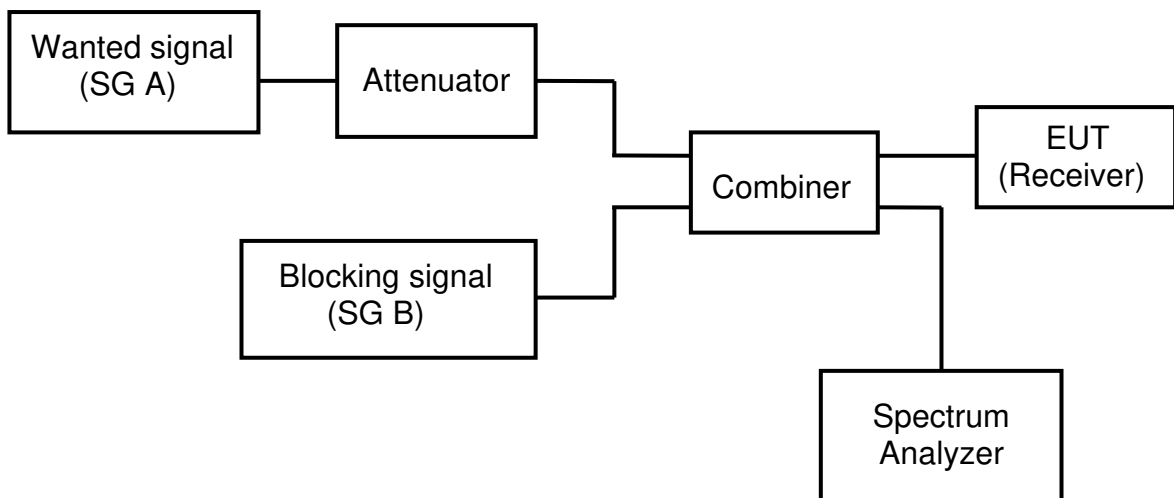
The factor k is limited within the following:

$$-40 \text{ dB} < k < 0 \text{ dB}$$

#### 3.6.2 TEST PROCEDURES

Refer to chapter 4.3.4.3 of EN 300 440 V2.2.1 (2018-07).

#### 3.6.3 TEST SETUP





### 3.6.4 TEST RESULTS

#### Receiver Category 3 Equipment

#### For 802.11a

| Blocking measure of the capability   |                           |                           |                                 |                                 |  |               |
|--|---------------------------|---------------------------|---------------------------------|---------------------------------|--|---------------|
| P <sub>min</sub> : -77.56dBm   |                           |                           |                                 |                                 |  |               |
| The actual blocking signal power (Note)  |                           |                           |                                 |                                 | <input checked="" type="checkbox"/> at the antenna connector |               |
|  |                           |                           |                                 |                                 | <input type="checkbox"/> in front of the antenna             |               |
| Note: For the conducted measurements, the same level should be used at the antenna connector irrespective of antenna gain. |                           |                           |                                 |                                 |  |               |
| Operation mode   | Operation frequency (MHz) | Wanted signal power (dBm) | Offset of the bandwidth (times) | Blocking signal frequency (MHz) | Blocking signal Power (dBm)                                  | Minimum Limit |
| Normal working   | 5745                      | -74.56                    | -10                             | 5566.5568                       | -50.22   | -87.49        |
|  |                           |                           | -20                             | 5396.4968                       | -43.23   |               |
|  |                           |                           | -50                             | 4886.3168                       | -45.69   |               |
|  | 5825                      |                           | 10                              | 6003.6828                       | -56.85   | -87.61        |
|  |                           |                           | 20                              | 6173.7428                       | -45.98   |               |
|  |                           |                           | 50                              | 6683.9228                       | -43.27   |               |

Note:

Lower Channel:  $K=-20\log f -10\log BW= -27.49$

Upper Channel:  $K=-20\log f -10\log BW= -27.61$

For occupied bandwidth, please see the page 17.



For 802.11n 40MHz

| Blocking measure of the capability   |                           |                           |                                 |                                 |  |               |
|--|---------------------------|---------------------------|---------------------------------|---------------------------------|--|---------------|
| P <sub>min</sub> : -77.69dBm   |                           |                           |                                 |                                 |  |               |
| The actual blocking signal power (Note)  |                           |                           |                                 |                                 | <input checked="" type="checkbox"/> at the antenna connector |               |
|  |                           |                           |                                 |                                 | <input type="checkbox"/> in front of the antenna             |               |
| Note: For the conducted measurements, the same level should be used at the antenna connector irrespective of antenna gain. |                           |                           |                                 |                                 |  |               |
| Operation mode   | Operation frequency (MHz) | Wanted signal power (dBm) | Offset of the bandwidth (times) | Blocking signal frequency (MHz) | Blocking signal Power (dBm)                                  | Minimum Limit |
| Normal working   | 5755                      | -74.69                    | -10                             | 5374.481                        | -51.26   | -91.79        |
|  |                           |                           | -20                             | 5012.006                        | -43.89   |               |
|  |                           |                           | -50                             | 3924.581                        | -45.77   |               |
|  | 5795                      |                           | 10                              | 6175.679                        | -54.29   | -90.85        |
|  |                           |                           | 20                              | 6538.154                        | -45.61   |               |
|  |                           |                           | 50                              | 7625.579                        | -43.13   |               |

Note:

Lower Channel:  $K=-20\log f -10\log BW=-30.79$

Upper Channel:  $K=-20\log f -10\log BW=-30.85$

For occupied bandwidth, please see the page 18.



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### 3.7 RECEIVER SPURIOUS EMISSIONS

#### 3.7.1 LIMITS OF RECEIVER SPURIOUS EMISSIONS

| Frequency range | Frequencies below 1GHz | Frequencies above 1GHz |
|-----------------|------------------------|------------------------|
| Limit           | 2nW or -57dBm          | 20nW or -47dBm         |

#### 3.7.2 TEST PROCEDURES

Refer to chapter 4.3.5.3 of EN 300 440 V2.2.1 (2018-07).

#### 3.7.3 DEVIATION FROM TEST STANDARD

No deviation.

#### 3.7.4 TEST SETUP

1. For the actual test configuration, please refer to the related Item in this test report (Photographs of the Test Configuration).
2. The test setup has been constructed as the normal use condition. Controlling software (provided by manufacturer) has been activated to set the EUT on specific status.

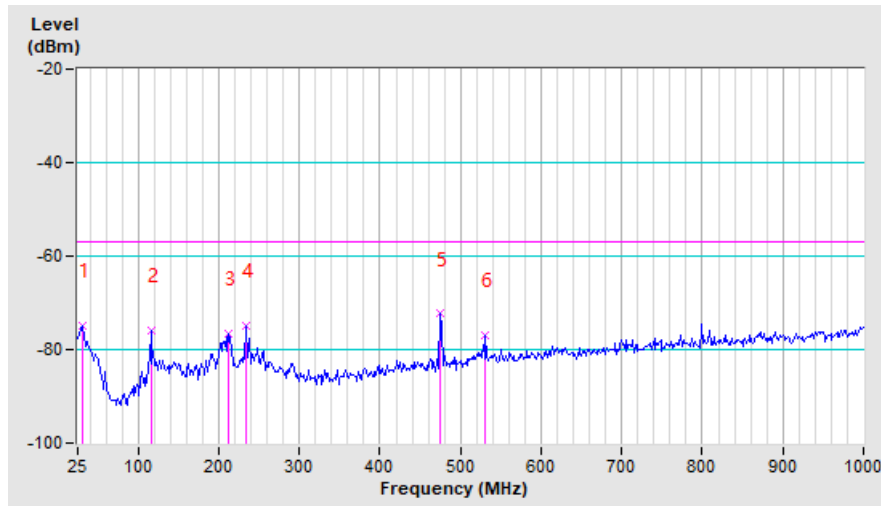


### 3.7.5 TEST RESULTS

#### RX BELOW 1GHz WORST-CASE DATA: 802.11a

|  |              |                          |     |
|--|--------------|--------------------------|-----|
| <b>SPURIOUS EMISSION FREQUENCY RANGE</b> | 25MHz ~ 1GHz | <b>OPERATING CHANNEL</b> | 149 |
|--|--------------|--------------------------|-----|

| SPURIOUS EMISSION LEVEL |                      |             |             |             |
|-------------------------|----------------------|-------------|-------------|-------------|
| Frequency (MHz)         | Antenna Polarization | Level (dBm) | Limit (dBm) | Margin (dB) |
| 31.25                   | H                    | -74.97      | -57.00      | -17.97      |
| 115.62                  | H                    | -75.90      | -57.00      | -18.90      |
| 212.50                  | H                    | -76.45      | -57.00      | -19.45      |
| 234.37                  | H                    | -74.96      | -57.00      | -17.96      |
| 475.00                  | H                    | -72.33      | -57.00      | -15.33      |
| 531.25                  | H                    | -76.82      | -57.00      | -19.82      |





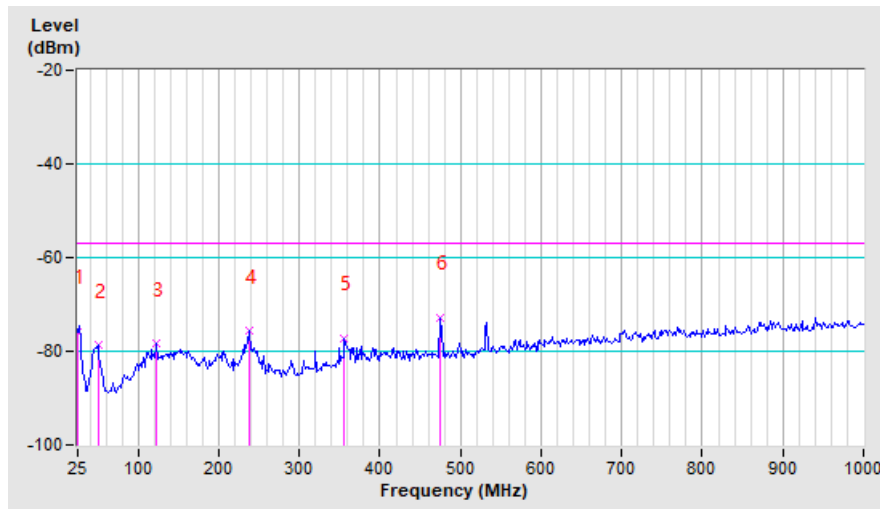


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Test Report No.: RE2312WDG0148-5

|  |              |                          |     |
|--|--------------|--------------------------|-----|
| <b>SPURIOUS EMISSION<br/>FREQUENCY RANGE</b> | 25MHz ~ 1GHz | <b>OPERATING CHANNEL</b> | 149 |
|--|--------------|--------------------------|-----|

| SPURIOUS EMISSION LEVEL |                         |                |                |                |
|-------------------------|-------------------------|----------------|----------------|----------------|
| Frequency<br>(MHz)      | Antenna<br>Polarization | Level<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
| 25.00                   | V                       | -75.85         | -57.00         | -18.85         |
| 50.00                   | V                       | -78.81         | -57.00         | -21.81         |
| 123.44                  | V                       | -78.42         | -57.00         | -21.42         |
| 237.50                  | V                       | -75.76         | -57.00         | -18.76         |
| 356.25                  | V                       | -77.33         | -57.00         | -20.33         |
| 475.00                  | V                       | -72.80         | -57.00         | -15.80         |



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**RX ABOVE 1GHz WORST-CASE DATA: 802.11a**

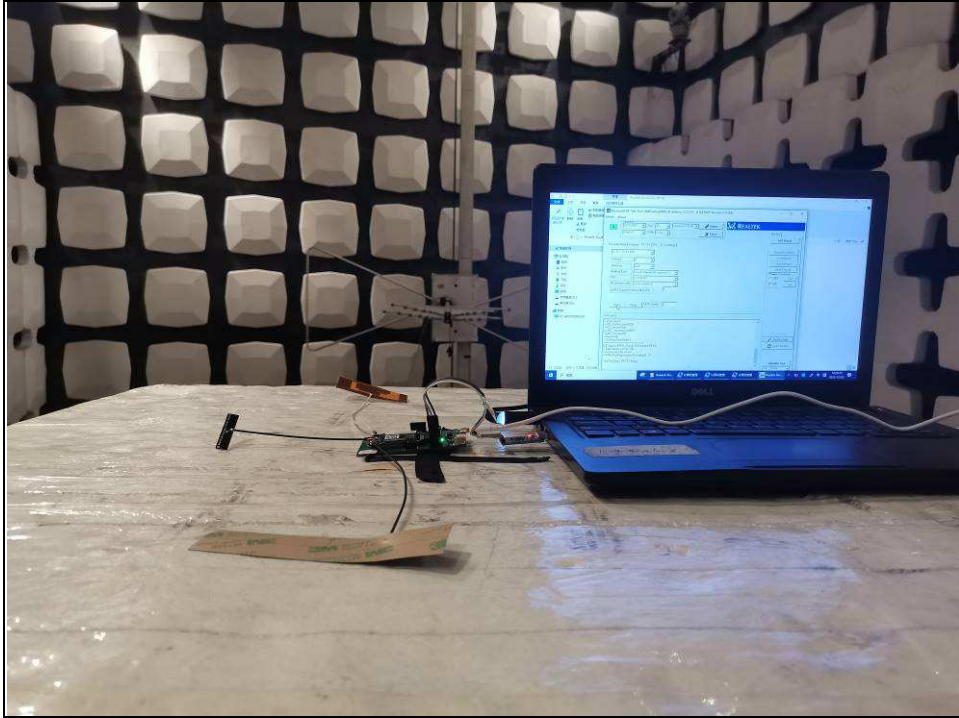
|  |              |                              |          |
|--|--------------|------------------------------|----------|
| <b>SPURIOUS EMISSION<br/>FREQUENCY RANGE</b> | 1GHz ~ 40GHz | <b>OPERATING<br/>CHANNEL</b> | 149, 165 |
|--|--------------|------------------------------|----------|

| <b>SPURIOUS EMISSION LEVEL</b> |                            |                                 |                        |                        |                        |
|--------------------------------|----------------------------|---------------------------------|------------------------|------------------------|------------------------|
| <b>Channel</b>                 | <b>Frequency<br/>(MHz)</b> | <b>Antenna<br/>Polarization</b> | <b>Level<br/>(dBm)</b> | <b>Limit<br/>(dBm)</b> | <b>Margin<br/>(dB)</b> |
| 149                            | 11490.00                   | H                               | -58.67                 | -47.00                 | -11.67                 |
|                                | 11490.00                   | V                               | -59.25                 | -47.00                 | -12.25                 |
|                                | 17235.00                   | H                               | -57.69                 | -47.00                 | -10.69                 |
|                                | 17235.00                   | V                               | -57.60                 | -47.00                 | -10.60                 |
| 165                            | 11650.00                   | H                               | -57.25                 | -47.00                 | -10.25                 |
|                                | 11650.00                   | V                               | -59.41                 | -47.00                 | -12.41                 |
|                                | 17475.00                   | H                               | -60.43                 | -47.00                 | -13.43                 |
|                                | 17475.00                   | V                               | -58.43                 | -47.00                 | -11.43                 |

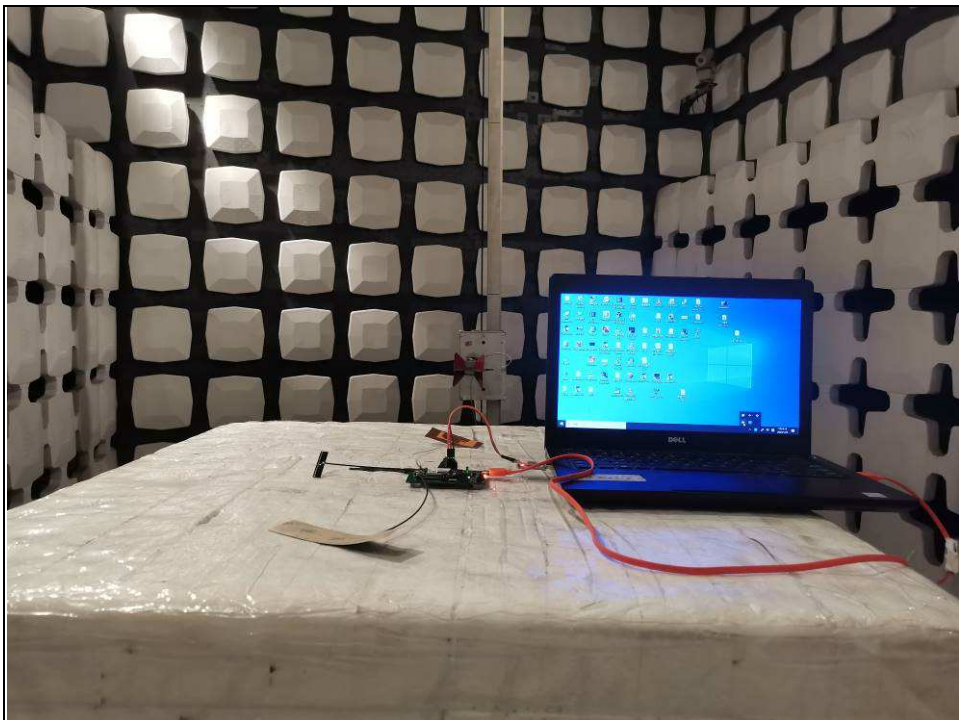


## 4 PHOTOGRAPHS OF THE TEST CONFIGURATION

### SPURIOUS EMISSION TEST BELOW 1GHz



### SPURIOUS EMISSION TEST ABOVE 1GHz





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## 5 APPENDIX A – MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No modifications were made to the EUT by the lab during the test.

---END---