



Informe de ensayo n°:
Test report No:

NIE: 55958RRF.001

Test report

ETSI EN 300 328 v 2.1.1 (2016-11)

| | |
|---|---|
| Identificación del objeto ensayado.....: Identification of item tested | System-on-Chip (SoC) |
| Marca Trademark | Nordic |
| Modelo y/o referencia tipo Model and /or type reference | N52840 |
| Other identification of the product | --- |
| Final HW version | QIAA CA0 |
| Final SW version | NA |
| Características Features | Data not provided |
| Fabricante Manufacturer | NORDIC SEMICONDUCTOR ASA Otto Nielsens veg 12, 7052 Trondheim, NORWAY |
| Método de ensayo solicitado, norma.....: Test method requested, standard | ETSI EN 300 328 v2.1.1 (2016-11): Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU. |
| Resultado.....: Summary | IN COMPLIANCE |
| Aprobado por (nombre / cargo y firma) Approved by (name / position & signature) | A. Llamas RF Lab. Manager |
| Fecha de realización Date of issue | 2018-05-14 |
| Formato de informe No.: Report template No | FDT08_20 |

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Competences and guarantees

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Uncertainty

Uncertainty (factor $k=2$) was calculated according to the DEKRA Testing and Certification internal document PODT000.

Usage of samples

Samples undergoing test have been selected by: **the client**

Sample S/01 is composed of the following elements:

| Control N° | Description | Model | Serial N° | Date of reception |
|------------|-------------|--------|-----------|-------------------|
| 55958/001 | SoC | N52840 | --- | 2018/02/19 |
| 54505/003 | Test board | --- | --- | 2018/01/23 |

1. Sample S/01 has undergone following test(s).

All tests indicated in appendix B.

Test sample description

The test sample consists of a system-on-chip (SoC) for wireless application, contains CPU, flash and radio interface.

Identification of the client

NORDIC SEMICONDUCTOR ASA

Otto Nielsens veg 12, N-7052 Trondheim NORWAY

Testing period

The performed test started on 2018-02-22 and finished on 2018-03-12.

The tests have been performed at DEKRA Testing and Certification.

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

| | |
|--------------------------------------|------------------------------|
| Temperature | Min. = 15 °C Max. = 35 °C |
| Relative humidity | Min. = 20 % Max. = 75 % |
| Shielding effectiveness | > 100 dB |
| Electric insulation | > 10 k Ω |
| Reference resistance to earth | < 1 Ω |

In the semianechoic chamber, the following limits were not exceeded during the test.

| | |
|--------------------------------------|--|
| Temperature | Min. = 15 °C Max. = 35 °C |
| Relative humidity | Min. = 20 % Max. = 75 % |
| Air pressure | Min. = 860 mbar Max. = 1060 mbar |
| Shielding effectiveness | > 100 dB |
| Electric insulation | > 10 k Ω |
| Reference resistance to earth | < 1 Ω |
| Normal site attenuation (NSA) | < ± 4 dB at 10 m distance between item under test and receiver antenna, (30 MHz to 1000 MHz) |
| Field homogeneity | More than 75% of illuminated surface is between 0 and 6 dB (26 MHz to 1000 MHz). |

In the chamber for conducted measurements, the following limits were not exceeded during the test:

| | |
|--------------------------------------|-------------------------------------|
| Temperature | Min. = 15 °C Max. = 35 °C |
| Relative humidity | Min. = 20 % Max. = 75 % |
| Air pressure | Min. = 860 mbar Max. = 1060 mbar |
| Shielding effectiveness | > 100 dB |
| Electric insulation | > 10 kΩ |
| Reference resistance to earth | < 1 Ω |

Remarks and comments

- 1: The tests have been performed by the technical personnel: José Alberto Aranda and Oscar San José.
- 2: The equipment is declared as non-adaptive mode using other forms of modulation than FHSS. The maximum measured RF Output power level is less than 10 dBm e.i.r.p.
- 3: The equipment does not implement geo-location capability as defined in clause 4.3.2.12.2.
- 4: Used instrumentation:

Conducted Measurements

Test system Rohde & Schwarz TS 8997:

| | | Last Cal. Date | Cal. Due date |
|----|--|----------------|---------------|
| 1. | Spectrum analyser Rohde & Schwarz FSL6 | 2016/10 | 2018/10 |
| 2. | Switch unit Rohde & Schwarz with power detector OSP120 / OSP-B157 | 2017/12 | 2019/12 |
| 3. | RF generator Rohde & Schwarz SMB100A | 2017/07 | 2019/07 |
| 4. | RF generator Rohde & Schwarz SMU200A | 2016/07 | 2018/07 |
| 5. | Climatic chamber HERAEUS VM 04/35 | 2016/03 | 2018/03 |
| 6. | DC power supply R&S NGPE 40/40 | 2018/02 | 2021/02 |

Test system for receiver blocking test:

| Test System | TACS4 BEST | | | | |
|-------------|-------------|--------------------------------|------------|-------------------------|-----------------------|
| Control No. | 5852 | | | | |
| Hardware: | Control No. | Equipment | Serial No. | Latest Calibration Date | Next Calibration Date |
| | 5767 | LAN/GPIB/USB E5810B | MY56030024 | N/A | N/A |
| | 5398 | Power Supply Agilent 66311B | MY52002833 | 2017-12-18 | 2018-12-18 |
| | 5399 | Sweep Generator AGILENT E8257D | MY53401729 | 2017-12-20 | 2018-12-20 |
| | 5749 | R&S® CMW270 | 100651 | 2017-03-13 | 2018-03-13 |
| | 5853 | COMBINER UNIT T4BCU100A | 000001 | N/A | N/A |

Radiated Measurements

| | | Last Cal. date | Cal. due date |
|----|--|----------------|---------------|
| 1. | Semianechoic Absorber Lined Chamber ETS FACT3 200STP | N.A. | N.A. |
| 2. | BiconicalLog antenna ETS LINDGREN 3142E | 2017/04 | 2020/04 |
| 3. | Multi Device Controller EMCO 2090 | N.A. | N.A. |
| 4. | Double-ridge Guide Horn antenna 1-18 GHz SCHWARZBECK BBHA 9120 D | 2016/11 | 2019/11 |
| 5. | Spectrum analyser Rohde & Schwarz FSV40 | 2017/07 | 2019/07 |
| 6. | EMI Test Receiver R&S ESU 40 | 2016/03 | 2018/03 |
| 7. | RF pre-amplifier 30 MHz-6 GHz Bonn Elektronik BLNA 0360-01N | 2017/07 | 2018/07 |
| 8. | RF pre-amplifier 1-18 GHz Bonn Elektronik BLMA 0118-3A | 2017/05 | 2018/05 |

Testing verdicts

| | |
|----------------------|-----|
| Not applicable | N/A |
| Pass | P |
| Fail | F |
| Not measured | N/M |

1. Bluetooth Low Energy

| EN 300 328 PARAGRAPH | | VERDICT | | | |
|----------------------|--|-----------------|---|---|----|
| | | NA | P | F | NM |
| 4.3.2.2 | Transmitter. RF Output Power | | P | | |
| 4.3.2.3 | Transmitter. Power Spectral Density | | P | | |
| 4.3.2.4 | Transmitter. Duty cycle, Tx-Sequence, Tx-gap | NA ² | | | |
| 4.3.1.4 | Accumulated Transmit Time, Frequency Occupation & Hopping Sequence | NA | | | |
| 4.3.1.5 | Hopping Frequency Separation | NA | | | |
| 4.3.2.5 | Medium Utilisation | NA ² | | | |
| 4.3.2.6 | Adaptivity | NA ² | | | |
| 4.3.2.7 | Occupied Channel Bandwidth | | P | | |
| 4.3.2.8 | Transmitter unwanted emissions in the out-of-band domain | | P | | |
| 4.3.2.9 | Transmitter unwanted emissions in the spurious domain (conducted) | | P | | |
| 4.3.2.9 | Transmitter unwanted emissions in the spurious domain (radiated) | | P | | |
| 4.3.2.10 | Receiver spurious emissions (conducted) | | P | | |
| 4.3.2.10 | Receiver spurious emissions (radiated) | | P | | |
| 4.3.2.11 | Receiver blocking | | P | | |
| 4.3.2.12 | Geo-location capability | NA ³ | | | |

2, 3: See section "Remarks and comments".

Appendix A – Application form

Information as required by EN 300 328 V2.1.1, clause 5.4.1

In accordance with EN 300 328, clause 5.4.1, the following information is provided by the manufacturer.

a) The type of modulation used by the equipment:

- ☐ FHSS
- ☒ other forms of modulation

b) In case of FHSS modulation:

- In case of non-Adaptive Frequency Hopping equipment:
The number of Hopping Frequencies:
- In case of Adaptive Frequency Hopping Equipment:
The maximum number of Hopping Frequencies:
The minimum number of Hopping Frequencies:- The (average) Dwell Time:

c) Adaptive / non-adaptive equipment:

- ☒ non-adaptive Equipment
- ☐ adaptive Equipment without the possibility to switch to a non-adaptive mode
- ☐ adaptive Equipment which can also operate in a non-adaptive mode

d) In case of adaptive equipment:

The maximum Channel Occupancy Time implemented by the equipment: ms

- ☐ The equipment has implemented an LBT based DAA mechanism

- In case of equipment using modulation different from FHSS:

- ☐ The equipment is Frame Based equipment
- ☐ The equipment is Load Based equipment
- ☐ The equipment can switch dynamically between Frame Based and Load Based equipment

The CCA time implemented by the equipment: μ s

- ☐ The equipment has implemented a non-LBT based DAA mechanism
- ☐ The equipment can operate in more than one adaptive mode
- ☐ The equipment has implemented Short Control Signalling Transmissions

e) In case of non-adaptive Equipment:

The maximum RF Output Power: +9 dBm

The maximum RF Output Power (e.i.r.p.). +10.6 dBm

The maximum (corresponding) Duty Cycle: %

Equipment with dynamic behaviour, that behaviour is described here. (e.g. the different combinations of duty cycle and corresponding power levels to be declared):

.....
.....
.....

f) The worst case operational mode for each of the following tests:

- RF Output Power
Operating_Instructions_Qualification_Boards_nDTM_FCC_ETSI.docx
- Power Spectral Density
Operating_Instructions_Qualification_Boards_nDTM_FCC_ETSI.docx
- Duty cycle, Tx-Sequence, Tx-gap
Operating_Instructions_Qualification_Boards_nDTM_FCC_ETSI.docx
- Accumulated Transmit time, Frequency Occupation & Hopping Sequence (only for FHSS equipment)
.....
- Hopping Frequency Separation (only for FHSS equipment)
.....
- Medium Utilization
.....
- Adaptivity & Receiver Blocking
Operating_Instructions_Qualification_Boards_nDTM_FCC_ETSI.docx
- Nominal Channel Bandwidth
1MHz
- Transmitter unwanted emissions in the OOB domain
Operating_Instructions_Qualification_Boards_nDTM_FCC_ETSI.docx
- Transmitter unwanted emissions in the spurious domain
Operating_Instructions_Qualification_Boards_nDTM_FCC_ETSI.docx
- Receiver spurious emissions

Operating_Instructions_Qualification_Boards_nDTM_FCC_ETSI.docx

g) The different transmit operating modes (tick all that apply):

- ☒ Operating mode 1: Single Antenna Equipment
- ☒ Equipment with only one antenna
- ☐ Equipment with two diversity antennas but only one antenna active at any moment in time
- ☐ Smart Antenna Systems with two or more antennas, but operating in a (legacy) mode where only one antenna is used. (e.g. IEEE 802.11™ [i.3] legacy mode in smart antenna systems)
- ☐ Operating mode 2: Smart Antenna Systems - Multiple Antennas without beam forming
- ☐ Single spatial stream / Standard throughput / (e.g. IEEE 802.11™[i.3] legacy mode)
- ☐ High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 1
- ☐ High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 2

NOTE: Add more lines if more channel bandwidths are supported.

- ☐ Operating mode 3: Smart Antenna Systems - Multiple Antennas with beam forming
- ☐ Single spatial stream / Standard throughput (e.g. IEEE 802.11™ [i.3] legacy mode)
- ☐ High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 1
- ☐ High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 2

NOTE: Add more lines if more channel bandwidths are supported.

h) In case of Smart Antenna Systems:

- The number of Receive chains:
- The number of Transmit chains:
 - ☐ symmetrical power distribution
 - ☐ asymmetrical power distribution

In case of beam forming, the maximum (additional) beam forming gain: dB

NOTE: The additional beam forming gain does not include the basic gain of a single antenna.

i) Operating Frequency Range(s) of the equipment:

- Operating Frequency Range 1: 2402 MHz to 2480 MHz
- Operating Frequency Range 2: MHz to MHz

NOTE: Add more lines if more Frequency Ranges are supported.

j) Nominal Channel Bandwidth(s):

- Nominal Channel Bandwidth 1. 1 MHz

- Nominal Channel Bandwidth 2: MHz

NOTE: Add more lines if more channel bandwidths are supported.

k) Type of Equipment (stand-alone, combined, plug-in radio device, etc.):

- ☒ Stand-alone
- ☐ Combined Equipment (Equipment where the radio part is fully integrated within another type of equipment)
- ☐ Plug-in radio device (Equipment intended for a variety of host systems)
- ☐ Other

l) The normal and the extreme operating conditions that apply to the equipment:

Normal operating conditions (if applicable):

Operating temperature: 25 ° C

Operating voltage range: 3.0

Extreme operating conditions:

Operating temperature range: Minimum -40 ° C Maximum +85° C

Operating voltage range: Minimum 1.7 V Maximum 3.6 V

Details provided are for the: ☒ stand-alone equipment
☐ combined (or host) equipment
☐ test jig

m) The intended combination(s) of the radio equipment power settings and one or more antenna assemblies and their corresponding e.i.r.p levels:

- Antenna Type:

☐ Integral Antenna

Antenna Gain:

Type:

If applicable, additional beamforming gain (excluding basic antenna gain): dB

- ☐ Temporary RF connector provided
- ☐ No temporary RF connector provided

☒ Dedicated Antennas (equipment with antenna connector)

☐ Single power level with corresponding antenna(s)

☒ Multiple power settings and corresponding antenna(s)

Number of different Power Levels: 14

Power Level 1: +8 dBm

Power Level 2: +4 dBm

NOTE 1: Add more lines in case the equipment has more power levels.

NOTE 2: These power levels are conducted power levels (at antenna connector).

- For each of the Power Levels, provide the intended antenna assemblies, their corresponding gains (G) and the resulting e.i.r.p. levels also taking into account the beamforming gain (Y) if applicable

Power Level 1: +8 dBm

Number of antenna assemblies provided for this power level: 1

| Assembly # | Gain (dBi) | e.i.r.p. (dBm) | Part number or model name |
|------------|------------|----------------|--|
| 1 | 1.6 | 9.6 | ANT-2.4-CVW-RAH [Manufacturer: Linx Technologies Inc.] |
| 2 | | | |
| 3 | | | |
| 4 | | | |

NOTE 3: Add more rows in case more antenna assemblies are supported for this power level.

Power Level 2: +4 dBm

Number of antenna assemblies provided for this power level: 1

| Assembly # | Gain (dBi) | e.i.r.p. (dBm) | Part number or model name |
|------------|------------|----------------|---------------------------|
| 1 | 1.6 | 5.6 | ANT-2.4-CVW-RAH |
| 2 | | | |
| 3 | | | |
| 4 | | | |

NOTE 4: Add more rows in case more antenna assemblies are supported for this power level.

n) The nominal voltages of the stand-alone radio equipment or the nominal voltages of the combined (host) equipment or test jig in case of plug-in devices:

Details provided are for the:

☒ stand-alone equipment

☐ combined (or host) equipment

☐ test jig

Supply Voltage ☐ AC mains State AC voltage V
☒ DC State DC voltage 3.0 V

In case of DC, indicate the type of power source

- ☒ Internal Power Supply
☐ External Power Supply or AC/DC adapter
☐ Battery
☐ Other:

o) Describe the test modes available which can facilitate testing:

Operating_Instructions_Qualification_Boards_nDTM_FCC_ETSI.docx

.....
.....

p) The equipment type (e.g. Bluetooth®, IEEE 802.11™[i.3], IEEE 802.15.4™[i.4], proprietary, etc.):

Bluetooth LE 5.0 and Proprietary

q) If applicable, the statistical analysis referred to in clause 5.4.1 q)

(to be provided as separate attachment)

r) If applicable, the statistical analysis referred to in clause 5.4.1 r)

(to be provided as separate attachment)

s) Geo-location capability supported by the equipment:

- ☐ Yes
☐ The geographical location determined by the equipment as defined in clause 4.3.1.13.2 or clause 4.3.2.12.2 is not accessible to the user.
☒ No

t) Describe the minimum performance criteria that apply to the equipment (see clause 4.3.1.12.3 or clause 4.3.2.11.3):

10%

.....
.....

Appendix B – Test results. Bluetooth Low Energy

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TEST CONDITIONS

Power supply (V):

$$V_{\text{nominal}} = 3.0 \text{ Vdc}$$

Type of power supply = DC voltage from external power supply.

Temperature (°C):

$$T_n = +15 \text{ to } +35$$

$$T_{\text{min}} = -40 (*)$$

$$T_{\text{max}} = +85 (*)$$

The subscript n indicates normal test conditions.

The subscripts min and max indicates extreme test conditions (minimum and maximum respectively).

(*): Declared by applicant.

TEST FREQUENCIES FOR CONDUCTED TESTS:

Lowest channel: 2402 MHz

Middle channel: 2440 MHz

Highest channel: 2480 MHz

TEST FREQUENCIES FOR RADIATED TESTS:

Lowest range: 2402 MHz

Highest range: 2480 MHz

PRODUCT INFORMATION

The following information is provided by the supplier, in accordance with clause 5.4.1:

| Information | Description |
|--|--|
| Modulation | Other than FHSS |
| Adaptive | Non-adaptive equipment |
| Maximum RF Output Power (e.i.r.p.) | <10 dBm |
| Operation mode 1: Single Antenna Equipment | Equipment with only one antenna |
| - Operating Frequency Range | 2402 – 2480 MHz |
| - Nominal Channel Bandwidth | 1MHz. |
| Extreme operating conditions | |
| - Temperature range | -40 °C to +85 °C |
| Antenna type | Dedicated Antenna (equipment with antenna connector) |
| Antenna gain | +1.6 dBi |
| Nominal Voltage | |
| - Supply Voltage | 3.0 Vdc |
| - Type of power source | External Power Supply |
| Equipment type | Bluetooth Low Energy |
| Geo-location capability | No |

Test modes available:

- Continuous modulated carrier at 2402 MHz, 2440 MHz and 2480 MHz.
- Continuous reception at 2402 MHz, 2440 MHz and 2480 MHz.

TEST 4.3.2.2: Transmitter. RF Output Power.

LIMITS

For adaptive equipment using wide band modulations other than FHSS, the maximum RF output power shall be 20 dBm.

The maximum RF output power for non-adaptive equipment shall be declared by the supplier and shall not exceed 20 dBm. For non-adaptive equipment using wide band modulations other than FHSS, the maximum RF output power shall be equal to or less than the value declared by the manufacturer.

This limit shall apply for any combination of power level and intended antenna assembly.

RESULTS

Type of equipment: Non-adaptive equipment.

Maximum declared RF Output Power (e.i.r.p.). +10.6 dBm.

Antenna assembly declared gain (dBi) = +1.6 dBi.

Mode 1: BTLE BitRate 1Mbps.

| | | Transmitter power e.i.r.p. (dBm) | | |
|-------------------------|----------------|----------------------------------|------------------|-------------------|
| TEST CONDITIONS | | Lowest frequency | Middle frequency | Highest frequency |
| T _n | V _n | P= 9.143 | P= 8.229 | P= 8.885 |
| T _{min} | V _n | P= 9.747 | P= 8.908 | P= 9.517 |
| T _{max} | V _n | P= 8.620 | P= 7.661 | P= 8.264 |
| Measurement uncertainty | | <±0.66 dB | | |

Note: P is the e.i.r.p. as defined in clause 5.4.2.2.1.2 step 6

Verdict: PASS

Mode 2: BTLE BitRate 2Mbps.

| | | Transmitter power e.i.r.p. (dBm) | | |
|-------------------------|----------------|----------------------------------|------------------|-------------------|
| TEST CONDITIONS | | Lowest frequency | Middle frequency | Highest frequency |
| T _n | V _n | P= 9.112 | P= 8.272 | P= 8.923 |
| T _{min} | V _n | P= 9.742 | P= 8.882 | P= 9.499 |
| T _{max} | V _n | P= 8.612 | P= 7.661 | P= 8.254 |
| Measurement uncertainty | | <±0.66 dB | | |

Note: P is the e.i.r.p. as defined in clause 5.4.2.2.1.2 step 6

Verdict: PASS

TEST 4.3.2.3: Transmitter. Power Spectral Density.

LIMITS

For equipment using wide band modulations other than FHSS, the maximum Power Spectral Density is limited to 10 dBm per MHz.

RESULTS

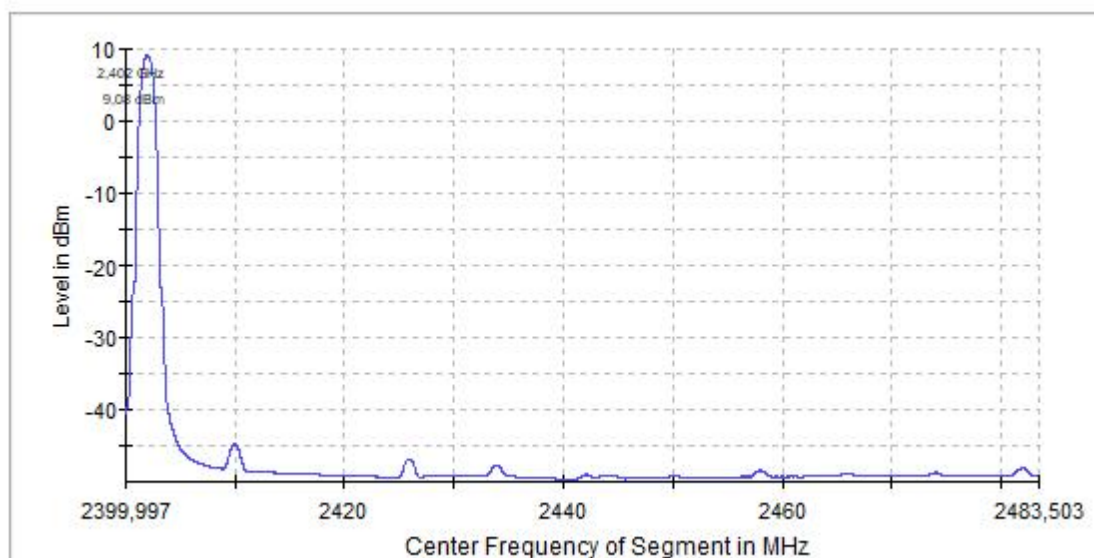
Antenna assembly declared maximum gain (dBi) = +1.6 dBi.
See next plots.

Mode 1: BTLE BitRate 1Mbps.

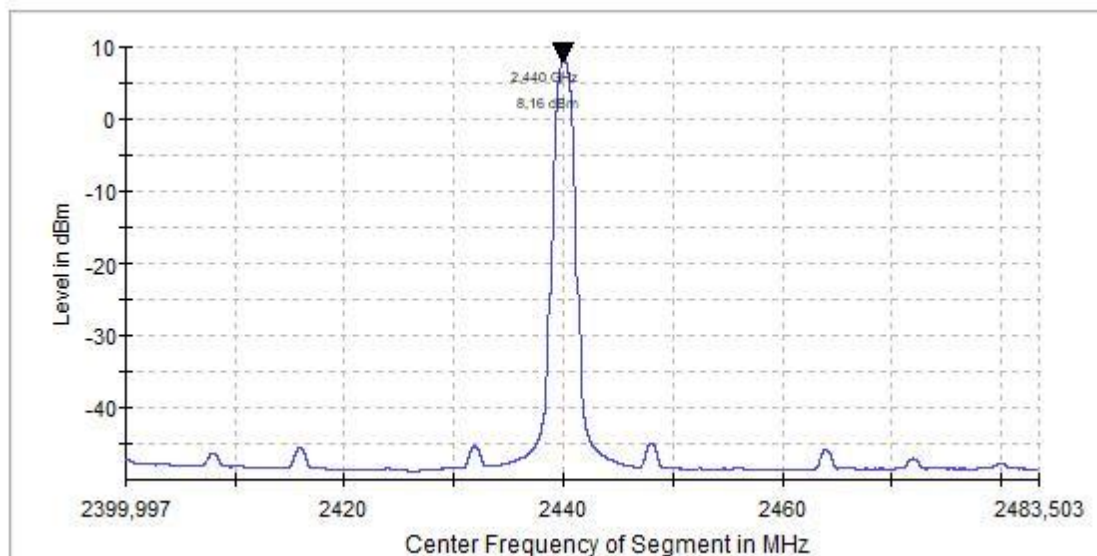
| | Lowest frequency 2401.9774 MHz | Middle frequency 2439.4801 MHz | Highest frequency 2479.9777 MHz |
|-------------------------|-----------------------------------|-----------------------------------|------------------------------------|
| Measured power density | 9.076 dBm/1 MHz | 8.158 dBm/1 MHz | 8.814 dBm/1 MHz |
| Measurement uncertainty | <±0.95 dB | | |

Verdict: PASS

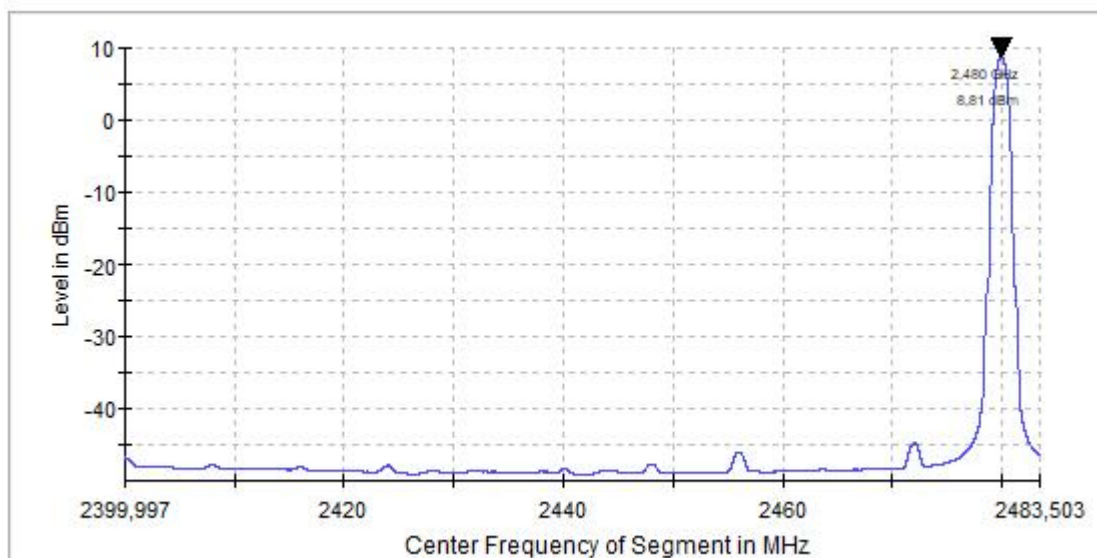
Channel Low



Channel Middle



Channel High

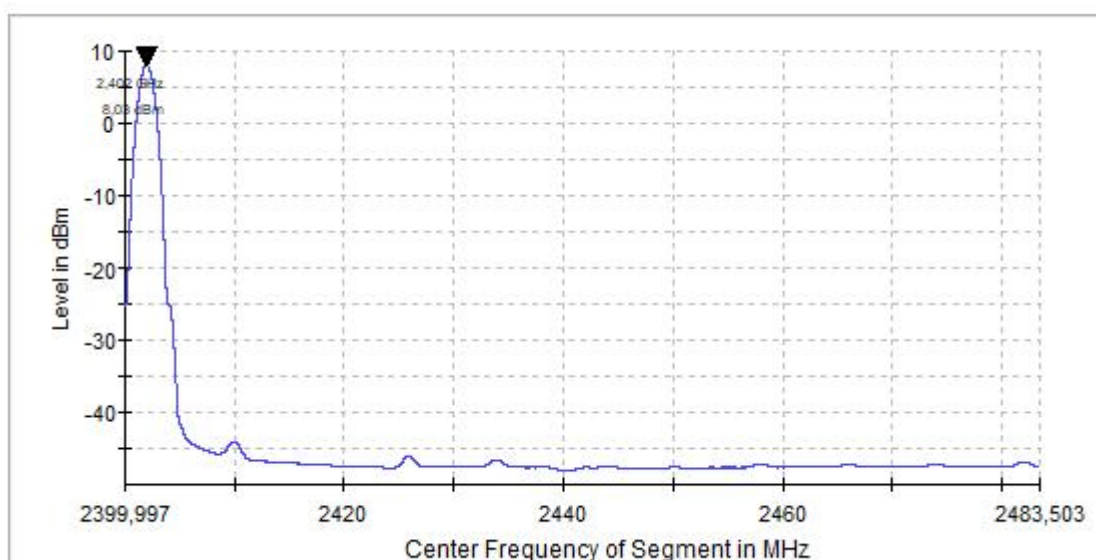


Mode 2: BTLE BitRate 2Mbps.

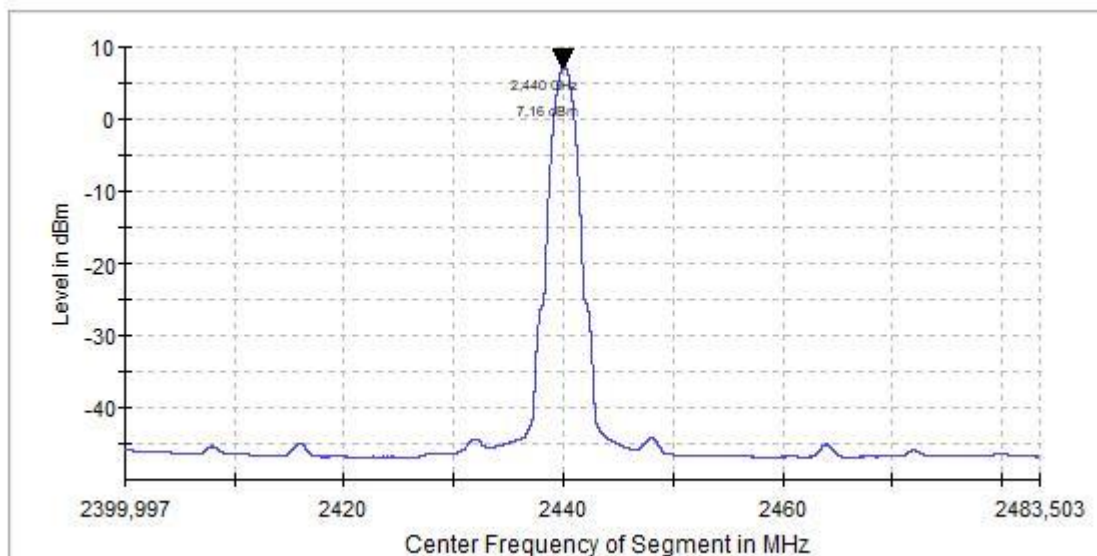
| | Lowest frequency 2401.9874 MHz | Middle frequency 2439.9902 MHz | Highest frequency 2479.9877 MHz |
|-------------------------|-----------------------------------|-----------------------------------|------------------------------------|
| Measured power density | 8.027 dBm/1 MHz | 7.158 dBm/1 MHz | 7.802 dBm/1 MHz |
| Measurement uncertainty | <±0.95 dB | | |

Verdict: PASS

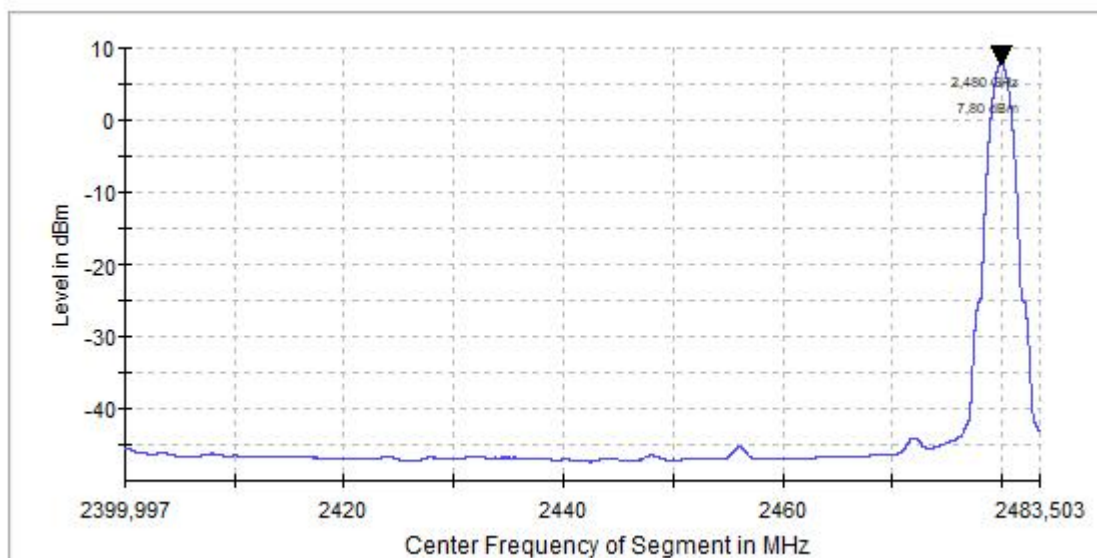
Channel Low



Channel Middle



Channel High



TEST 4.3.2.7: Occupied Channel Bandwidth.

LIMITS

The Occupied Channel Bandwidth shall fall completely within the 2400 – 2483.5 MHz band.

In addition, for non-adaptive systems using wide band modulations other than FHSS and with e.i.r.p greater than 10 dBm, the occupied channel bandwidth shall be less than 20 MHz.

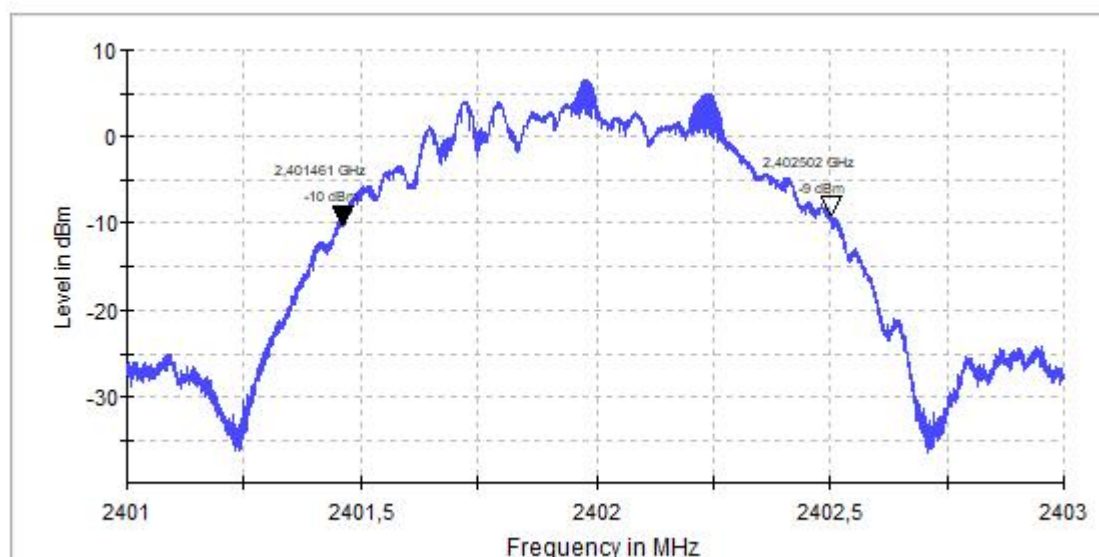
RESULTS:

Type of equipment: Non-adaptive mode.
e.i.r.p. < 10 dBm

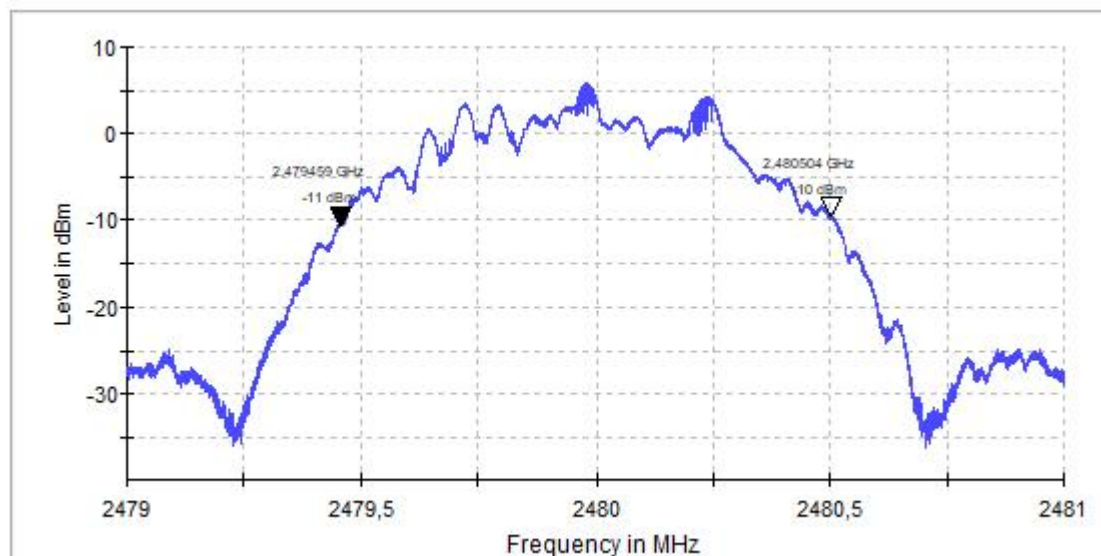
Mode 1: BTLE BitRate 1Mbps.

| Channel | Channel Center Frequency (MHz) | Occupied Channel Bandwidth (MHz) | Band Edge (MHz) |
|-------------------------|--------------------------------|----------------------------------|-----------------|
| Lowest | 2401.9816 | 1.0416 | 2401.4608 |
| Highest | 2479.9814 | 1.0456 | 2480.5042 |
| Measurement uncertainty | | < ± 1.31 kHz | |

Channel Low



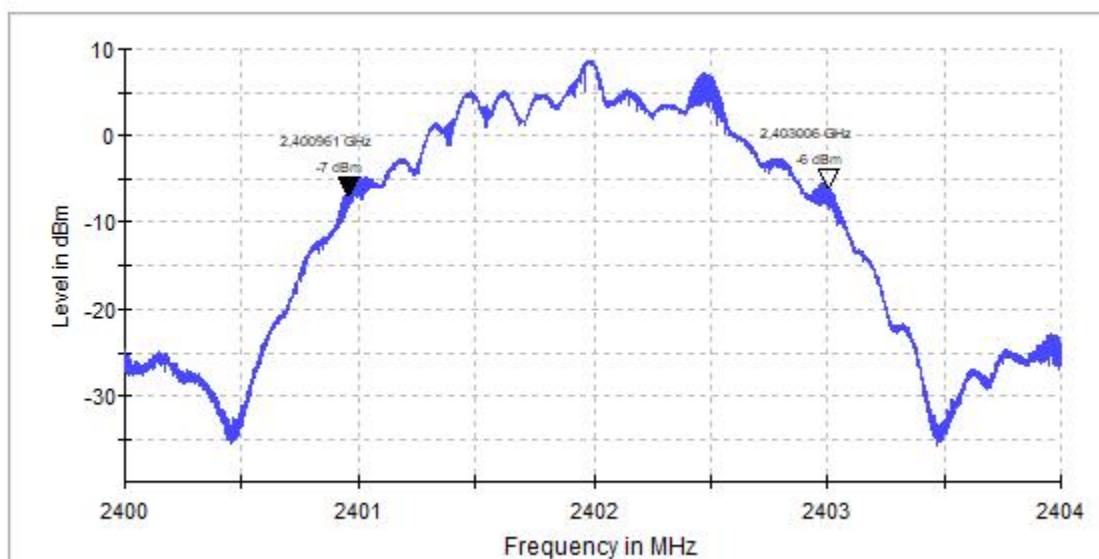
Channel High



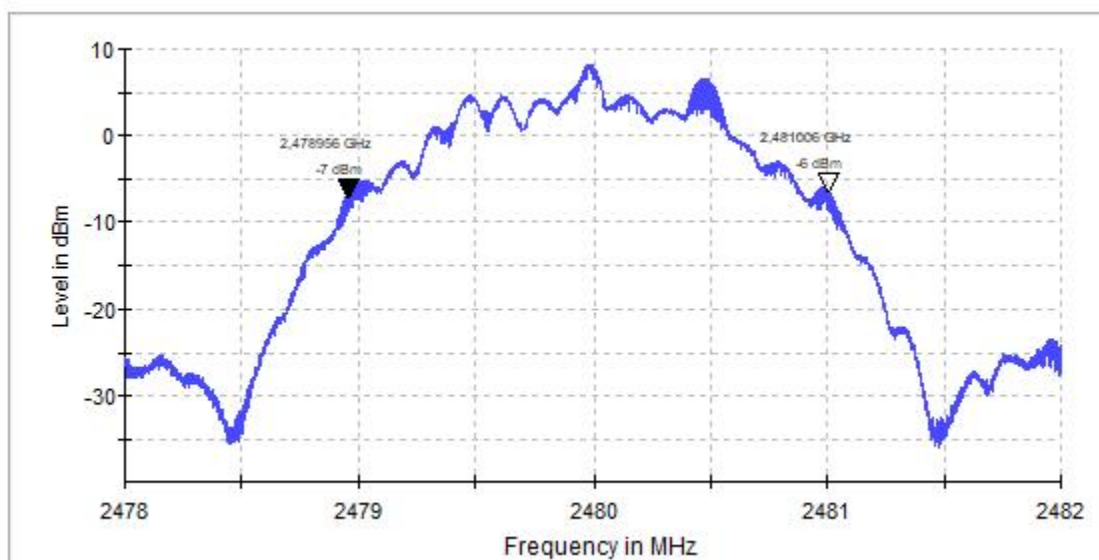
Verdict: PASS

Mode 2: BTLE BitRate 2Mbps.

| Channel | Channel Center Frequency (MHz) | Occupied Channel Bandwidth (MHz) | Band Edge (MHz) |
|-------------------------|--------------------------------|----------------------------------|-----------------|
| Lowest | 2401.9835 | 2.0457 | 2400.9606 |
| Highest | 2479.9810 | 2.0507 | 2481.0064 |
| Measurement uncertainty | | < ± 1.31 kHz | |



Channel High

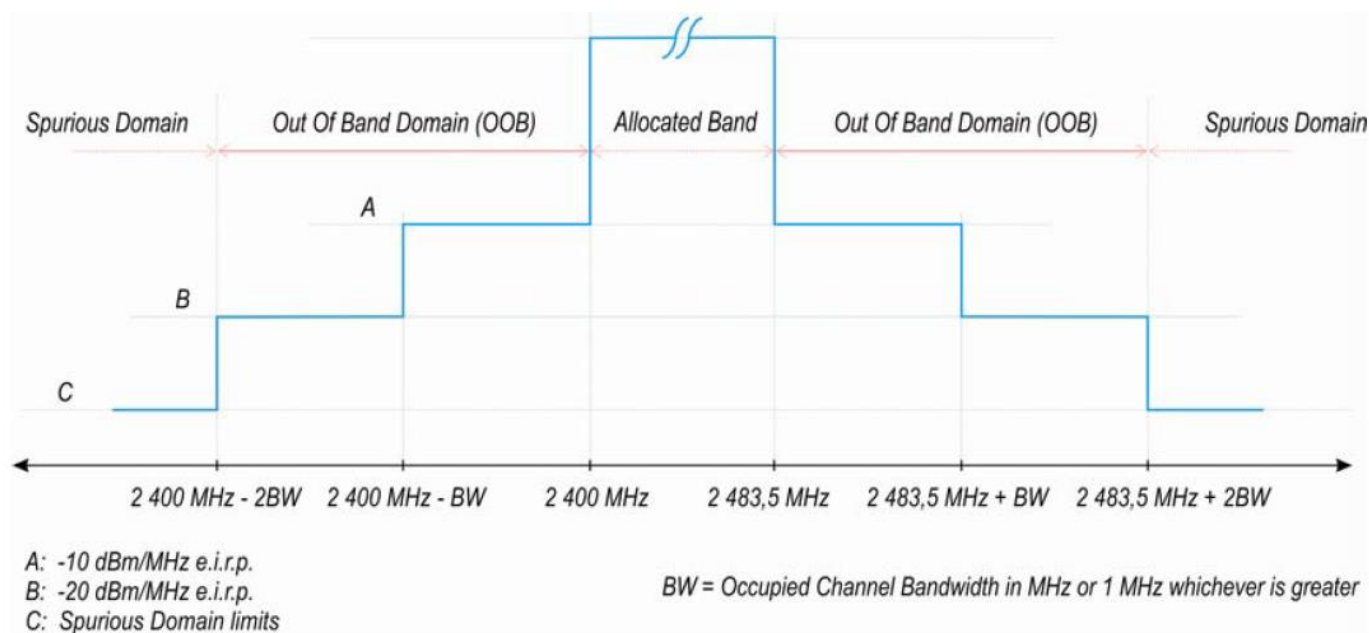


Verdict: PASS

TEST 4.3.2.8: Transmitter unwanted emissions in the out-of-band (OOB) domain.

LIMITS

The transmitter unwanted emissions in the out-of-band domain but outside the allocated band, shall not exceed the values provided in the next mask:



RESULTS:

Mode 1: BTLE BitRate 1Mbps

Spurious levels operating (conducted).

| Temperature (°C) | Channel | Frequency (MHz) | Level (dBm) | Limit (dBm) |
|------------------|---------|-----------------|-------------|-------------|
| Normal | Low | 2398.416760 | -45.417 | -20.000 |
| Normal | Low | 2398.458380 | -45.365 | -20.000 |
| Normal | Low | 2399.458380 | -41.375 | -10.000 |
| Normal | Low | 2399.500000 | -40.866 | -10.000 |
| Normal | Low | 2484.000000 | -48.358 | -10.000 |
| Normal | Low | 2484.041620 | -48.359 | -10.000 |
| Normal | Low | 2485.041620 | -48.061 | -20.000 |
| Normal | Low | 2485.083240 | -48.437 | -20.000 |
| Normal | High | 2398.408761 | -48.221 | -20.000 |
| Normal | High | 2398.454381 | -46.226 | -20.000 |
| Normal | High | 2399.454381 | -47.204 | -10.000 |
| Normal | High | 2399.500000 | -43.455 | -10.000 |
| Normal | High | 2484.000000 | -45.714 | -10.000 |
| Normal | High | 2484.045619 | -46.215 | -10.000 |
| Normal | High | 2485.045619 | -45.505 | -20.000 |
| Normal | High | 2485.091239 | -45.112 | -20.000 |

| | |
|-------------------------|-----------|
| Measurement uncertainty | <±0.95 dB |
|-------------------------|-----------|

Verdict: PASS

Mode 2: BTLE BitRate 2Mbps

Spurious levels operating (conducted).

| Temperature (°C) | Channel | Frequency (MHz) | Level (dBm) | Limit (dBm) |
|------------------|---------|-----------------|-------------|-------------|
| Normal | Low | 2396.408511 | -46.769 | -20.000 |
| Normal | Low | 2396.454256 | -46.565 | -20.000 |
| Normal | Low | 2397.454256 | -44.081 | -20.000 |
| Normal | Low | 2398.454256 | -42.857 | -10.000 |
| Normal | Low | 2398.500000 | -42.191 | -10.000 |
| Normal | Low | 2399.500000 | -26.231 | -10.000 |
| Normal | Low | 2484.000000 | -48.499 | -10.000 |
| Normal | Low | 2485.000000 | -48.449 | -10.000 |
| Normal | Low | 2485.045744 | -48.493 | -10.000 |
| Normal | Low | 2486.045744 | -48.377 | -20.000 |
| Normal | Low | 2487.045744 | -48.382 | -20.000 |
| Normal | Low | 2487.091489 | -44.390 | -20.000 |
| Normal | High | 2396.398513 | -48.350 | -20.000 |
| Normal | High | 2396.449256 | -48.429 | -20.000 |
| Normal | High | 2397.449256 | -48.440 | -20.000 |
| Normal | High | 2398.449256 | -48.338 | -10.000 |
| Normal | High | 2398.500000 | -45.839 | -10.000 |
| Normal | High | 2399.500000 | -47.665 | -10.000 |
| Normal | High | 2484.000000 | -42.685 | -10.000 |
| Normal | High | 2485.000000 | -45.362 | -10.000 |
| Normal | High | 2485.050744 | -46.619 | -10.000 |
| Normal | High | 2486.050744 | -44.909 | -20.000 |
| Normal | High | 2487.050744 | -46.193 | -20.000 |
| Normal | High | 2487.101487 | -43.883 | -20.000 |

| | |
|-------------------------|-----------|
| Measurement uncertainty | <±0.95 dB |
|-------------------------|-----------|

Verdict: PASS

TEST 4.3.2.9: Transmitter unwanted emissions in the spurious domain.

LIMITS

The transmitter unwanted emissions in the spurious domain shall not exceed the values given in the next table:

In case of equipment with antenna connectors, these limits apply to emissions at the antenna port (conducted). For emissions radiated by the cabinet or emissions radiated by integral antenna equipment (without antenna connectors), these limits are e.r.p. for emissions up to 1 GHz and e.i.r.p. for emissions above 1 GHz.

| Frequency range | Maximum power | Bandwidth |
|---------------------|---------------|-----------|
| 30 MHz to 47 MHz | -36 dBm | 100 kHz |
| 47 MHz to 74 MHz | -54 dBm | 100 kHz |
| 74 MHz to 87,5 MHz | -36 dBm | 100 kHz |
| 87,5 MHz to 118 MHz | -54 dBm | 100 kHz |
| 118 MHz to 174 MHz | -36 dBm | 100 kHz |
| 174 MHz to 230 MHz | -54 dBm | 100 kHz |
| 230 MHz to 470 MHz | -36 dBm | 100 kHz |
| 470 MHz to 862 MHz | -54 dBm | 100 kHz |
| 862 MHz to 1 GHz | -36 dBm | 100 kHz |
| 1 GHz to 12,75 GHz | -30 dBm | 1 MHz |

RESULTS:

Conducted results:

The level of spurious emissions was measured as their power in a specified load (conducted spurious emissions).

Spurious levels operating (conducted).

Frequency range 30 MHz – 1000 MHz

The spurious emissions below 1 GHz do not depend on either the operating channel or the modulation mode selected in the EUT.

No conducted spurious signals were detected at less than 6 dB respect to the limit.

Frequency range 1 GHz – 12.75 GHz

No conducted spurious signals were detected at less than 6 dB respect to the limit for both the lowest and highest operating channels selected in all possible modulation modes.

Radiated results:

The level of spurious emissions was measured as their effective radiated power when radiated by cabinet.

Frequency range 30 MHz – 1000 MHz

The spurious emissions below 1 GHz do not depend on either the operating channel or the modulation mode selected in the EUT.

No radiated spurious signals were detected at less than 6 dB respect to the limit.

Frequency range 1 GHz – 12.75 GHz

No radiated spurious signals were detected at less than 6 dB respect to the limit for both the lowest and highest operating channels selected in all possible modulation modes.

Verdict: PASS

TEST 4.3.2.10: Receiver spurious emissions.

LIMITS

In case of equipment with antenna connectors, these limits apply to emissions at the antenna port (conducted). For emissions radiated by the cabinet or emissions radiated by integral antenna equipment (without antenna connectors), these limits are e.r.p. for emissions up to 1 GHz and e.i.r.p. for emissions above 1 GHz.

| Frequency Range | Maximum power | Measurement bandwidth |
|-------------------|---------------|-----------------------|
| 30 MHz - 1 GHz | -57 dBm | 100 kHz |
| 1 GHz - 12.75 GHz | -47 dBm | 1 MHz |

RESULTS:

Conducted results:

The level of spurious emissions was measured as their power in a specified load (conducted spurious emissions).

Frequency range 30 MHz – 1000 MHz

The spurious emissions below 1 GHz do not depend on either the operating channel or the modulation mode selected in the EUT.

No conducted spurious signals were detected at less than 6 dB respect to the limit.

Frequency range 1 GHz – 12.75 GHz

No conducted spurious signals were detected at less than 6 dB respect to the limit for both the lowest and highest operating channels selected in all possible modulation modes.

Radiated results:

The level of spurious emissions was measured as their effective radiated power when radiated by cabinet.

Frequency range 30 MHz – 1000 MHz

The spurious emissions below 1 GHz do not depend on either the operating channel or the modulation mode selected in the EUT.

No radiated spurious signals were detected at less than 6 dB respect to the limit.

Frequency range 1 GHz – 12.75 GHz

No radiated spurious signals were detected at less than 6 dB respect to the limit for both the lowest and highest operating channels selected in all possible modulation modes.

Verdict: PASS

TEST 4.3.2.11: Receiver blocking.

LIMITS

The minimum performance criterion shall be a PER less than or equal to 10 %. The manufacturer may declare alternative performance criteria as long as that is appropriate for the intended use of the equipment (see application form section t)).

The blocking levels at specified frequency offsets shall be equal to or greater than the limits defined for the applicable receiver category provided in table 14, table 15 or table 16.

Table 14: Receiver Blocking parameters for Receiver Category 1 equipment

| Wanted signal mean power from companion device (dBm) | Blocking signal frequency (MHz) | Blocking signal power (dBm) (see note 2) | Type of blocking signal |
|--|--|--|-------------------------|
| $P_{\min} + 6 \text{ dB}$ | 2 380 2 503,5 | -53 | CW |
| $P_{\min} + 6 \text{ dB}$ | 2 300 2 330 2 360 | -47 | CW |
| $P_{\min} + 6 \text{ dB}$ | 2 523,5 2 553,5 2 583,5 2 613,5 2 643,5 2 673,5 | -47 | CW |
| NOTE 1: P_{\min} is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.2.11.3 in the absence of any blocking signal. | | | |
| NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain. | | | |

Table 15: Receiver Blocking parameters receiver category 2 equipment

| Wanted signal mean power from companion device (dBm) | Blocking signal frequency (MHz) | Blocking signal power (dBm) (see note 2) | Type of blocking signal |
|--|---------------------------------|--|-------------------------|
| $P_{\min} + 6 \text{ dB}$ | 2 380 2 503,5 | -57 | CW |
| $P_{\min} + 6 \text{ dB}$ | 2 300 2 583,5 | -47 | CW |
| NOTE 1: P_{\min} is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.2.11.3 in the absence of any blocking signal. | | | |
| NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain. | | | |

Table 16: Receiver Blocking parameters receiver category 3 equipment

| Wanted signal mean power from companion device (dBm) | Blocking signal frequency (MHz) | Blocking signal power (dBm) (see note 2) | Type of blocking signal |
|--|---------------------------------|--|-------------------------|
| $P_{\min} + 12 \text{ dB}$ | 2 380 2 503,5 | -57 | CW |
| $P_{\min} + 12 \text{ dB}$ | 2 300 2 583,5 | -47 | CW |
| NOTE 1: P_{\min} is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.2.11.3 in the absence of any blocking signal. | | | |
| NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain. | | | |

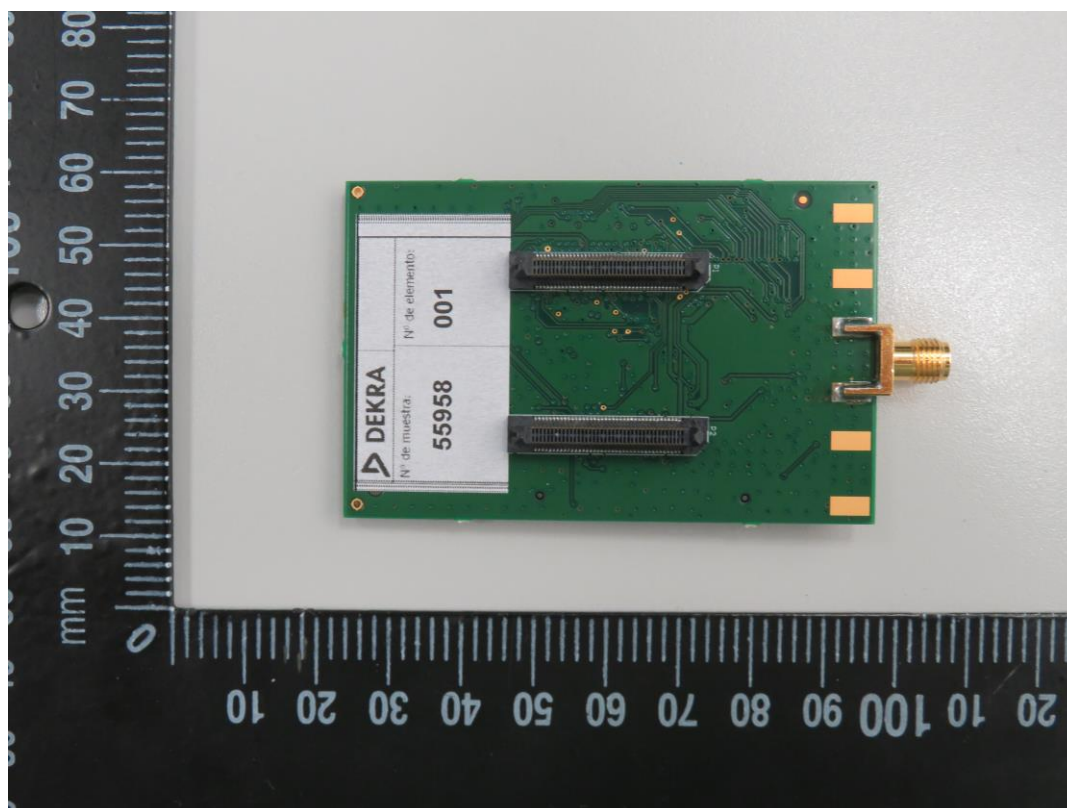
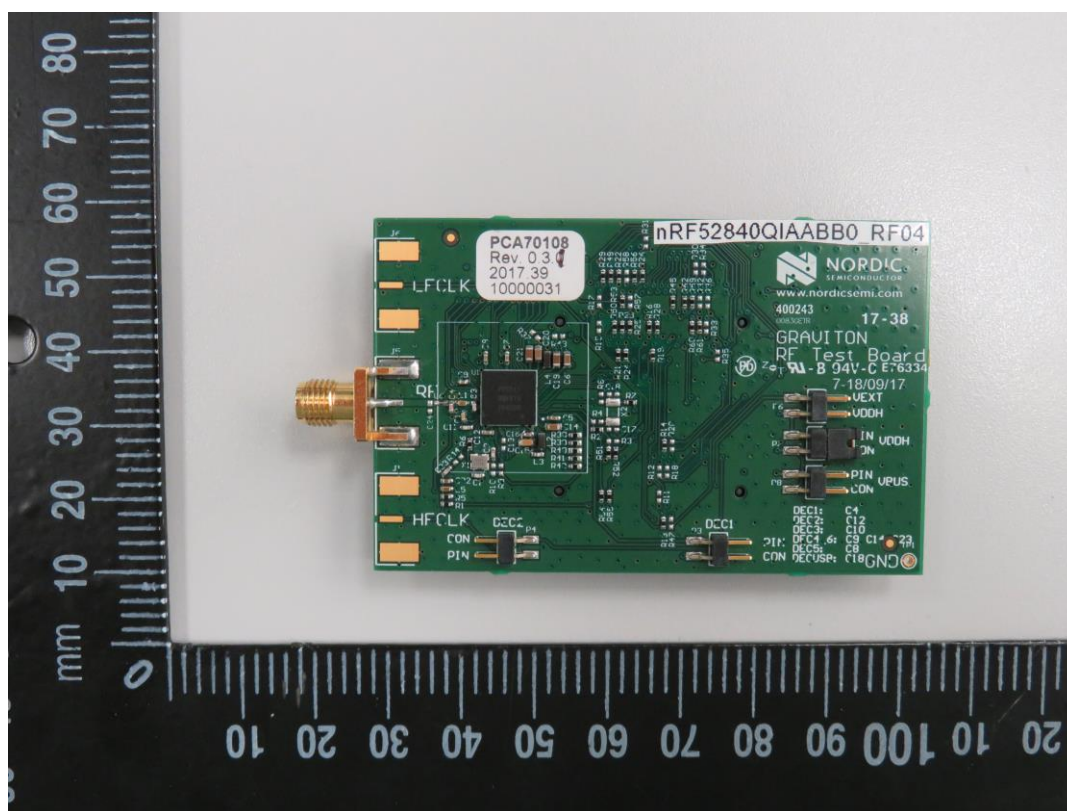
RESULTS:

Equipment's receiver category = 2.

| | | | |
|-----------------------|---|--|---------------|
| Test Case | TP_5_4_11_RECEIVER_BLOCKING_LE | | |
| Verdict | PASS | | |
| Date | 2018-03-12 12:05:46 | | |
| Comments | | | |
| Technology Version | REGBT v2.0.0_R1 | | |
| Core Version | N/A | | |
| Test Specs Version | ETSI EN 300 328 V2.1.1 | | |
| Project | 55958 | | |
| Project Creation Date | 2018-03-12 11:47:09 | | |
| Sample | DevID:M01 AppID:001 SW:XXX HW:XXX | | |
| Parameters | Type Packet Payload | | 4 |
| | EUT Rx Frequencies Connectable Devices | | 2402;2480 MHz |
| | Number of Total Packets | | 1500 |
| | Cat 2 and 3 - Blocking Signal Power Level | | -57;-47 dBm |
| | Wanted Signal Sensitivity Level (Pmin) at 2402 MHz: | | -92.5 dBm |
| | Wanted Signal Sensitivity Level (Pmin) at 2480 MHz: | | -92 dBm |
| | Conformance Test Case Execution | | True |
| Time Stamp (ms) | Event | Summary | |
| 5 | Start Test Case: | TP_5_4_11_RECEIVER_BLOCKING_LE | |
| 17171 | LOG: | Test Frequency: 2402 MHz | |
| 92108 | LOG: | Wanted Signal Power Level: -86.5 dBm | |
| 96273 | LOG: | Test Interferer Frequency: 2380 MHz | |
| 96274 | LOG: | Blocking Signal Power Level: -55.4 dBm | |
| 96275 | LOG: | PER = 0.1 % | |
| 96275 | LOG: | PER Limit: 10 % | |
| 96276 | Partial Verdict: | Partial Verdict: PASS | |
| 100445 | LOG: | Test Interferer Frequency: 2503.5 MHz | |
| 100446 | LOG: | Blocking Signal Power Level: -55.4 dBm | |
| 100446 | LOG: | PER = 0.2 % | |
| 100447 | LOG: | PER Limit: 10 % | |
| 100447 | Partial Verdict: | Partial Verdict: PASS | |
| 104629 | LOG: | Test Interferer Frequency: 2300 MHz | |
| 104630 | LOG: | Blocking Signal Power Level: -45.4 dBm | |
| 104631 | LOG: | PER = 0.3 % | |
| 104632 | LOG: | PER Limit: 10 % | |
| 104632 | Partial Verdict: | Partial Verdict: PASS | |
| 108811 | LOG: | Test Interferer Frequency: 2583.5 MHz | |
| 108813 | LOG: | Blocking Signal Power Level: -45.4 dBm | |
| 108813 | LOG: | PER = 0.4 % | |
| 108814 | LOG: | PER Limit: 10 % | |
| 108815 | Partial Verdict: | Partial Verdict: PASS | |
| 108815 | Partial Verdict: | Partial Verdict 2402 MHz: PASS | |
| 109821 | LOG: | Test Frequency: 2480 MHz | |
| 179140 | LOG: | Wanted Signal Power Level: -86 dBm | |
| 183316 | LOG: | Test Interferer Frequency: 2380 MHz | |
| 183317 | LOG: | Blocking Signal Power Level: -55.4 dBm | |
| 183318 | LOG: | PER = 0 % | |
| 183318 | LOG: | PER Limit: 10 % | |
| 183319 | Partial Verdict: | Partial Verdict: PASS | |
| 187497 | LOG: | Test Interferer Frequency: 2503.5 MHz | |
| 187499 | LOG: | Blocking Signal Power Level: -55.4 dBm | |
| 187499 | LOG: | PER = 0 % | |
| 187500 | LOG: | PER Limit: 10 % | |
| 187500 | Partial Verdict: | Partial Verdict: PASS | |
| 191668 | LOG: | Test Interferer Frequency: 2300 MHz | |
| 191679 | LOG: | Blocking Signal Power Level: -45.4 dBm | |
| 191681 | LOG: | PER = 0.1 % | |
| 191682 | LOG: | PER Limit: 10 % | |
| 191683 | Partial Verdict: | Partial Verdict: PASS | |
| 195857 | LOG: | Test Interferer Frequency: 2583.5 MHz | |
| 195859 | LOG: | Blocking Signal Power Level: -45.4 dBm | |
| 195860 | LOG: | PER = 0.1 % | |
| 195862 | LOG: | PER Limit: 10 % | |
| 195864 | Partial Verdict: | Partial Verdict: PASS | |
| 195866 | Partial Verdict: | Partial Verdict 2480 MHz: PASS | |
| 197489 | Final verdict: | Final Verdict: PASS | |

Appendix C - Photographs

EQUIPMENT VIEW



EQUIPMENT ON TEST BOARD

