

## EN 300 328 RF Test Report

(802.15.4)

**Report No.:** RECDBM-WTW-P22030865-1

**Test Model:** MGM240P22A, MGM240P32A, MGM240P32N

**Series Model:** BGM240P22A, BGM240P32A, BGM240P32N (refer to item 3.1 for more details)

**Received Date:** Mar. 22, 2022

**Test Date:** Apr. 08 ~ Jun. 13, 2022

**Issued Date:** Jun. 27, 2022

**Applicant:** Silicon Laboratories Finland Oy

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### Release Control Record

Issue No.	Description	Date Issued
RECDBM-WTW-P22030865-1	Original release.	Jun. 27, 2022

## 1 Certificate of Conformity

**Product:** Bluetooth Low Energy and 802.15.4 wireless radio module

**Brand:** Silicon Labs

**Test Model:** MGM240P22A, MGM240P32A, MGM240P32N

**Series Model:** BGM240P22A, BGM240P32A, BGM240P32N (refer to item 3.1 for more details)

**Sample Status:** Engineering samples fully representing the production models


**Applicant:** Silicon Laboratories Finland Oy

**Test Date:** Apr. 08 ~ Jun. 13, 2022

**Standards:** EN 300 328 V2.2.2 (2019-07)

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

**Prepared by :**  , **Date:** Jun. 27, 2022  
Polly Chien / Specialist

**Approved by :**  , **Date:** Jun. 27, 2022  
Jeremy Lin / Project Engineer

## 2 Summary of Test Results

The EUT has been tested according to the following specifications:

EN 300 328 V2.2.2		
Clause	Test Parameter	Results
4.3.2.2	RF Output Power	Pass
4.3.2.3	Power Spectral Density	Pass
4.3.2.4	Duty cycle, Tx-sequence, Tx-gap (Non-adaptive equipment)	Not Applicable
4.3.2.5	Medium Utilization (MU) Factor (Non-Adaptive Equipment)	Not Applicable
4.3.2.6	Adaptivity (Adaptive Equipment using modulation other than FHSS)	Pass
4.3.2.7	Occupied Channel Bandwidth	Pass
4.3.2.8	Transmitter Unwanted Emissions in the out-of-band Domain	Pass
4.3.2.9	Transmitter Unwanted Emissions in the Spurious Domain	Pass
4.3.2.10	Receiver Spurious Emissions	Pass
4.3.2.11	Receiver Blocking	Pass
4.3.2.12	Geo-location capability	Not Applicable

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

## 2.1 Test Instruments

**For all tests except adaptive & receiver blocking:**

Description & Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Spectrum Analyzer Agilent	N9030B	MY57140488	Feb. 19, 2021 Feb. 24, 2022	Feb. 18, 2022 Feb. 23, 2023
Spectrum Analyzer Rohde & Schwarz	FSV40	100980	Apr. 14, 2021 Apr. 20, 2022	Apr. 13, 2022 Apr. 19, 2023
USB Wideband Power Sensor KEYSIGHT	U2021XA	MY55050005/MY55190004/MY55190007/MY55210005	Jul. 12, 2021	Jul. 11, 2022
BILOG Antenna SCHWARZBECK	VULB 9168	9168-161	Oct. 28, 2021	Oct. 27, 2022
HORN Antenna ETS	3117	00034130	Nov. 14, 2021	Nov. 13, 2022
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170243	Nov. 14, 2021	Nov. 13, 2022
Loop Antenna TESEQ	HLA 6121	45745	Jul. 21, 2021	Jul. 20, 2022
Preamplifier Agilent	8449B	3008A01976	Jul. 24, 2021	Jul. 23, 2022
Preamplifier Agilent	8447D	2944A10634	Jul. 24, 2021	Jul. 23, 2022
RF signal cable HUBER+SUHNER	SUCOFLEX 104	Cable-RF2-03 (246272/4)	Jul. 24, 2021	Jul. 23, 2022
RF signal cable WOKEN	8D-FB	Cable-RF2-01	Jul. 24, 2021	Jul. 23, 2022
RF signal cable INFINET	CA3501-3501-G.90 (3m) & CA3501-3501-F.90 (2m)	INF090 (3m)*2 & TCF427S (2m)*1	Jul. 24, 2021	Jul. 23, 2022
Software ADT	ADT_Radiated_ V7.6.15.9.5	NA	NA	NA
Antenna Tower Max-Full	MFA-440H	1308111	NA	NA
Turn Table ADT	NA	SN30303	NA	NA
Controller Max-Full	MF7802	MF780208363	NA	NA
Temperature & Humidity chamber TERCHY	MHU-225AU	920842	Jun. 15, 2021	Jun. 14, 2022

- Note:
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
  2. The test was performed in HwaYa RF Chamber 2.
  3. The horn antenna and preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
  4. Tested date: Apr. 08 ~ Apr. 20, 2022

**For Adaptive:**

Description & Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
MXG Vector signal generator KEYSIGHT	N5182B	MY53052282	Dec. 21, 2021	Dec. 20, 2022
Vector signal generator Agilent	E4438C	MY47271120	Nov. 09, 2021	Nov. 08, 2022
PXA Signal Analyzer KEYSIGHT	N9030B	MY57140938	Mar. 15, 2022	Mar. 14, 2023

- Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.  
2. Tested date: Apr. 20 ~ Jun. 13, 2022

**For receiver blocking**

Description & Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Spectrum Analyzer Rohde & Schwarz	FSV40	100980	Apr. 14, 2021	Apr. 13, 2022
Vector signal generator Agilent	E4438C	MY47271120	Nov. 09, 2021	Nov. 08, 2022

- Note: 1. The calibration interval of the above test instruments is 12/24 months and the calibrations are traceable to NML/ROC and NIST/USA.  
2. Tested date: Apr. 06, 2022



## 2.2 Measurement Uncertainty

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

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

Parameter	Uncertainty
Occupied Channel Bandwidth	$\pm 1.229 \times 10^{-6} \%$
RF output power, conducted	$\pm 1.371 \text{ dB}$
Power Spectral Density, conducted	$\pm 2.889 \text{ dB}$
Unwanted Emissions, conducted	$\pm 1.34 \text{ dB}$
All emissions, radiated	$\pm 3.013 \text{ dB}$
Temperature	$\pm 0.23 \text{ }^{\circ}\text{C}$
Supply voltages	$\pm 0.3 \%$
Time	$\pm 2.53 \%$

## 2.3 Maximum Measurement Uncertainty

For the test methods, according to ETSI EN 300 328 standard, the measurement uncertainty figures shall be calculated in accordance with ETR 100 028-1 [4] 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)).

Maximum measurement uncertainty

Parameter	Uncertainty
Occupied Channel Bandwidth	$\pm 5 \%$
RF output power, conducted	$\pm 1.5 \text{ dB}$
Power Spectral Density, conducted	$\pm 3 \text{ dB}$
Unwanted Emissions, conducted	$\pm 3 \text{ dB}$
All emissions, radiated	$\pm 6 \text{ dB}$
Temperature	$\pm 3 \text{ }^{\circ}\text{C}$
Supply voltages	$\pm 3 \%$
Time	$\pm 5 \%$

## 2.4 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT

Product	Bluetooth Low Energy and 802.15.4 wireless radio module
Brand	Silicon Labs
Test Model	MGM240P22A, MGM240P32A, MGM240P32N
Series Model	BGM240P22A, BGM240P32A, BGM240P32N
Model Difference	Refer to note
Status of EUT	Engineering samples fully representing the production models
Power Supply Rating	1.8Vdc to 3.8Vdc (from host equipment)
Normal Testing Voltage	3.3Vdc
Temperature Operating Range	-40~105°C
Modulation Type	O-QPSK
Transfer Rate	250kbps
Operating Frequency	2405~2480MHz
Number of Channel	16
Adaptive/Non-Adaptive	<input type="checkbox"/> non-adaptive Equipment <input checked="" type="checkbox"/> adaptive Equipment without the possibility to switch to a non-adaptive mode <input type="checkbox"/> adaptive Equipment which can also operate in a non-adaptive mode
EIRP Power (Measured Max. Average)	Mode A (MGM240P32A / High power): 11.78dBm Mode B (MGM240P32N / High power): 11.79dBm Mode C (MGM240P22A / Low power): 11.91dBm
Antenna Type	Refer to note
Antenna Connector	Refer to note
Accessory Device	NA
Cable Supplied	NA

Note:

1. The following samples are provided by client and used for testing.

Sample	Model
A	MGM240P32A
B	MGM240P32N
C	MGM240P22A

2. All models are listed as below. Model MGM240P22A, MGM240P32A and MGM240P32N are the representative for final test. And this documents applies to these three models in particular, as they are the only modules additionally supporting the 802.15.4 protocol.

Product Spec.	Model		
	MGM240P22A (covers BGM240P22A)	MGM240P32A (covers BGM240P32A)	MGM240P32N (covers BGM240P32N)
	Low-Power/ Bluetooth Low Energy and 802.15.4 (802.15.4 being disabled for BGM240P22A)	High-Power/ Bluetooth Low Energy and 802.15.4 (802.15.4 being disabled for BGM240P32A)	High-Power/ Bluetooth Low Energy and 802.15.4 (802.15.4 being disabled for BGM240P32N)
Max nominal RF TX power, as declared by manufacturer	10dBm	20dBm	20dBm
Antenna type	integral antenna	integral antenna	RF pin
Hardware	<p>MGM240P22A (and BGM240P22A) --&gt; hardware variants with integral antenna and 10dBm max power, to be tested as DTS for both 802.15.4 and Bluetooth Low Energy</p> <p>MGM240P32A (and BGM240P32A) --&gt; hardware variants with integral antenna and 20dBm max power, to be tested as DTS for 802.15.4 and FHSS for Bluetooth Low Energy</p> <p>MGM240P32N (and BGM240P32N) --&gt; hardware variants with RF pin and 20dBm max power, to be tested as DTS for 802.15.4 and FHSS for Bluetooth Low Energy</p> <p>These three hardware variants should be RF tested separately, because PAs are configured differently and also antenna matching components are different between them, meaning for example that conducted RF measurements cannot be assumed to deliver the exact same results across the three samples.</p> <p>MGM modules are the ones under testing as they support both 802.15.4 and Bluetooth Low Energy, whereas the BGM modules are the series models because they are exactly the same except for the 802.15.4 being disabled by a hardcoded software configuration during production.</p>		

3. The antenna information is listed as below.

No.	Type	Connector	Gain (dBi)	Remark
1	Integral antenna	NA	1.82	For model: MGM240P22A, MGM240P32A, BGM240P22A, BGM240P32A
2	External reference dipole antenna**	SMA Male	2.80	For model: MGM240P32N, BGM240P32N

\* The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

\*\* The dipole antenna is not sold with the EUT, but is used during testing as a reference antenna for radiated measurements of the parts with the RF pin.

4. The power setting is listed as below.

Test Mode	MGM240P32A / High power / Integral ant.	MGM240P32N / High power / Dipole ant.	MGM240P22A / Low power / Integral ant.
CH 11	97	91	100
CH 18	97	91	100
CH 26	97	91	100

### 3.2 Description of Test Modes

16 channels are provided to this EUT:

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
11	2405	15	2425	19	2445	23	2465
12	2410	16	2430	20	2450	24	2470
13	2415	17	2435	21	2455	25	2475
14	2420	18	2440	22	2460	26	2480

### 3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable to										Description
	ROP	PSD	DC/TS/TG	MU	AD	OCB	EOB	SE< 1G	SE≥ 1G	RB	
A	√	√	-	-	√	√	√	√	√	√	Sample A / High power / Integral ant.
B	√	√	-	-	√	√	√	√	√	√	Sample B / High power / Dipole ant.
C	√	√	-	-	√	√	√	√	√	√	Sample C / Low power / Integral ant.

Where ROP: RF Output Power PSD: Power Spectral Density  
DC/TS/TG: Duty Cycle/ Tx-Sequence / Tx-gap MU: Medium Utilization  
AD: Adaptivity (Channel Access Mechanism) OCB: Occupied Channel Bandwidth  
EOB: Transmitter unwanted emissions in the out-of-band domain SE<1G: Unwanted Emissions in the Spurious Domain below 1 GHz  
SE≥1G: Unwanted Emissions in the Spurious Domain above 1 GHz RB: Receiver Blocking

Note:

1. The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane**.
2. "-": Means no effect.

#### **RF Output Power Test:**

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type
A, B, C	11 to 26	11, 18, 26	O-QPSK

#### **Power Spectral Density Test:**

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type
A, B, C	11 to 26	11, 18, 26	O-QPSK

#### **Adaptivity:**

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type
A, B, C	11 to 26	11, 26	O-QPSK

### **Occupied Channel Bandwidth Test:**

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type
A, B, C	11 to 26	11, 26	O-QPSK

### **Transmitter Unwanted Emissions in the Out-of-band Domain Test:**

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type
A, B, C	11 to 26	11, 26	O-QPSK

### **Unwanted Emissions in the Spurious Domain Test (Below 1 GHz):**

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type
A, B, C	11 to 26	11	O-QPSK

### **Unwanted Emissions in the Spurious Domain Test (above 1 GHz):**

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type
A, B, C	11 to 26	11, 19, 26	O-QPSK

### **Receiver Blocking test:**

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type
A, B, C	11 to 26	11, 26	O-QPSK

**Test Condition:**

Applicable To	Environmental Conditions	Input Power	Tested by
ROP	25 deg. C, 60% RH	3.3Vdc	Chun Wu
PSD	25 deg. C, 60% RH	3.3Vdc	Chun Wu
AD	25 deg. C, 65% RH, 24 deg. C, 65% RH	3.3Vdc	Oakley Chen, Matthew Yang
OCB	25 deg. C, 60% RH	3.3Vdc	Chun Wu
EOB	25 deg. C, 60% RH	3.3Vdc	Chun Wu
SE<1G	25 deg. C, 64% RH, 21 deg. C, 66% RH	230Vac, 50Hz (System)	Vanness Huang
SE≥1G	25 deg. C, 64% RH, 21 deg. C, 66% RH	230Vac, 50Hz (System)	Vanness Huang
RB	25 deg. C, 65% RH	3.3Vdc	Oakley Chen

### 3.3 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.

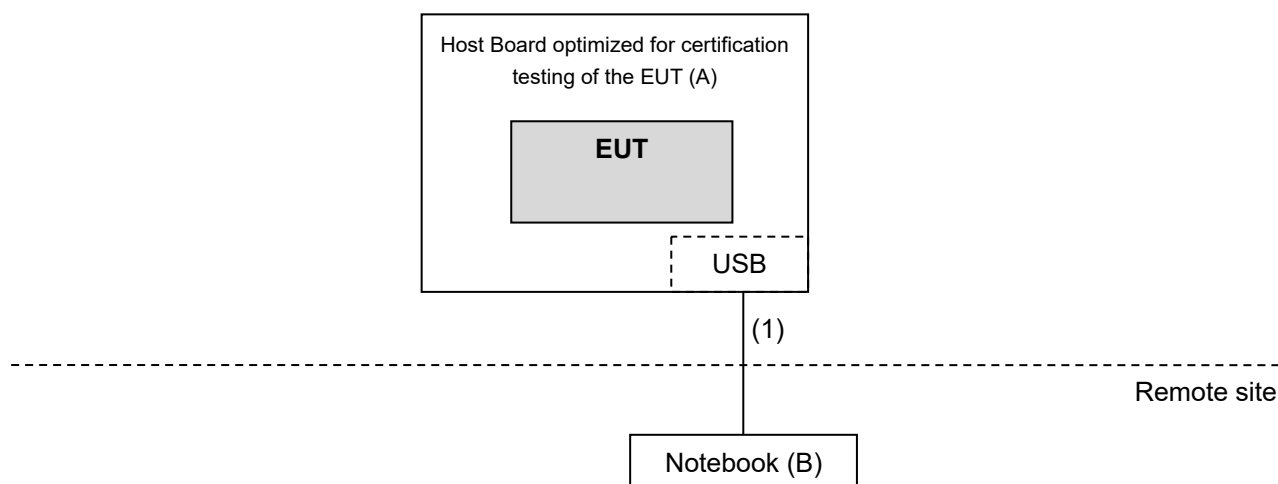
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Host Board optimized for certification testing of the EUT	Silicon Labs	NA	NA	NA	Provided by client
B.	Notebook	DELL	E5430	BPJVKV1	FCC DoC Approved	-

Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Item B acted as a communication partner to transfer data.

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	USB cable	1	1.5	Y	0	Provided by client

#### 3.3.1 Configuration of System under Test



### 3.4 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

#### EN 300 328 V2.2.2 (2019-07)

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



## 4 Test Procedure and Results

### 4.1 RF Output Power

#### 4.1.1 Limits of RF Output Power

Condition	Frequency Band	Limit (e.i.r.p)
Under all test conditions	2400 ~ 2483.5 MHz	AV: 20dBm

#### 4.1.2 Test Procedures

Refer to chapter 5.4.2 of ETSI EN 300 328 V2.2.2.

Measurement Method	
<input checked="" type="checkbox"/> Conducted measurement	<input type="checkbox"/> Radiated measurement

#### 4.1.3 Deviation from Test Standard

No deviation.

#### 4.1.4 Test Setup

The measurements for RF output power was performed at both normal environmental conditions and at the extremes of the operating temperature. Controlling software (provided by manufacturer) has been activated to set the EUT on specific channel and power level.

#### 4.1.5 Test Results

##### Mode A

Mode A

Channel	Frequency (MHz)	EIRP (dBm)			Limit (dBm)	Test Result
		Test Conditions				
		25 °C	-40 °C	105 °C		
11	2405	11.62	<b>11.78</b>	10.92	20	Pass
18	2440	11.54	11.72	10.91	20	Pass
26	2480	11.52	11.64	10.86	20	Pass

##### Mode B

Channel	Frequency (MHz)	EIRP (dBm)			Limit (dBm)	Test Result
		Test Conditions				
		25 °C	-40 °C	105 °C		
11	2405	11.63	<b>11.79</b>	10.93	20	Pass
18	2440	11.60	11.78	10.97	20	Pass
26	2480	11.47	11.59	10.81	20	Pass

##### Mode C

Channel	Frequency (MHz)	EIRP (dBm)			Limit (dBm)	Test Result
		Test Conditions				
		25 °C	-40 °C	105 °C		
11	2405	11.75	<b>11.91</b>	11.05	20	Pass
18	2440	11.52	11.70	10.89	20	Pass
26	2480	11.39	11.51	10.73	20	Pass

## 4.2 Power Spectral Density

### 4.2.1 Limit of Power Spectral Density

Condition	Frequency Band	Limit (e.i.r.p.)
Under normal conditions	2400 ~ 2483.5 MHz	10dBm / 1MHz

### 4.2.2 Test Procedures

Refer to chapter 5.4.3 of ETSI EN 300 328 V2.2.2.

Measurement Method	
<input checked="" type="checkbox"/> Conducted measurement	<input type="checkbox"/> Radiated measurement
<input checked="" type="checkbox"/> Option 1: For equipment with continuous and non-continuous transmissions <input type="checkbox"/> Option 2: For equipment with continuous transmission capability or for equipment operating (or with the capability to operate) with a constant duty cycle (e.g. Frame Based equipment)	

### 4.2.3 Deviation of Test Standard

No deviation.

### 4.2.4 Test Setup

The test setup has been constructed as the normal test condition. (In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator.) The power spectral density as defined in EN 300 328 clause 4.3.2.3 shall be measured and recorded. Controlling software (provided by manufacturer) has been activated to set the EUT on specific status.

#### 4.2.5 Test Results

##### Mode A

Channel	Channel Frequency (MHz)	Power Density (dBm/1MHz) (EIRP)	Limit (dBm/1MHz) (EIRP)	Pass/Fail
11	2405	9.64	10	Pass
18	2440	9.55	10	Pass
26	2480	9.53	10	Pass

##### Mode B

Channel	Channel Frequency (MHz)	Power Density (dBm/1MHz) (EIRP)	Limit (dBm/1MHz) (EIRP)	Pass/Fail
11	2405	9.62	10	Pass
18	2440	9.60	10	Pass
26	2480	9.46	10	Pass

##### Mode C

Channel	Channel Frequency (MHz)	Power Density (dBm/1MHz) (EIRP)	Limit (dBm/1MHz) (EIRP)	Pass/Fail
11	2405	9.71	10	Pass
18	2440	9.51	10	Pass
26	2480	9.36	10	Pass

### 4.3 Adaptivity (adaptive equipment using modulations other than FHSS)

This requirement does not apply to non-adaptive equipment or adaptive equipment operating in a non-adaptive mode providing the equipment complies with the requirements and/or restrictions applicable to non-adaptive equipment.

In addition, this requirement does not apply for equipment with a maximum declared RF Output power level of less than 10 dBm e.i.r.p. or for equipment when operating in a mode where the RF Output power is less than 10 dBm e.i.r.p.

#### 4.3.1 Limit of Adaptive

Applicability of adaptive requirements and limit for wide band modulation techniques Interference threshold level

Requirement	Operational Mode			
	Non-LBT based Detect and Avoid	LBT based Detect and Avoid		
		Frame Based Equipment	Load Based Equipment (Base on 'Spectrum Sharing' mechanisms)	Load Based Equipment (Not using any of the mechanisms referenced)
Minimum Clear Channel Assessment (CCA) Time	NA	18 us (see note 1)	(see note 2)	18 us (see note 1)
Maximum Channel Occupancy (COT) Time	40 ms	1 ms to 10 ms	(see note 2)	13ms
Minimum Idle Period	5us	5% of COT	(see note 2)	18us (see note 3)
Extended CCA check	NA	NA	(see note 2)	18us~160us
Short Control Signalling Transmissions	Maximum duty cycle of 10 % within an observation period of 50 ms (see note 4)			
Note 1: The CCA time used by the equipment shall be declared by the supplier.				
Note 2: Load Based Equipment may implement an LBT based spectrum sharing mechanism based on the Clear Channel Assessment (CCA) mode using energy detect, as described in IEEE 802.11™-2012 clause 9, clause 10, clause 16, clause 17, clause 19 and clause 20, or in IEEE 802.15.4™-2011 [i.4], clause 4, clause 5 and clause 8				
Note 3: The Idle Period in between transmissions is considered to be the CCA or the Extended CCA check as there are no transmissions during this period.				
Note 4: Adaptive equipment may or may not have Short Control Signalling Transmissions				

Threshold Level for Non-LBT based Detect and Avoid	
Maximum transmit power (P <sub>H</sub> ) EIRP dBm	Threshold level (TL)
20	see notes 1 and 2
Note 1: For a 20 dBm e.i.r.p. transmitter the detection threshold level (TL) shall be equal to or less than -70 dBm/MHz at the input to the receiver assuming a 0 dBi (receive) antenna assembly. This threshold level (TL) may be corrected for the (receive) antenna assembly gain (G) Note 2: For power levels less than 20 dBm e.i.r.p., the detection threshold level may be relaxed to: $TL = -70 \text{ dBm/MHz} + 10 \times \log_{10} (100 \text{ mW} / P_{out})$ ; (P <sub>out</sub> in mW e.i.r.p.)	

**Unwanted signal parameters for Non-LBT based Detect and Avoid**

Wanted signal mean power from companion device (dBm)	Unwanted signal frequency (MHz)	Unwanted CW signal power (dBm)
-30	2 395 or 2 488.5 (see note 1)	-35 (see note 2)
<p>Note 1: The highest frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483.5 MHz.</p> <p>Note 2: The level specified is the level in front of the UUT antenna. In case of conducted measurements, this level has to be corrected by the actual antenna assembly gain.</p>		

**Threshold Level for LBT based Detect and Avoid (Frame Based Equipment)**

Maximum transmit power (P <sub>H</sub> ) EIRP dBm	Threshold level (TL) (see notes 1 and 2)
20	-70 dBm / MHz
<p>Note 1: For a 20 dBm e.i.r.p. transmitter the CCA threshold level (TL) shall be equal to or less than -70 dBm/MHz at the input to the receiver assuming a 0 dBi (receive) antenna assembly. This threshold level (TL) may be corrected for the (receive) antenna assembly gain (G)</p> <p>Note 2: For power levels less than 20 dBm e.i.r.p. the CCA threshold level may be relaxed to:  <math>TL = -70 \text{ dBm/MHz} + 10 \times \log_{10} (100 \text{ mW} / P_{out})</math> ; (P<sub>out</sub> in mW e.i.r.p.)</p>	

**Unwanted signal parameters for LBT based Detect and Avoid (Frame Based Equipment)**

Wanted signal mean power from companion device	Unwanted signal frequency (MHz)	Unwanted signal power (dBm)
sufficient to maintain the link (see note 2)	2 395 or 2 488,5 (see note 1)	-35 (see note 3)
<p>Note 1: The highest frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483.5 MHz. See clause 5.4.6.1.</p> <p>Note 2: A typical value which can be used in most cases is -50 dBm/MHz.</p> <p>Note 3: The level specified is the level in front of the UUT antenna. In case of conducted measurements, this level has to be corrected by the actual antenna assembly gain.</p>		

**Threshold Level for LBT based Detect and Avoid (Load Based Equipment)**

Maximum transmit power (P <sub>H</sub> ) EIRP dBm	Threshold level (TL) (see notes 1 and 2)
20	-70 dBm / MHz
<p>Note 1: For a 20 dBm e.i.r.p. transmitter the CCA threshold level (TL) shall be equal to or less than -70 dBm/MHz at the input to the receiver assuming a 0 dBi (receive) antenna assembly. This threshold level (TL) may be corrected for the (receive) antenna assembly gain (G)</p> <p>Note 2: For power levels less than 20 dBm e.i.r.p. the CCA threshold level may be relaxed to:  <math>TL = -70 \text{ dBm/MHz} + 10 \times \log_{10} (100 \text{ mW} / P_{out})</math> ; (P<sub>out</sub> in mW e.i.r.p.)</p>	

Unwanted signal parameters for LBT based Detect and Avoid (Load Based Equipment)

Wanted signal mean power from companion device	Unwanted signal frequency (MHz)	Unwanted signal power (dBm)
sufficient to maintain the link (see note 2)	2 395 or 2 488,5 (see note 1)	-35 (see note 3)
<p>Note 1: The highest frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483.5 MHz. See clause 5.4.6.1.</p> <p>Note 2: A typical value which can be used in most cases is -50 dBm/MHz.</p> <p>Note 3: The level specified is the level in front of the UUT antenna. In case of conducted measurements, this level has to be corrected by the actual antenna assembly gain.</p>		

#### 4.3.2 Test Procedure

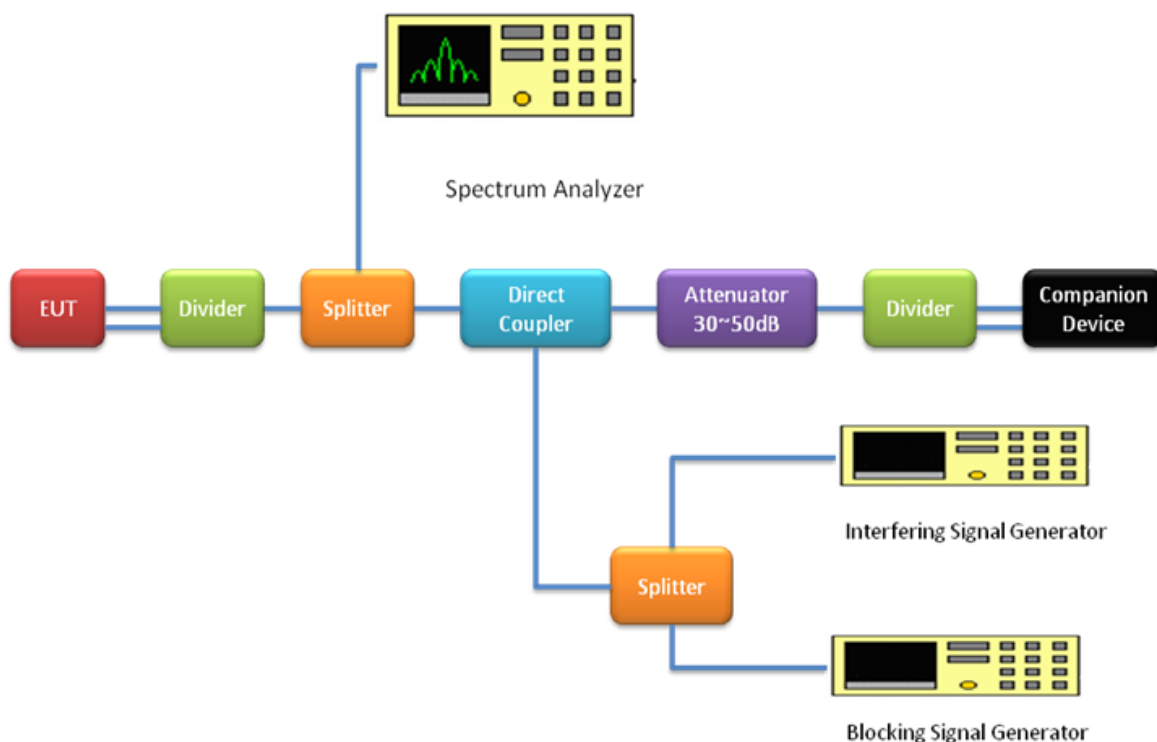
Refer to chapter 5.4.6 of EN 300 328 V2.2.2.

Measurement Method	
<input checked="" type="checkbox"/> Conducted measurement	<input type="checkbox"/> Radiated measurement

#### 4.3.3 Deviation from Test Standard

No deviation.

#### 4.3.4 Test Setup Configuration



#### UUT Software and Firmware Version

Product	Model No.	Software/Firmware Version
Bluetooth Low Energy and 802.15.4 wireless radio module	MGM240P32A, MGM240P32N, MGM240P22A	4.0.x (Gecko SDK)

#### Companion Device Information

Product	Model No.	Software/Firmware Version
Bluetooth Low Energy and 802.15.4 wireless radio module	MGM240P32A, MGM240P32N, MGM240P22A	4.0.x (Gecko SDK)



#### 4.3.5 List of Measurements

UUT Operational Mode	Applicable	Limit	
		The Maximum Channel Occupancy Time	The Minimum idle Period
Frame Based Equipment		meet in 1ms ~ 10ms	>5% x channel occupancy time
Load Based Equipment (Base on 'Spectrum Sharing' mechanisms)		Follow IEEE 802.11 Less than ____ms	Follow IEEE 802.11 More than ____ms
Load Based Equipment (Not using any of the mechanisms referenced)	v	13ms	18us

Clause	Test Parameter	Remarks	Pass/Fail
4.3.2.6.3.2.2	Adaptive (Frame Based Equipment)	Not Applicable	NA
4.3.2.6.3.2.3	Adaptive (Load Based Equipment)	Applicable	Pass
4.3.2.6.4	Short Control Signalling Transmissions	Not Applicable	NA
4.3.2.6.2	Unwanted Signal Parameters	Not Applicable	NA

### 4.3.6 Interference Threshold Level

#### Mode A

##### Detection Threshold Level

The maximum EIRP power is 11.78dBm and antenna gain is 1.82dBi.

Detection Threshold Level =  $-70\text{dBm/MHz} + 10 \cdot \log_{10} (100\text{mW} / P_{\text{out}} (15.97\text{mW})) + G (1.82\text{dBi}) = -59.96\text{dBm/MHz}$ .

The interference signal level to the UUT is -59.96dBm/MHz



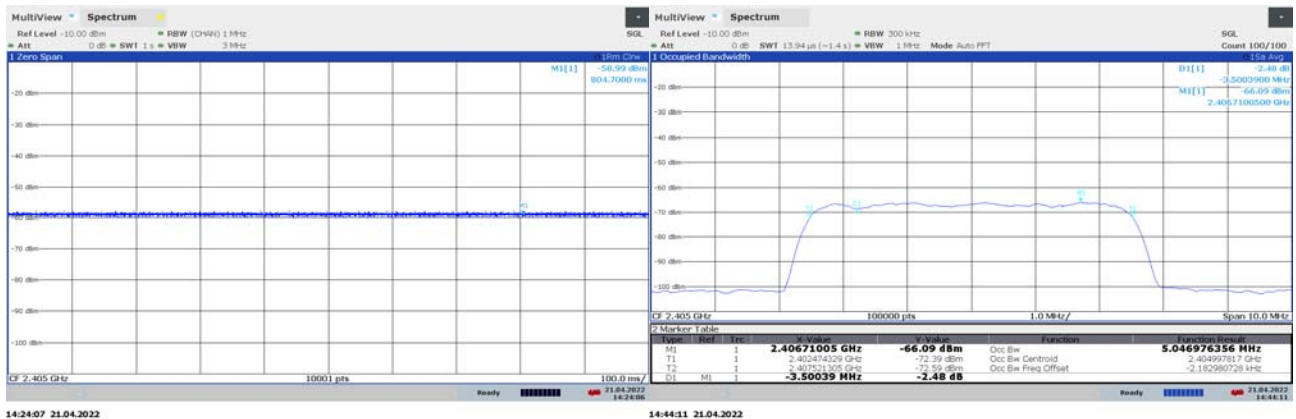
#### Mode B

##### Detection Threshold Level

The maximum EIRP power is 11.79dBm and antenna gain is 2.8dBi.

Detection Threshold Level =  $-70\text{dBm/MHz} + 10 \cdot \log_{10} (100\text{mW} / P_{\text{out}} (15.10\text{mW})) + G (2.8\text{dBi}) = -58.99\text{dBm/MHz}$ .

The interference signal level to the UUT is -58.99dBm/MHz



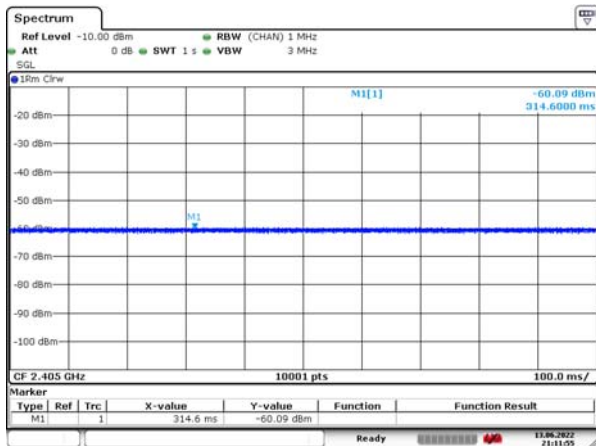
## Mode C

### Detection Threshold Level

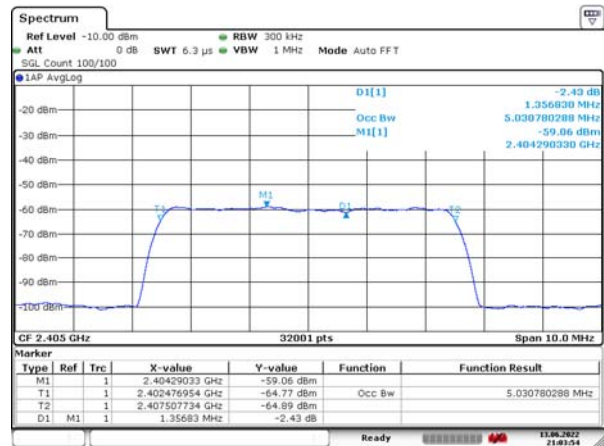
The maximum EIRP power is 11.91dBm and antenna gain is 1.82dBi.

Detection Threshold Level =  $-70\text{dBm/MHz} + 10 \cdot \log_{10}(100\text{mW} / P_{\text{out}} (15.52\text{mW})) + G (1.82\text{dBi}) = -60.09\text{dBm/MHz}$ .

The interference signal level to the UUT is  $-60.09\text{dBm/MHz}$



Date: 13.JUN.2022 21:11:55



Date: 13.JUN.2022 21:03:54

#### 4.3.7 Test Result

- |  |
|--|
| <input type="checkbox"/> Not applicable to non-adaptive equipment or adaptive equipment operating in a non-adaptive mode |
| <input type="checkbox"/> Not applicable to equipment with RF output power is less than 10 dBm e.i.r.p.                   |
| <input checked="" type="checkbox"/> Refer to below test result   |

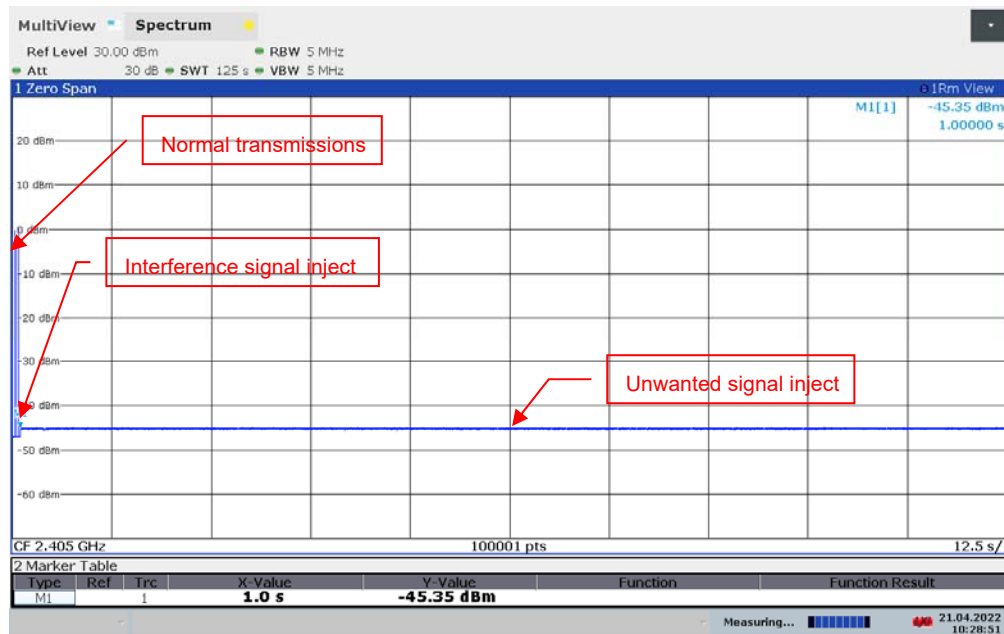
##### 4.3.7.1 Adaptive Result

###### Operating Frequency Bands and Mode of EUT

Operational Mode	Operating Frequency (Low Channel, MHz)	Operating Frequency (High Channel, MHz)	Test Result
802.15.4	2405	2480	Pass

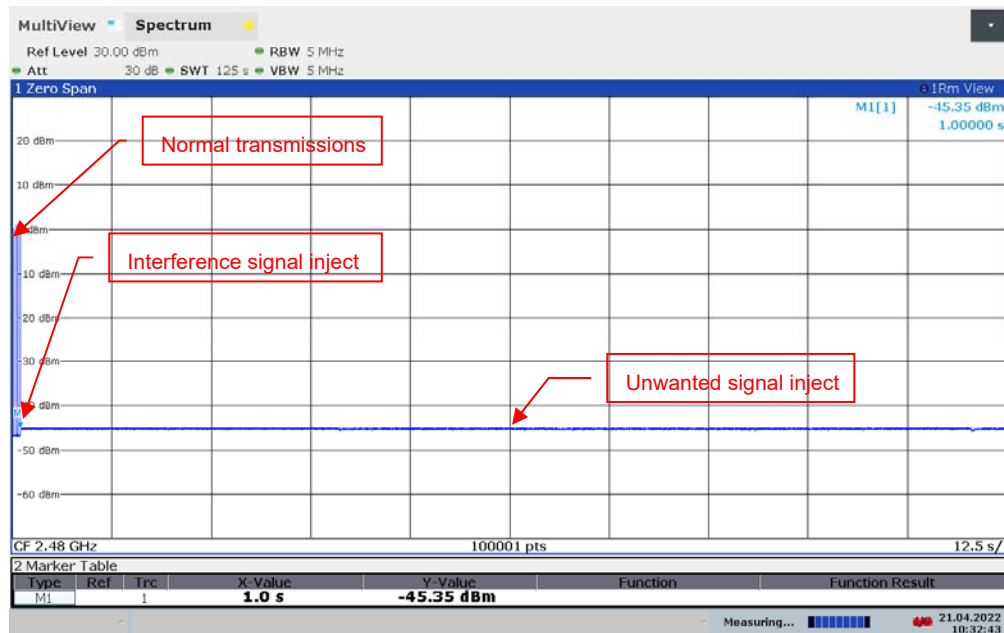
## Mode A

### 2405MHz



10:28:51 21.04.2022

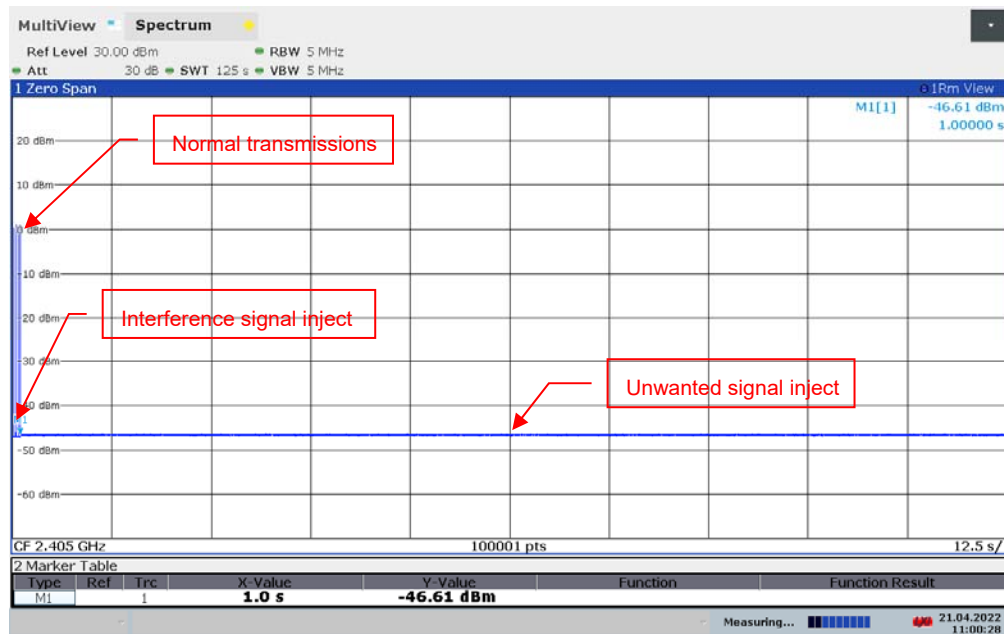
## 2480MHz



10:32:44 21.04.2022

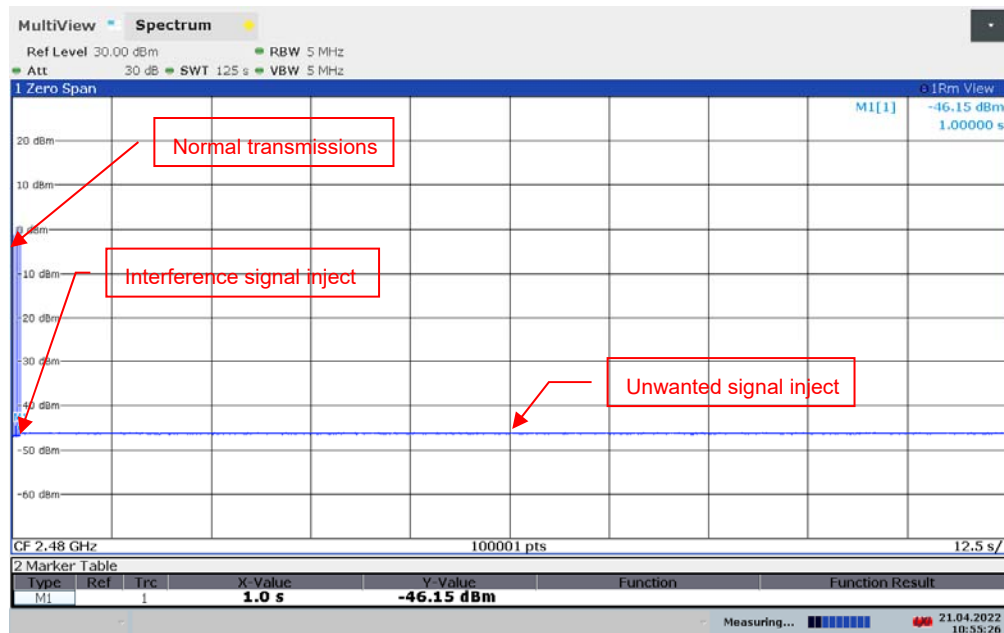
## Mode B

### 2405MHz



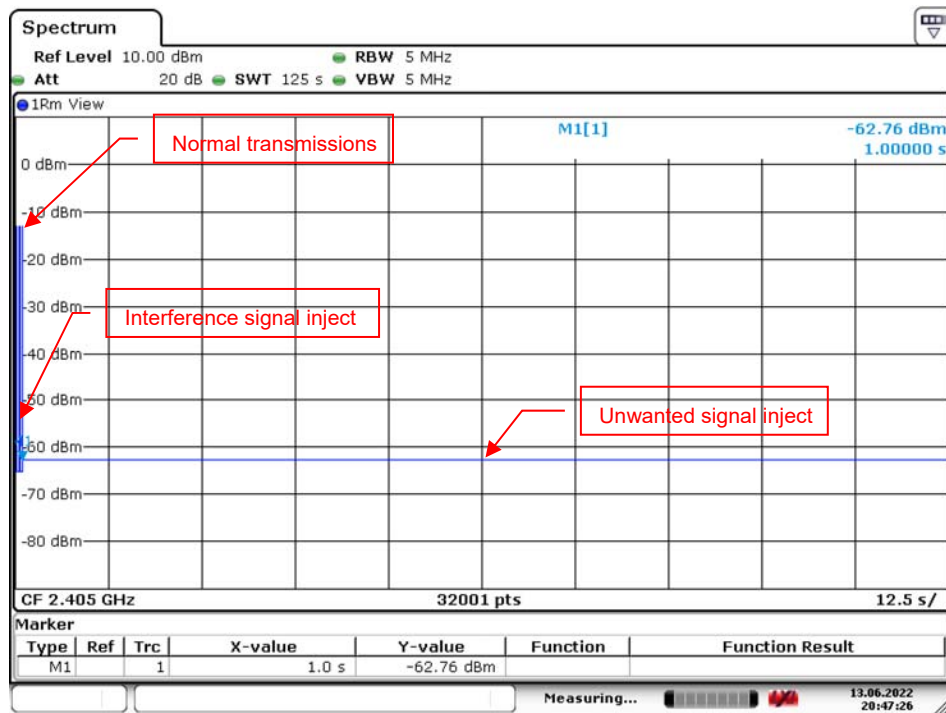
11:00:29 21.04.2022

### 2480MHz



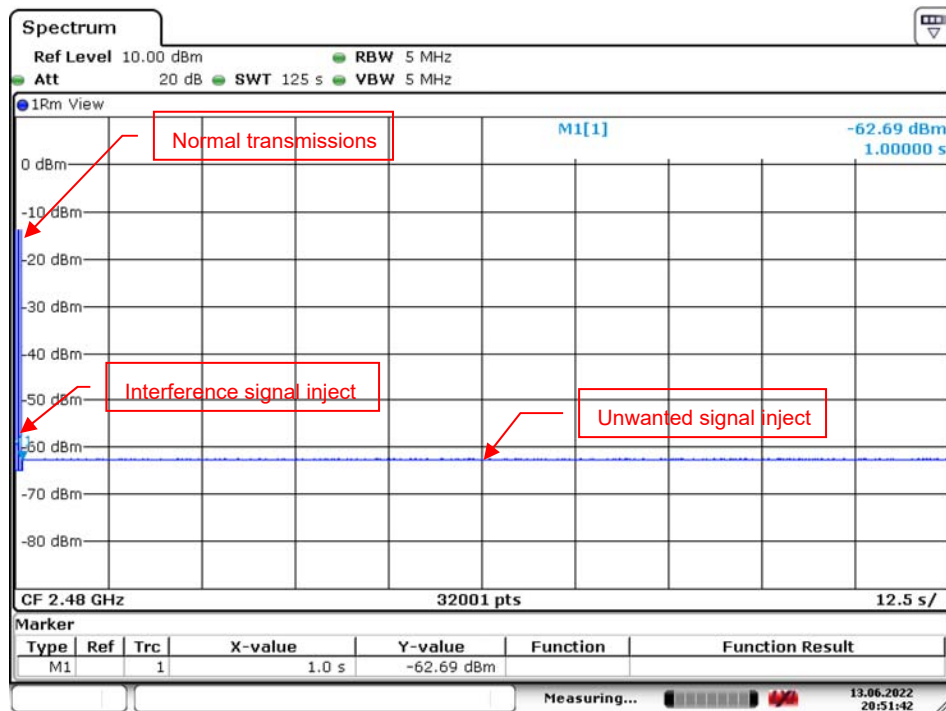
10:55:27 21.04.2022

## Mode C 2405MHz



Date: 13.JUN.2022 20:47:26

## 2480MHz



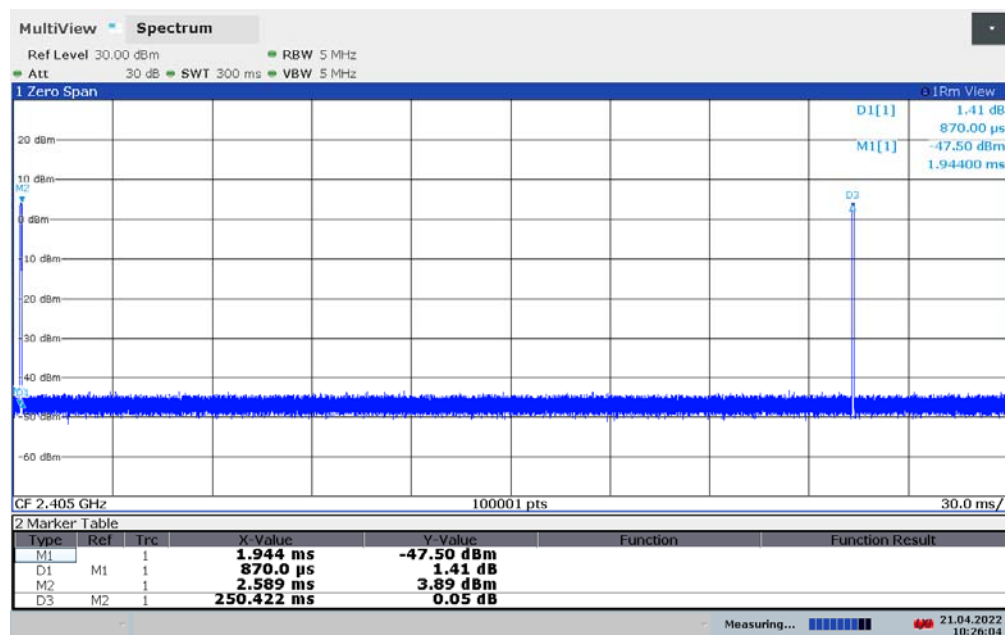
Date: 13.JUN.2022 20:51:42

### 4.3.7.2 The Channel Occupancy Time Result

#### Operating Frequency Bands and Mode of EUT

##### Mode A

Operational Mode	Operating Frequency Low Channel (MHz)	The Channel Occupancy Time (ms)	Minimum Idle Period (us)	Test Result
802.15.4	2405	0.87	250422	Pass

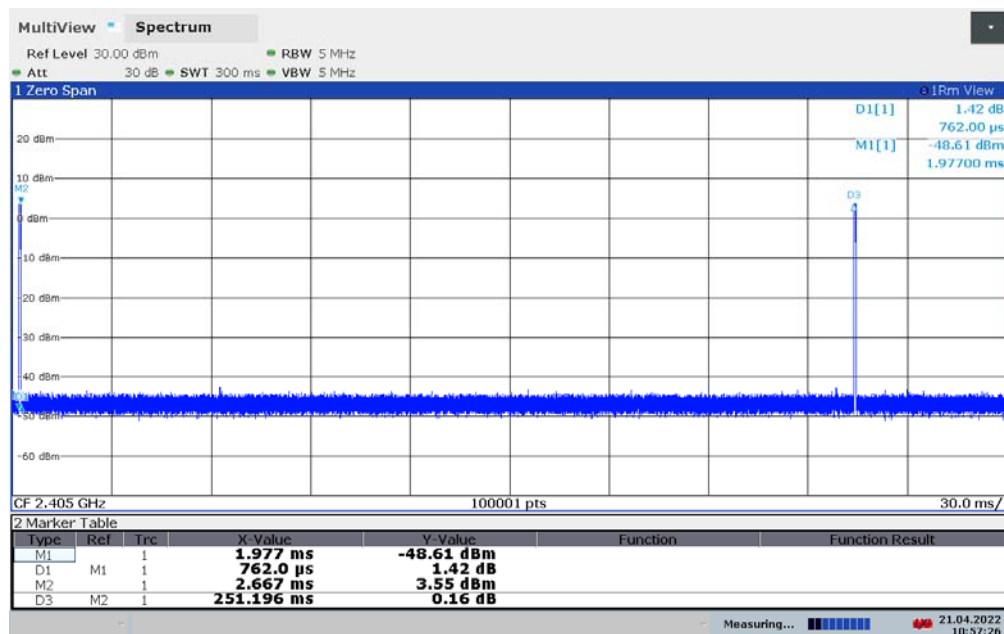


10:26:04 21.04.2022



## Mode B

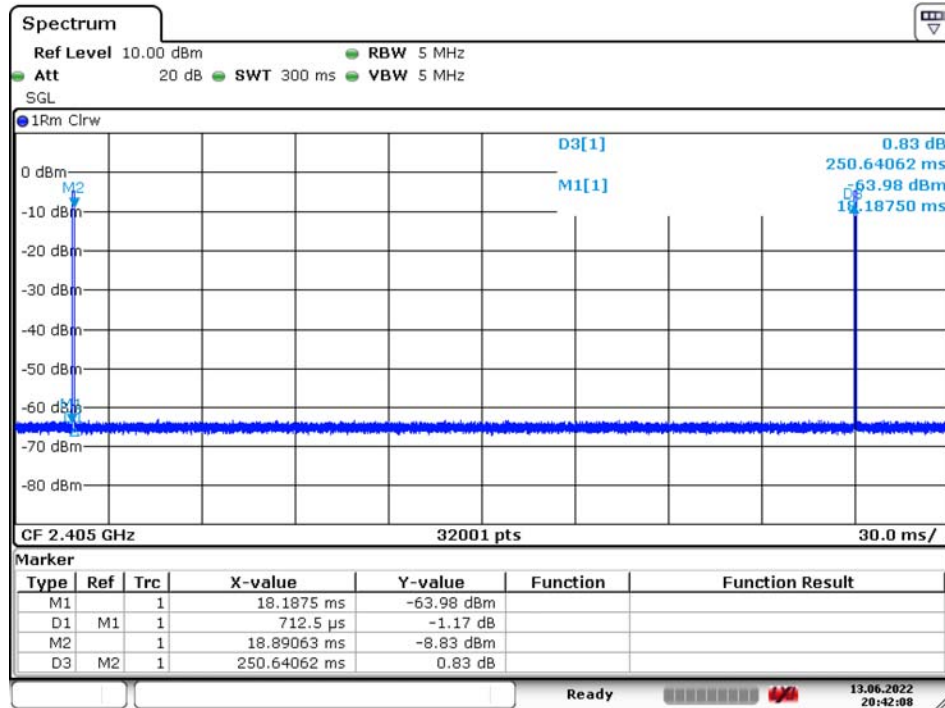
Operational Mode	Operating Frequency Low Channel (MHz)	The Channel Occupancy Time (ms)	Minimum Idle Period (us)	Test Result
802.15.4	2405	0.762	251196	Pass



10:57:26 21.04.2022

## Mode C

Operational Mode	Operating Frequency Low Channel (MHz)	The Channel Occupancy Time (ms)	Minimum Idle Period (us)	Test Result
802.15.4	2405	0.7125	250640.62	Pass



Date: 13.JUN.2022 20:42:08

#### 4.3.7.3 Unwanted Signal Interference

##### Mode A, B

Channel	Channel Frequency (MHz)	Wanted Signal Mean Power from Companion Device (dBm/MHz)	Blocking Signal Frequency (MHz)	Blocking Signal Power (dBm)	Pass/Fail
11	2405	-50	2488.5	-35	Pass
26	2480	-50	2395.0	-35	Pass

##### Mode C

Channel	Channel Frequency (MHz)	Wanted Signal Mean Power from Companion Device (dBm/MHz)	Blocking Signal Frequency (MHz)	Blocking Signal Power (dBm)	Pass/Fail
11	2405	-50	2488.5	-33.18	Pass
26	2480	-50	2395.0	-33.18	Pass

#### 4.4 Occupied Channel Bandwidth

##### 4.4.1 Limit of Occupied Channel Bandwidth

Condition		Limit
All types of equipment		Shall fall completely within the band 2400 to 2483.5 MHz.
Additional requirement	For non-adaptive using wide band modulations other than FHSS system and e.i.r.p >10dBm.	Less than 20MHz
	For non-adaptive Frequency Hopping system and e.i.r.p >10dBm.	Less than 5MHz

##### 4.4.2 Test Procedure

Refer to chapter 5.4.7 of ETSI EN 300 328 V2.2.2.

Measurement Method	
<input checked="" type="checkbox"/> Conducted measurement	<input type="checkbox"/> Radiated measurement

##### 4.4.3 Deviation from Test Standard

No deviation.

##### 4.4.4 Test Setup

These measurements only were performed at normal test conditions. The measurement shall be performed only on the lowest and the highest frequency within the stated frequency range. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator. Controlling software (provided by manufacturer) has been activated to set the EUT on specific status.

#### 4.4.5 Test Results

##### Mode A

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	Measured Frequencies		Limit	Pass/Fail
			F <sub>L</sub> (MHz)	F <sub>H</sub> (MHz)		
11	2405	3.20	2403.40	2406.60	F <sub>L</sub> > 2400 MHz and F <sub>H</sub> < 2483.5 MHz	Pass
26	2480	3.20	2478.40	2481.60		Pass

Note: FL is the lowest frequency of the 99% occupied bandwidth of power envelope.  
FH is the highest frequency of the 99% occupied bandwidth of power envelope.

##### Mode B

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	Measured Frequencies		Limit	Pass/Fail
			F <sub>L</sub> (MHz)	F <sub>H</sub> (MHz)		
11	2405	3.20	2403.40	2406.60	F <sub>L</sub> > 2400 MHz and F <sub>H</sub> < 2483.5 MHz	Pass
26	2480	3.20	2478.40	2481.60		Pass

Note: FL is the lowest frequency of the 99% occupied bandwidth of power envelope.  
FH is the highest frequency of the 99% occupied bandwidth of power envelope.

##### Mode C

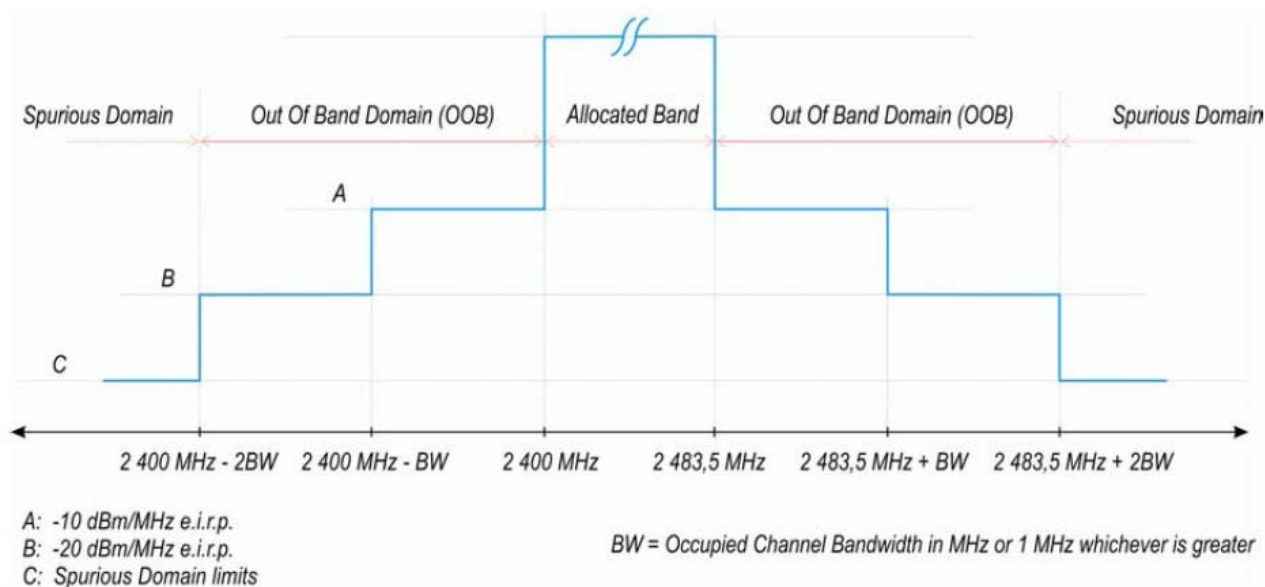
Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	Measured Frequencies		Limit	Pass/Fail
			F <sub>L</sub> (MHz)	F <sub>H</sub> (MHz)		
11	2405	3.20	2403.40	2406.60	F <sub>L</sub> > 2400 MHz and F <sub>H</sub> < 2483.5 MHz	Pass
26	2480	3.20	2478.40	2481.60		Pass

Note: FL is the lowest frequency of the 99% occupied bandwidth of power envelope.

## 4.5 Transmitter Unwanted Emissions in the Out-of-band Domain

### 4.5.1 Limits of Transmitter Unwanted Emissions in the Out-of-band Domain

Condition	Limit
Under all test conditions	The transmitter unwanted emissions in the out-of-band domain but outside the allocated band, shall not exceed the values provided by the mask in below figure.



### 4.5.2 Test Procedure

Refer to chapter 5.4.8 of ETSI EN 300 328 V2.2.2.

Measurement Method	
<input checked="" type="checkbox"/> Conducted measurement	<input type="checkbox"/> Radiated measurement

### 4.5.3 Deviation from Test Standard

No deviation

### 4.5.4 Test Setup

The measurements were performed at normal environmental conditions. The measurement was performed at the lowest and the highest channel on which the equipment can operate. The equipment was configured to operate under its worst case situation with respect to output power. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator. The frequency has to be recorded for the right and left end above threshold of highest and lowest channel respectively.

#### 4.5.5 Test Results

##### Mode A

Channel	Frequency (MHz)	Out-Of-Band Domain			Limit (dBm/MHz)	Test Result
		Frequency Range (MHz)	Worst Frequency (MHz)	Emission Level (dBm/MHz)		
11	2405	2393.60 ~ 2396.80	2396.30	-43.41	-20	Pass
		2396.80 ~ 2400.00	2399.50	-34.98	-10	Pass
26	2480	2483.50 ~ 2486.70	2484.00	-30.25	-10	Pass
		2486.70 ~ 2489.90	2487.20	-39.60	-20	Pass

##### Mode B

Channel	Frequency (MHz)	Out-Of-Band Domain			Limit (dBm/MHz)	Test Result
		Frequency Range (MHz)	Worst Frequency (MHz)	Emission Level (dBm/MHz)		
11	2405	2393.60 ~ 2396.80	2396.30	-42.63	-20	Pass
		2396.80 ~ 2400.00	2399.50	-34.35	-10	Pass
26	2480	2483.50 ~ 2486.70	2484.00	-29.34	-10	Pass
		2486.70 ~ 2489.90	2487.20	-38.76	-20	Pass

##### Mode C

Channel	Frequency (MHz)	Out-Of-Band Domain			Limit (dBm/MHz)	Test Result
		Frequency Range (MHz)	Worst Frequency (MHz)	Emission Level (dBm/MHz)		
11	2405	2393.60 ~ 2396.80	2396.30	-49.75	-20	Pass
		2396.80 ~ 2400.00	2399.50	-41.50	-10	Pass
26	2480	2483.50 ~ 2486.70	2484.00	-36.02	-10	Pass
		2486.70 ~ 2489.90	2487.20	-45.91	-20	Pass

## 4.6 Transmitter Spurious Emissions in the spurious domain

### 4.6.1 Limits of Transmitter Spurious Emissions

Frequency Range	Maximum Power Limit	Bandwidth
30 MHz to 47 MHz	-36dBm	100kHz
47 MHz to 74 MHz	-54dBm	100kHz
74 MHz to 87.5 MHz	-36dBm	100kHz
87.5 MHz to 118 MHz	-54dBm	100kHz
118 MHz to 174 MHz	-36dBm	100kHz
174 MHz to 230 MHz	-54dBm	100kHz
230 MHz to 470 MHz	-36dBm	100kHz
470 MHz to 694 MHz	-54dBm	100kHz
694 MHz to 1 GHz	-36dBm	100kHz
1GHz ~ 12.75GHz	-30dBm	1MHz

Note: These limits are e.r.p. for emissions up to 1 GHz and as e.i.r.p. for emissions above 1 GHz.

### 4.6.2 Test Procedure

Refer to chapter 5.4.9 of ETSI EN 300 328 V2.2.2

Measurement Method	
<input type="checkbox"/> Conducted measurement	<input checked="" type="checkbox"/> Radiated measurement
<p><u>For Conducted measurement:</u> The level of unwanted emissions shall be measured as their power in a specified load (conducted spurious emissions) and their effective radiated power when radiated by the cabinet or structure of the equipment with the antenna connector(s) terminated by a specified load (cabinet radiation).</p> <p><u>Conducted measurement (For equipment with multiple transmit chains):</u>  <input type="checkbox"/> Option 1: The results for each of the transmit chains for the corresponding 1MHz segments shall be added and compared with the limits.  <input type="checkbox"/> Option 2: The results for each of the transmit chains shall be individually compared with the limits after these limits have been reduced by <math>10 \times \log(N)</math> (number of active transmit chains)</p>	

### 4.6.3 Deviation from Test Standard

No deviation.

### 4.6.4 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 equipment was configured to operate under its worst case situation with respect to output power.
3. 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.



#### 4.6.5 Test Results

##### Mode A

##### Worst-case Data:

Frequency Range	30MHz ~ 1GHz	Operating Channel	11
-----------------	--------------	-------------------	----

Spurious Emission Level				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
48.09	H	-73.85	-54.00	-19.85
49.35	V	-67.20	-54.00	-13.20
99.60	V	-68.64	-54.00	-14.64
99.70	H	-74.16	-54.00	-20.16
199.18	V	-66.47	-54.00	-12.47
199.52	H	-70.83	-54.00	-16.83
482.92	V	-72.56	-54.00	-18.56
484.86	H	-70.64	-54.00	-16.64
611.11	V	-72.27	-54.00	-18.27
612.90	H	-72.01	-54.00	-18.01
676.05	H	-70.96	-54.00	-16.96
684.49	V	-71.10	-54.00	-17.10

Frequency Range	1GHz ~ 12.75GHz	Operating Channel	11, 26
-----------------	-----------------	-------------------	--------

Spurious Emission Level					
Channel	Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
11	4810.03	H	-55.89	-30.00	-25.89
	4810.16	V	-56.95	-30.00	-26.95
26	4960.13	V	-56.26	-30.00	-26.26
	4960.92	H	-55.70	-30.00	-25.70

## Mode B

### Worst-case Data:

Frequency Range	30MHz ~ 1GHz	Operating Channel	11
-----------------	--------------	-------------------	----

Spurious Emission Level				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
46.39	V	-66.70	-36.00	-30.70
47.41	H	-63.21	-54.00	-9.21
99.65	H	-69.90	-54.00	-15.90
99.75	V	-71.75	-54.00	-17.75
180.02	V	-72.15	-54.00	-18.15
232.35	H	-67.46	-36.00	-31.46
482.92	H	-71.50	-54.00	-17.50
517.26	V	-74.25	-54.00	-20.25
593.11	H	-72.44	-54.00	-18.44
602.96	V	-72.86	-54.00	-18.86
671.59	V	-71.42	-54.00	-17.42
673.82	H	-72.67	-54.00	-18.67

Frequency Range	1GHz ~ 12.75GHz	Operating Channel	11, 26
-----------------	-----------------	-------------------	--------

Spurious Emission Level					
Channel	Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
11	4810.83	V	-56.37	-30.00	-26.37
	4810.95	H	-54.70	-30.00	-24.70
26	4960.03	H	-56.29	-30.00	-26.29
	4960.08	V	-56.09	-30.00	-26.09

## Mode C

### Worst-case Data:

Frequency Range	30MHz ~ 1GHz	Operating Channel	11
-----------------	--------------	-------------------	----

Spurious Emission Level				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
47.22	V	-67.69	-54.00	-13.69
99.99	H	-73.96	-54.00	-19.96
180.02	V	-70.54	-54.00	-16.54
232.84	H	-72.01	-36.00	-36.01
300.01	H	-67.54	-36.00	-31.54
344.97	V	-68.32	-36.00	-32.32
493.68	V	-75.83	-54.00	-21.83
493.88	H	-76.44	-54.00	-22.44
562.75	V	-74.73	-54.00	-20.73
601.21	H	-72.64	-54.00	-18.64
652.24	H	-73.06	-54.00	-19.06
667.32	V	-71.44	-54.00	-17.44

Frequency Range	1GHz ~ 12.75GHz	Operating Channel	11, 26
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Spurious Emission Level					
Channel	Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
11	4810.01	V	-56.92	-30.00	-26.92
	4810.85	H	-58.70	-30.00	-28.70
26	4960.65	H	-58.72	-30.00	-28.72
	4960.72	V	-58.68	-30.00	-28.68

## 4.7 Receiver Spurious Emissions

### 4.7.1 Limit of Receiver Spurious Emissions

Frequency Range	Maximum Power Limit	Bandwidth
30 MHz ~ 1 GHz	-57dBm	100 kHz
1 GHz ~ 12.75 GHz	-47dBm	1 MHz

Note: These limits are e.r.p. for emissions up to 1 GHz and as e.i.r.p. for emissions above 1 GHz.

### 4.7.2 Test Procedure

Refer to chapter 5.4.10 of ETSI EN 300 328 V2.2.2.

Measurement Method	
<input type="checkbox"/> Conducted measurement	<input checked="" type="checkbox"/> Radiated measurement
<p><u>For Conducted measurement:</u>            The level of unwanted emissions shall be measured as their power in a specified load (conducted spurious emissions) and their effective radiated power when radiated by the cabinet or structure of the equipment with the antenna connector(s) terminated by a specified load (cabinet radiation).</p>	
<p><u>Conducted measurement (For equipment with multiple transmit chains):</u>  <input type="checkbox"/> Option 1: The results for each of the transmit chains for the corresponding 1MHz segments shall be added and compared with the limits.  <input type="checkbox"/> Option 2: The results for each of the transmit chains shall be individually compared with the limits after these limits have been reduced by <math>10 \times \log(N)</math> (number of active transmit chains)</p>	

### 4.7.3 Deviation from Test Standard

No deviation.

### 4.7.4 Test Setup

1. For the actual test configuration, please refer to the related Item in this test report (Photographs of the Test Configuration).
2. Testing was performed when the equipment was in a receive-only mode.
3. 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.

#### 4.7.5 Test Results

##### Mode A

##### RX Worst-case Data:

Frequency Range	30MHz ~ 1GHz	Operating Channel	11
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Spurious Emission Level				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
48.43	V	-69.25	-57.00	-12.25
49.40	H	-71.56	-57.00	-14.56
166.29	V	-64.11	-57.00	-7.11
232.40	H	-70.48	-57.00	-13.48
331.93	V	-65.83	-57.00	-8.83
332.56	H	-65.72	-57.00	-8.72
482.92	H	-70.68	-57.00	-13.68
484.76	V	-71.56	-57.00	-14.56
621.15	H	-71.23	-57.00	-14.23
622.70	V	-72.82	-57.00	-15.82
839.07	V	-69.80	-57.00	-12.80
849.84	H	-69.93	-57.00	-12.93

Frequency Range	1GHz ~ 12.75GHz	Operating Channel	11, 26
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Spurious Emission Level					
Channel	Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
11	4810.10	H	-57.68	-47.00	-10.68
	4810.24	V	-57.32	-47.00	-10.32
26	4960.92	H	-57.61	-47.00	-10.61
	4960.94	V	-58.04	-47.00	-11.04

## Mode B

### RX Worst-case Data:

Frequency Range	30MHz ~ 1GHz	Operating Channel	11
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Spurious Emission Level				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
46.73	H	-66.61	-57.00	-9.61
102.75	V	-63.59	-57.00	-6.59
232.35	H	-68.12	-57.00	-11.12
300.01	V	-66.03	-57.00	-9.03
331.88	H	-64.04	-57.00	-7.04
383.10	V	-72.12	-57.00	-15.12
391.10	H	-72.21	-57.00	-15.21
570.90	V	-73.68	-57.00	-16.68
594.47	H	-72.80	-57.00	-15.80
683.42	V	-71.83	-57.00	-14.83
843.29	H	-69.66	-57.00	-12.66
852.36	V	-70.05	-57.00	-13.05

Frequency Range	1GHz ~ 12.75GHz	Operating Channel	11, 26
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Spurious Emission Level					
Channel	Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
11	4810.23	V	-58.88	-47.00	-11.88
	4810.58	H	-59.09	-47.00	-12.09
26	4960.17	H	-59.39	-47.00	-12.39
	4960.41	V	-59.11	-47.00	-12.11

## Mode C

### RX Worst-case Data:

Frequency Range	30MHz ~ 1GHz	Operating Channel	11
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Spurious Emission Level				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
90.68	H	-71.96	-57.00	-14.96
103.19	V	-66.71	-57.00	-9.71
166.29	H	-73.42	-57.00	-16.42
180.02	V	-70.97	-57.00	-13.97
300.01	H	-67.04	-57.00	-10.04
346.33	V	-67.87	-57.00	-10.87
413.95	H	-74.49	-57.00	-17.49
420.01	V	-70.75	-57.00	-13.75
600.34	H	-73.75	-57.00	-16.75
665.87	V	-72.56	-57.00	-15.56
846.97	V	-72.11	-57.00	-15.11
851.73	H	-71.90	-57.00	-14.90

Frequency Range	1GHz ~ 12.75GHz	Operating Channel	11, 26
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Spurious Emission Level					
Channel	Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
11	4810.03	V	-58.28	-47.00	-11.28
	4810.67	H	-58.60	-47.00	-11.60
26	4960.42	V	-59.29	-47.00	-12.29
	4960.88	H	-59.24	-47.00	-12.24

## 4.8 Receiver Blocking

### 4.8.1 Limit of Receiver Blocking

This requirement applies to all receiver categories.

Receiver Category 1 Equipment			
Wanted signal mean power from companion device (dBm) (see notes 1 to 4)	Blocking Signal Frequency (MHz)	Blocking Signal Power (dBm) (see note 4)	Type of blocking signal
(-133 dBm + 10 × log <sub>10</sub> (OCBW)) or -68 dBm whichever is less (see note 2)	2 380 2 504	-34	CW
(-139 dBm + 10 × log <sub>10</sub> (OCBW)) or -74 dBm whichever is less (see note 3)	2 300 2 330 2 360 2 524 2 584 2 674		
<p>Note 1: OCBW is in Hz.</p> <p>Note 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to Pmin + 26 dB where Pmin is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.</p> <p>Note 3: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to Pmin + 20 dB where Pmin is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.</p> <p>Note 4: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured / positioned as recorded in clause 5.4.3.2.2.</p>			



### Receiver Category 2 Equipment

Wanted signal mean power from companion device (dBm) (see notes 1 to 3)	Blocking Signal Frequency (MHz)	Blocking Signal Power (dBm) (see note 3)	Type of blocking signal
$(-139 \text{ dBm} + 10 \times \log_{10}(\text{OCBW}) + 10)$ or $(-74 \text{ dBm} + 10)$ whichever is less (see note 2)	2 380 2 504 2 300 2 584	-34	CW

Note 1: OCBW is in Hz.

Note 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to  $P_{\text{min}} + 26 \text{ dB}$  where  $P_{\text{min}}$  is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.

Note 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured / positioned as recorded in clause 5.4.3.2.2.

### Receiver Category 3 Equipment

Wanted signal mean power from companion device (dBm) (see notes 1 to 3)	Blocking Signal Frequency (MHz)	Blocking Signal Power (dBm) (See note 3)	Type of blocking signal
$(-139 \text{ dBm} + 10 \times \log_{10}(\text{OCBW}) + 20)$ or $(-74 \text{ dBm} + 20)$ whichever is less (see note 2)	2 380 2 504 2 300 2 584	-34	CW

Note 1: OCBW is in Hz.

Note 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to  $P_{\text{min}} + 26 \text{ dB}$  where  $P_{\text{min}}$  is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.

Note 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured / positioned as recorded in clause 5.4.3.2.2.

#### 4.8.2 Test Procedure

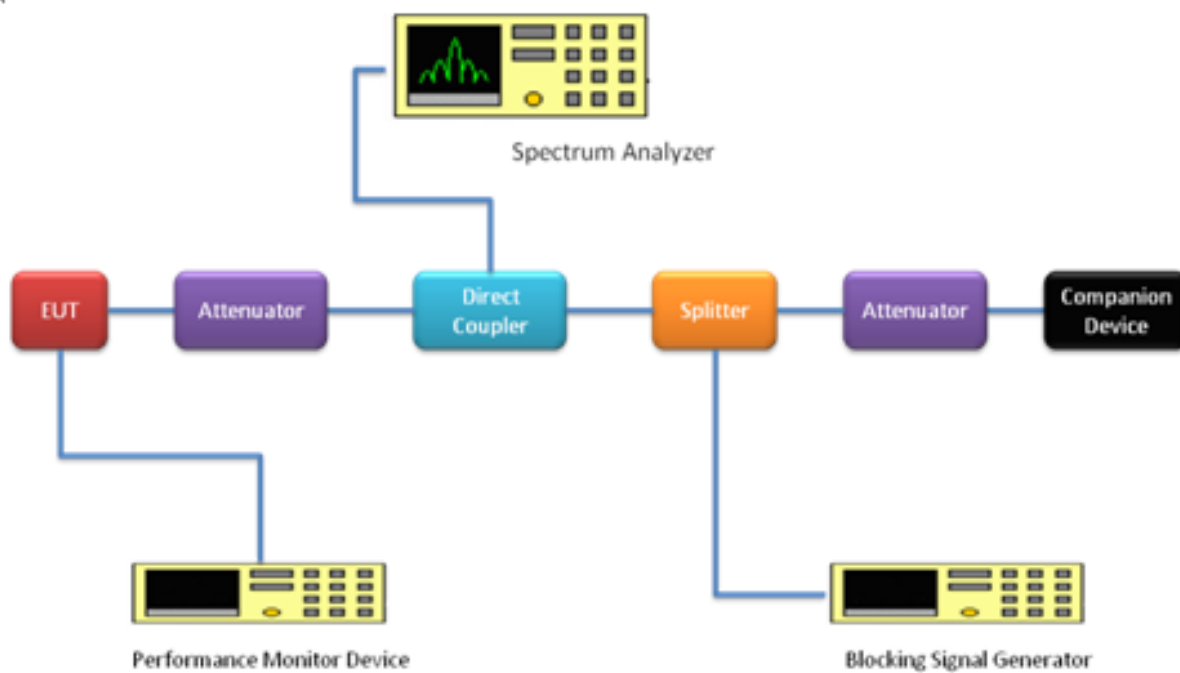
Refer to chapter 5.4.11 of EN 300 328 V2.2.2.

Measurement Method	
<input checked="" type="checkbox"/> Conducted measurement	<input type="checkbox"/> Radiated measurement

#### 4.8.3 Deviation from Test Standard

No deviation.

#### 4.8.4 Test Setup Configuration



#### 4.8.5 Test Results

Receiver Category		
<input checked="" type="checkbox"/> Category 1	<input type="checkbox"/> Category 2	<input type="checkbox"/> Category 3
Minimum performance criterion	<input checked="" type="checkbox"/> PER $\leq$ 10%	
	<input type="checkbox"/> Alternative performance criteria (See note)	
Note: The manufacturer was declared performance criteria is x% for the intended use of the equipment.		

#### Mode A

Receiver blocking performance when operating at the lowest and highest channels							
CH 0	OCBW	3.2 MHz	Antenna Gain:	1.82 dBi	Blocking signal Power	<input checked="" type="checkbox"/> at the antenna connector	
CH 39	OCBW	3.2 MHz				<input type="checkbox"/> in front of the antenna	
Operation Mode	Channel Number	Wanted signal mean power from companion device (dBm) (Note 1)	Blocking signal frequency (MHz)	Blocking signal frequency shift (MHz) (Note 2)	Blocking signal power (dBm) (Note 1)	PER(%)	Pass/Fail
802.15.4	11	-66.18	2380	-	-32.18	1.3	Pass
		-72.18	2300	-	-32.18	0.7	Pass
			2330	-	-32.18	2.8	Pass
			2360	-	-32.18	1.6	Pass
	26	-66.18	2504	-	-32.18	3.1	Pass
		-72.18	2524	-	-32.18	2.4	Pass
			2584	-	-32.18	0.9	Pass
			2674	-	-32.18	2.8	Pass
<p>Note 1: In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G).</p> <p>Note 2: If the performance criteria is not met, those frequencies of the blocking signal has been increased/decreased with a value equal to the Occupied Channel Bandwidth except the blocking frequencies 2380, 2504MHz shall be increased/decreased with a value equal to 10MHz also if the frequency offset is more than 7MHz, the level of the wanted signal shall be increased by 3dB.</p>							

## Mode B

Receiver blocking performance when operating at the lowest and highest channels							
CH 0 OCBW	3.2 MHz	Antenna Gain:	2.8 dBi	Blocking signal Power	<input checked="" type="checkbox"/> at the antenna connector		
CH 39 OCBW	3.2 MHz				<input type="checkbox"/> in front of the antenna		
Operation Mode	Channel Number	Wanted signal mean power from companion device (dBm) (Note 1)	Blocking signal frequency (MHz)	Blocking signal frequency shift (MHz) (Note 2)	Blocking signal power (dBm) (Note 1)	PER(%)	Pass/Fail
802.15.4	11	-65.20	2380	-	-31.20	3.6	Pass
		-71.20	2300	-	-31.20	1.8	Pass
			2330	-	-31.20	0.7	Pass
			2360	-	-31.20	2.9	Pass
	26	-65.20	2504	-	-31.20	1.6	Pass
		-71.20	2524	-	-31.20	3.4	Pass
			2584	-	-31.20	4.1	Pass
			2674	-	-31.20	2.7	Pass

Note 1: In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G).

Note 2: If the performance criteria is not met, those frequencies of the blocking signal has been increased/decreased with a value equal to the Occupied Channel Bandwidth except the blocking frequencies 2380, 2504MHz shall be increased/decreased with a value equal to 10MHz also if the frequency offset is more than 7MHz, the level of the wanted signal shall be increased by 3dB.

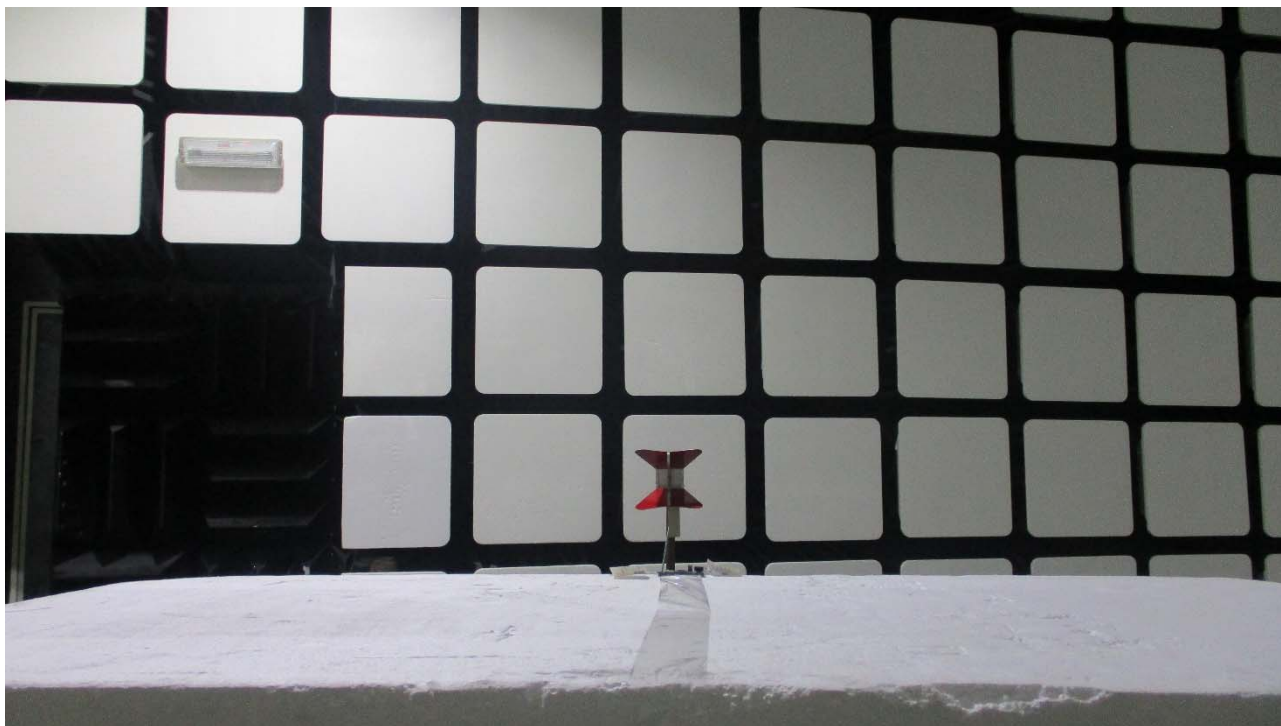
Receiver Category		
<input type="checkbox"/> Category 1	<input checked="" type="checkbox"/> Category 2	<input type="checkbox"/> Category 3
Minimum performance criterion	<input checked="" type="checkbox"/> PER $\leq 10\%$	
	<input type="checkbox"/> Alternative performance criteria (See note)	
Note: The manufacturer was declared performance criteria is x% for the intended use of the equipment.		

### Mode C

Receiver blocking performance when operating at the lowest and highest channels							
CH 11 OCBW	3.28 MHz	Antenna Gain: 1.82 dBi	Blocking signal Power	<input checked="" type="checkbox"/> at the antenna connector			
CH 26 OCBW	3.28 MHz			<input type="checkbox"/> in front of the antenna			
Operation Mode	Channel Number	Wanted signal mean power from companion device (dBm) (Note 1)	Blocking signal frequency (MHz)	Blocking signal frequency shift (MHz) (Note 2)	Blocking signal power (dBm) (Note 1)	PER (%)	Pass/Fail
802.15.4	11	-62.18	2380	-	-32.18	2.3	Pass
		-62.18	2300	-	-32.18	1.6	Pass
	26	-62.18	2504	-	-32.18	0.7	Pass
		-62.18	2584	-	-32.18	1.9	Pass
<p>Note 1: In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G).</p> <p>Note 2: If the performance criteria is not met, those frequencies of the blocking signal has been increased/decreased with a value equal to the Occupied Channel Bandwidth except the blocking frequencies 2380, 2504MHz shall be increased/decreased with a value equal to 10MHz also if the frequency offset is more than 7MHz, the level of the wanted signal shall be increased by 3dB.</p>							

## 5 Photographs of the Test Configuration

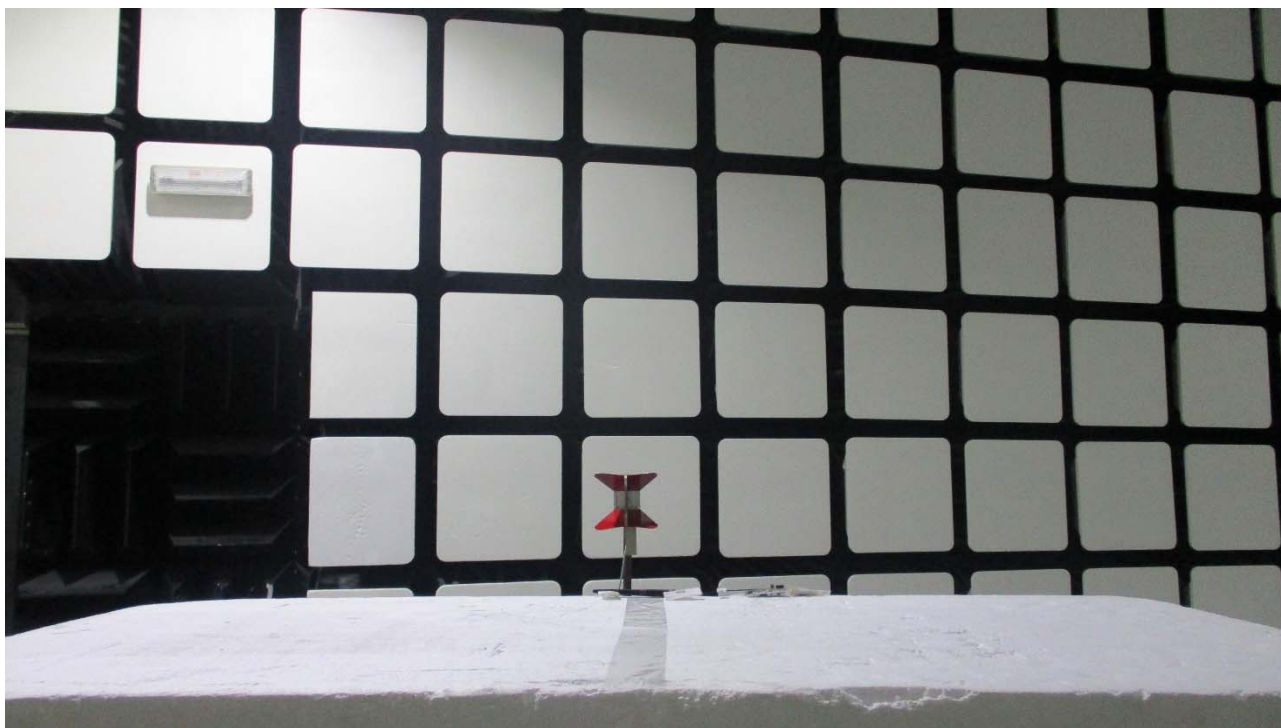
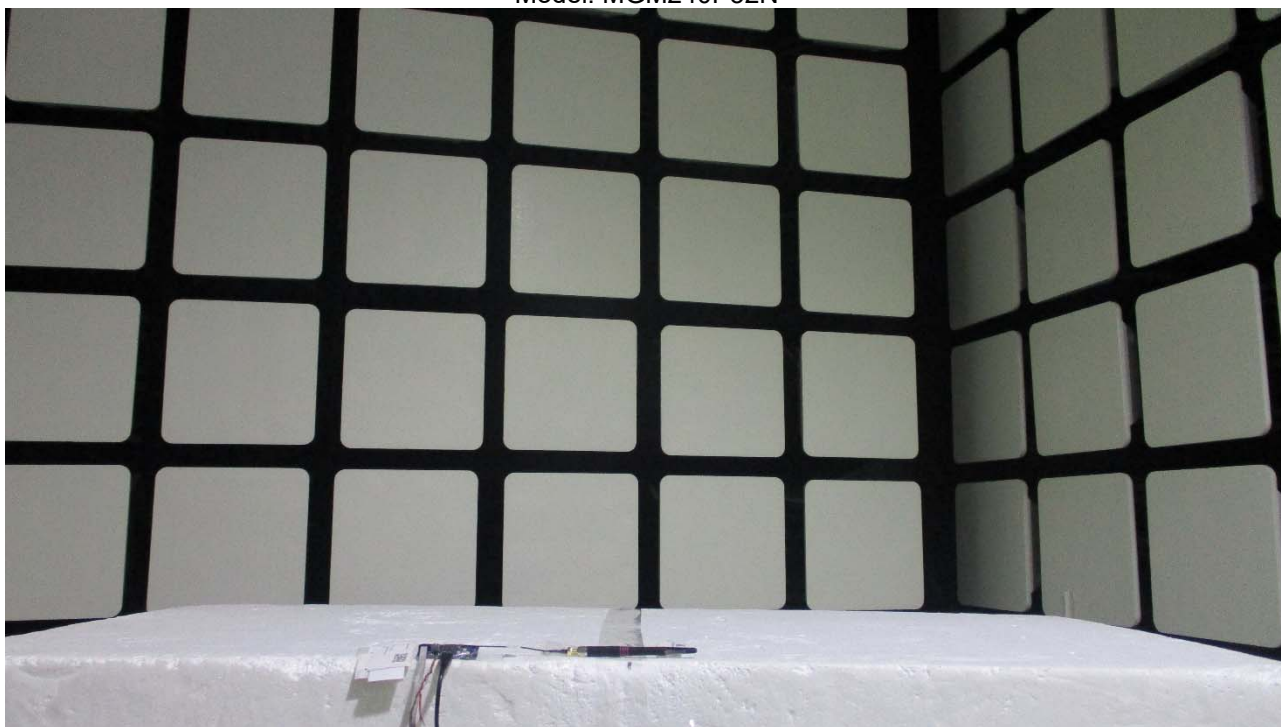
TX / RX Spurious Emission Test  
Model: MGM240P32A



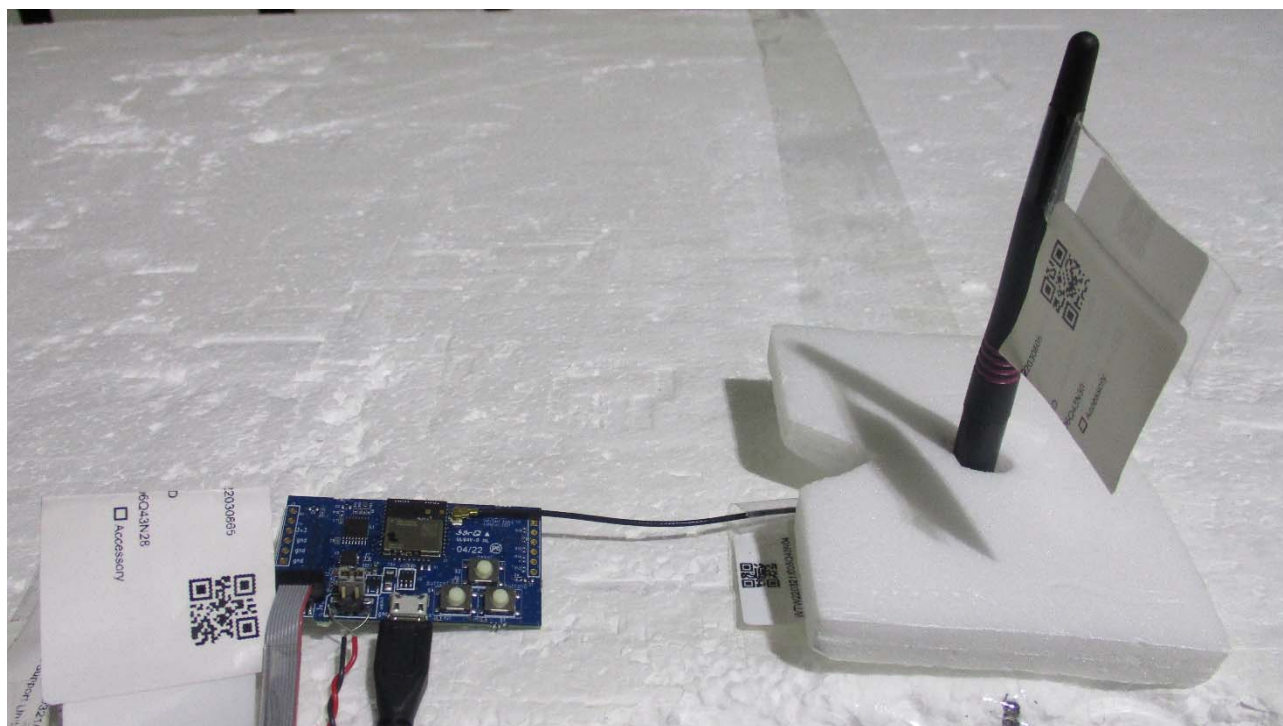




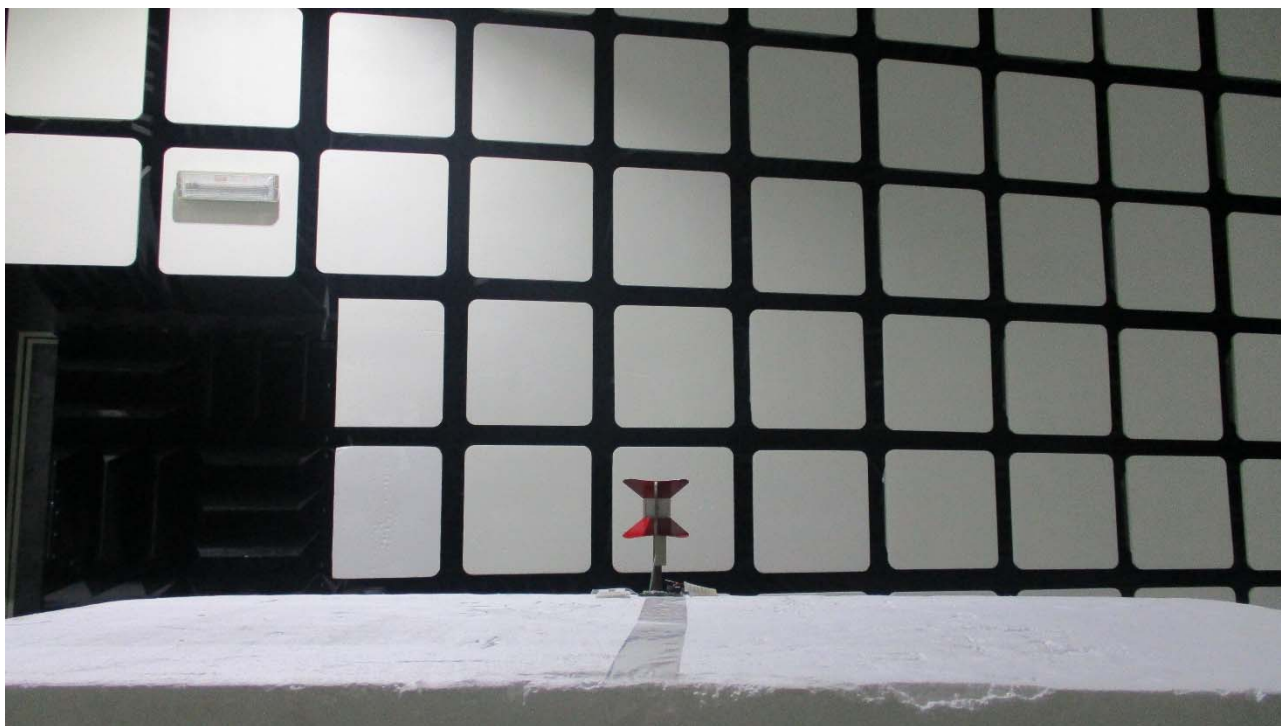
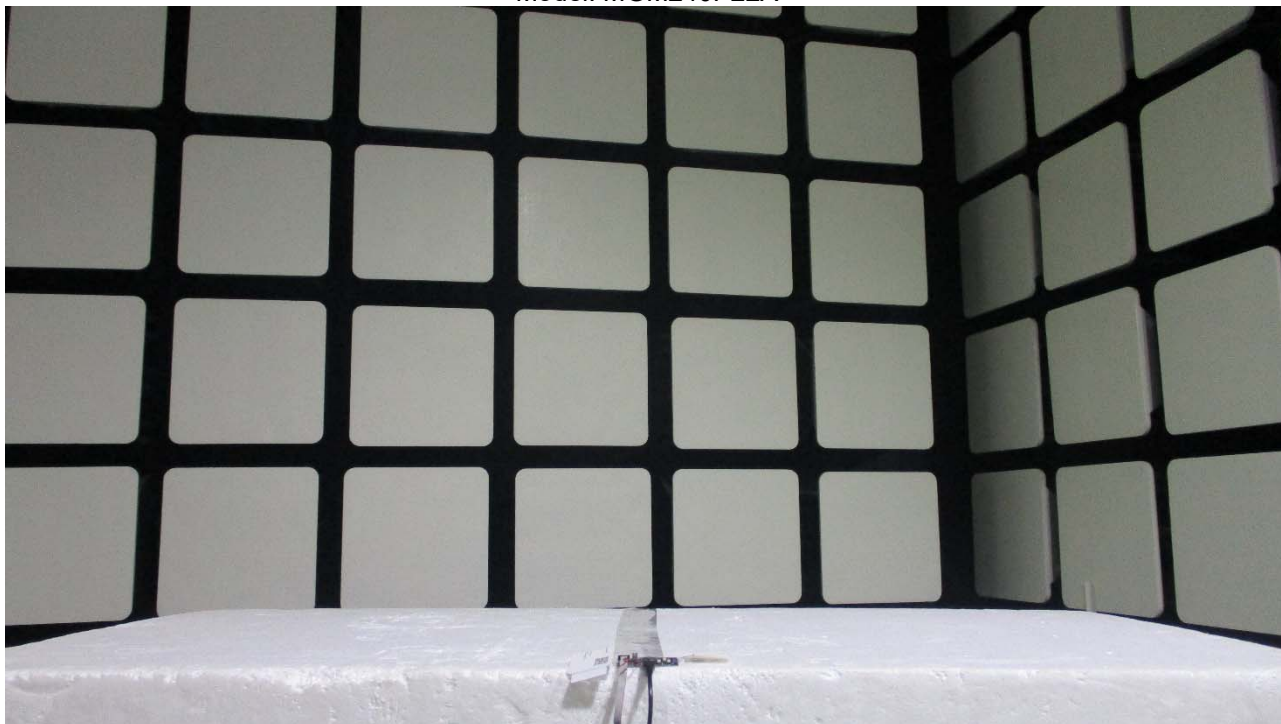
TX / RX Spurious Emission Test  
Model: MGM240P32N







TX / RX Spurious Emission Test  
Model: MGM240P22A



## Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited and approved according to ISO/IEC 17025.

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The address and road map of all our labs can be found in our web site also.

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