

## EN 300 328 RF Test Report

### (Bluetooth Low Energy)

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

**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 ~ Apr. 21, 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	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 ~ Apr. 21, 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 :** Polly Chien , **Date:** Jun. 27, 2022  
Polly Chien / Specialist

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

## 2 Summary of Test Results

The EUT has been tested according to the following specifications:

For FHSS

EN 300 328 V2.2.2		
Clause	Test Parameter	Results
4.3.1.2	RF Output Power	Pass
4.3.1.3	Duty cycle, Tx-sequence, Tx-gap (Only for non-Adaptive equipment)	Not Applicable
4.3.1.4	Accumulated Transmit Time, Frequency Occupation and Hopping Sequence (Only for FHSS equipment)	Pass
4.3.1.5	Hopping Frequency Separation (Only for FHSS equipment)	Pass
4.3.1.6	Medium Utilisation (Only for non-Adaptive Equipment)	Not Applicable
4.3.1.7	Adaptivity (Adaptive Equipment)	Pass
4.3.1.8	Occupied Channel Bandwidth	Pass
4.3.1.9	Transmitter Unwanted Emission in the OOB Domain	Pass
4.3.1.10	Transmitter Unwanted Emissions in the Spurious Domain	Pass
4.3.1.11	Receiver Spurious Emissions	Pass
4.3.1.12	Receiver Blocking	Pass
4.3.1.13	Geo-location capability (Only for equipment with geo-location capability)	Not Applicable

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

For DTS

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 (Modulations other than FHSS equipment)	Pass
4.3.2.4	Duty cycle, Tx-sequence, Tx-gap (Non-adaptive equipment)	Not Applicable
4.3.2.5	Medium Utilization (Non-Adaptive Equipment)	Not Applicable
4.3.2.6	Adaptivity (Adaptive Equipment)	Not Applicable (Note)
4.3.2.7	Occupied Channel Bandwidth	Pass
4.3.2.8	Transmitter Unwanted Emissions in the OOB 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

- 1: These requirements do not apply for equipment with a maximum declared RF Output power of less than 10 dBm EIRP or for equipment when operating in a mode where the RF Output power is less than 10 dBm EIRP.
- 2: 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. 18, 2022
			Feb. 24, 2022	Feb. 23, 2023
Spectrum Analyzer Rohde & Schwarz	FSV40	100980	Apr. 14, 2021	Apr. 13, 2022
			Apr. 20, 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 ~ Apr. 21, 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
Bluetooth Tester Rohde & Schwarz	CBT	100946	Aug. 06, 2020	Aug. 05, 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	$\pm 1.132 \times 10^{-4} \%$
RF output power, conducted	$\pm 1.371 \text{ dB}$
Power Spectral Density, conducted	$\pm 1.371 \text{ dB}$
Unwanted Emissions, conducted	$\pm 1.371 \text{ dB}$
All emissions, radiated	$\pm 3.294 \text{ dB}$
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	GFSK
Modulation Technology	FHSS / DTS
Transfer Rate	1MBaud with 1Mbps transfer rate 1MBaud with coded 125Kbps transfer rate 1MBaud with coded 500Kbps transfer rate 2MBaud with 2Mbps transfer rate
Operating Frequency	2402 ~ 2480MHz
Number of Channel	1MBaud: 40 2MBaud: 37
Adaptive/Non-Adaptive	<input checked="" type="checkbox"/> non-adaptive Equipment (for DTS) <input checked="" type="checkbox"/> adaptive Equipment without the possibility to switch to a non-adaptive mode (for FHSS) <input type="checkbox"/> adaptive Equipment which can also operate in a non-adaptive mode
EIRP Power (Measured Max. Average)	Mode A1 (MGM240P32A / High power 1M): 19.81dBm Mode A2 (MGM240P32A / High power 2M): 19.67dBm Mode B1 (MGM240P32N / High power 1M): 19.92dBm Mode B2 (MGM240P32N / High power 2M): 19.93dBm Mode C1 (MGM240P22A / Low power 1M): 9.99dBm Mode C2 (MGM240P22A / Low power 2M): 11.02dBm
Antenna Type	Refer to note
Antenna Connector	Refer to note
Accessory Device	NA
Data Cable Supplied	NA

Note:

1. All models are listed as below. Model MGM240P22A, MGM240P32A and MGM240P32N are the representative for final test.

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>		

2. 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.

3. For 1MBaud, after the pretesting three transfer rates (1Mbps, 125Kbps and 500Kbps), 1MBaud with 1Mbps transfer rate was the worst case test and chosen for final test.)

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

Sample	Model
A	MGM240P32A
B	MGM240P32N
C	MGM240P22A

5. The power setting is list as below.

Test Mode	MGM240P32A / High power 1M / Integral ant.	Test Mode	MGM240P32A / High power 2M / Integral ant.
CH 0	180	CH 1	180
CH 19	180	CH 19	180
CH 39	180	CH 38	180
Test Mode	MGM240P32N / High power 1M / Dipole ant.	Test Mode	MGM240P32N / High power 2M / Dipole ant.
CH 0	170	CH 1	170
CH 19	170	CH 19	170
CH 39	170	CH 38	170
Test Mode	MGM240P22A / Low power 1M / Integral ant.	Test Mode	MGM240P22A / Low power 2M / Integral ant.
CH 0	90	CH 1	100
CH 19	90	CH 19	100
CH 39	90	CH 38	100

### 3.2 Description of Test Modes

1MBaud:

40 channels are provided to this EUT:

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

2MBaud:

37 channels are provided to this EUT:

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
1	2404	11	2424	22	2446	32	2466
2	2406	13	2428	23	2448	33	2468
3	2408	14	2430	24	2450	34	2470
4	2410	15	2432	25	2452	35	2472
5	2412	16	2434	26	2454	36	2474
6	2414	17	2436	27	2456	37	2476
7	2416	18	2438	28	2458	38	2478
8	2418	19	2440	29	2460		
9	2420	20	2442	30	2462		
10	2422	21	2444	31	2464		

### 3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable to											Description	
	ROP	PSD	ATT/FO/HS	HFS	MU	AD	OCB	EOB	SE< 1G	SE≥ 1G	RB	Item	Condition
A1	√	-	√	√	-	√	√	√	√	√	√	FHSS	Sample A / High power 1M / Integral ant.
A2	√	-	√	√	-	√	√	√	√	√	-		Sample A / High power 2M / Integral ant.
B1	√	-	√	√	-	√	√	√	√	√	√		Sample B / High power 1M / Dipole ant.
B2	√	-	√	√	-	√	√	√	√	√	-		Sample B / High power 2M / Dipole ant.
C1	√	√	-	-	-	-	√	√	√	√	√	DTS	Sample C / Low power 1M / Integral ant.
C2	√	√	-	-	-	-	√	√	√	√	-		Sample C / Low power 2M / Integral ant.

Where ROP: RF Output Power PSD: Power Spectral Density  
ATT/FO/HS: Accumulated Transmit Time / Frequency Occupation/ Hopping Sequence HFS: Hopping Frequency Separation  
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	Data Rate (Mbps)
A1, B1	0 to 39	Hopping mode	GFSK	1.0
A2, B2	1 to 38	Hopping mode	GFSK	2.0
C1	0 to 39	0, 19, 39	GFSK	1.0
C2	1 to 38	1, 19, 38	GFSK	2.0

#### **Accumulated Transmit Time / Frequency Occupation / Hopping Sequence:**

- ☒ 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	Data Rate (Mbps)
A1, B1	0 to 39	Hopping mode	GFSK	1.0
A2, B2	1 to 38	Hopping mode	GFSK	2.0

### **Hopping Frequency Separation:**

- ☒ 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	Data Rate (Mbps)
A1, B1	0 to 39	0, 39	GFSK	1.0
A2, B2	1 to 38	1, 38	GFSK	2.0

### **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	Data Rate (Mbps)
C1	0 to 39	0, 19, 39	GFSK	1.0
C2	1 to 38	1, 19, 38	GFSK	2.0

### **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
A1, B1	0 to 39	0, 39	GFSK
A2, B2	1 to 38	1, 38	GFSK

### **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	Data Rate (Mbps)
A1, B1, C1	0 to 39	0, 39	GFSK	1.0
A2, B2, C2	1 to 38	1, 38	GFSK	2.0

### **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	Data Rate (Mbps)
A1, B1, C1	0 to 39	0, 39	GFSK	1.0
A2, B2, C2	1 to 38	1, 38	GFSK	2.0

### **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	Data Rate (Mbps)
A1, B1, C1	0 to 39	0	GFSK	1.0
A2, B2, C2	1 to 38	1	GFSK	2.0

### **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	Data Rate (Mbps)
A1, B1, C1	0 to 39	0, 39	GFSK	1.0
A2, B2, C2	1 to 38	1, 38	GFSK	2.0

### **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	Data Rate (Mbps)
A1, B1, C1	0 to 39	0, 39	GFSK	1.0

### **Test Condition:**

Applicable To	Environmental Conditions	Input Power	Tested by
ROP	25 deg. C, 60% RH	3.3Vdc	Chun Wu
ATT/FO/HS	25 deg. C, 60% RH	3.3Vdc	Chun Wu
HFS	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	3.3Vdc	Oakley Chen
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.

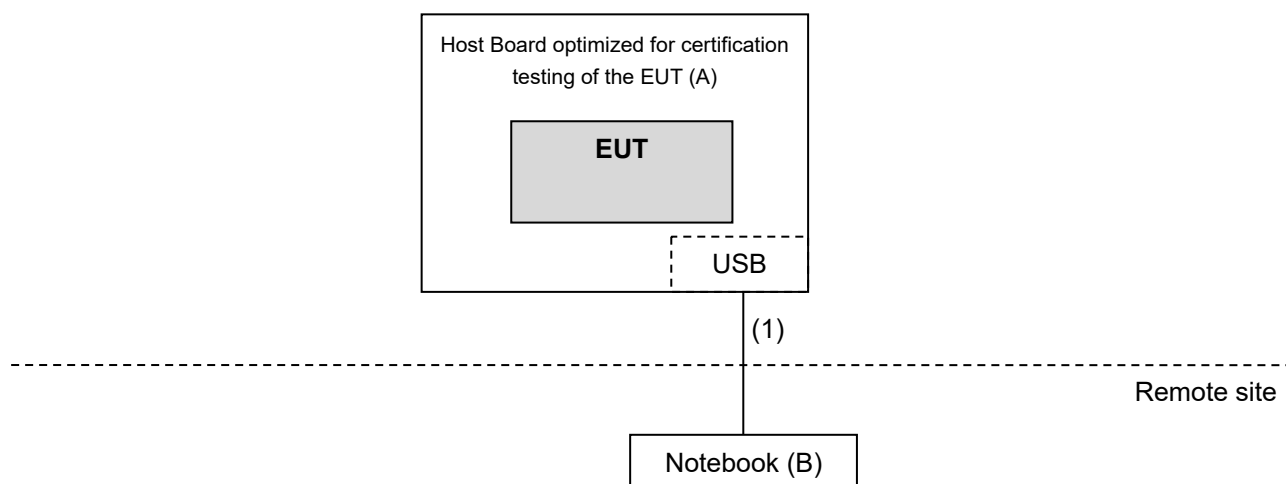
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Host Board optimized for certification testing of the EUT	Silicon Labs	NA	NA	NA	Provided by client
B.	Notebook	DELL	E5430	BPJVKV1	FCC DoC Approved	-

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 EN 300 328 V2.2.2.

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

For extreme test condition refer to chapter Annex B.4 and procedure follow Annex B.4.3.

#### 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 A1

EIRP (dBm)			Limit (dBm)	Test Result
Extreme test conditions				
25 °C	-40 °C	105 °C		
19.51	19.81	18.79	20	Pass

##### Mode A2

EIRP (dBm)			Limit (dBm)	Test Result
Extreme test conditions				
25 °C	-40 °C	105 °C		
19.35	19.67	18.65	20	Pass

##### Mode B1

EIRP (dBm)			Limit (dBm)	Test Result
Extreme test conditions				
25 °C	-40 °C	105 °C		
19.62	19.92	18.90	20	Pass

##### Mode B2

EIRP (dBm)			Limit (dBm)	Test Result
Extreme test conditions				
25 °C	-40 °C	105 °C		
19.62	19.93	18.90	20	Pass

##### Mode C1

Channel	Frequency (MHz)	EIRP (dBm)			Limit (dBm)	Test Result
		Test Conditions				
		25 °C	-40 °C	105 °C		
0	2402	9.89	<b>9.99</b>	9.23	20	Pass
19	2440	9.80	9.92	9.19	20	Pass
39	2480	9.67	9.80	9.03	20	Pass

##### Mode C2

Channel	Frequency (MHz)	EIRP (dBm)			Limit (dBm)	Test Result
		Test Conditions				
		25 °C	-40 °C	105 °C		
1	2404	10.94	<b>11.02</b>	10.24	20	Pass
19	2440	10.84	10.94	10.14	20	Pass
38	2478	10.75	10.95	10.07	20	Pass

## 4.2 Accumulated Transmit Time, Frequency Occupation and Hopping Sequence

### 4.2.1 Limits of Accumulated Transmit Time, Minimum Frequency Occupation and Hopping Sequence

Accumulated Transmit Time	
Condition	Limit
<input type="checkbox"/> Non-adaptive frequency hopping systems	$\leq 15$ ms
<input checked="" type="checkbox"/> Adaptive frequency hopping systems	$\leq 400$ ms

Frequency Occupation	
Condition	Limit
<input type="checkbox"/> Non-adaptive frequency hopping systems	<input checked="" type="checkbox"/> Option 1: Each hopping frequency of the hopping sequence shall be occupied at least once within a period not exceeding four times the product of the dwell time and the number of hopping frequencies in use. <input type="checkbox"/> Option 2: The occupation probability for each frequency shall be between $((1 / U) \times 25 \%)$ and 77 % where U is the number of hopping frequencies in use.
<input checked="" type="checkbox"/> Adaptive frequency hopping systems	

Hopping Sequence(s)	
Condition	Limit
<input type="checkbox"/> Non-adaptive frequency hopping systems	$\geq 5$ hopping frequencies or 15MHz/minimum Hopping Frequency Separation in MHz, whichever is the greater.
<input checked="" type="checkbox"/> Adaptive frequency hopping systems	Operating frequency band $\geq 58.45$ MHz (Operating over a minimum of 70 % of the operating in the band 2.4 GHz to 2.4835 GHz) $\geq 15$ hopping frequencies or 15MHz/minimum Hopping Frequency Separation in MHz, whichever is the greater.

### 4.2.2 Test Procedure

Refer to chapter 5.4.4 of EN 300 328 V2.2.2.

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

### 4.2.3 Deviation from Test Standard

No deviation

### 4.2.4 Test Setup

The measurements only were performed at normal test conditions. The equipment was configured to operate at its maximum Dwell Time and maximum Duty Cycle. The measurement was performed on a minimum of 2 hopping frequencies chosen arbitrary from the actual hopping sequence. 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.

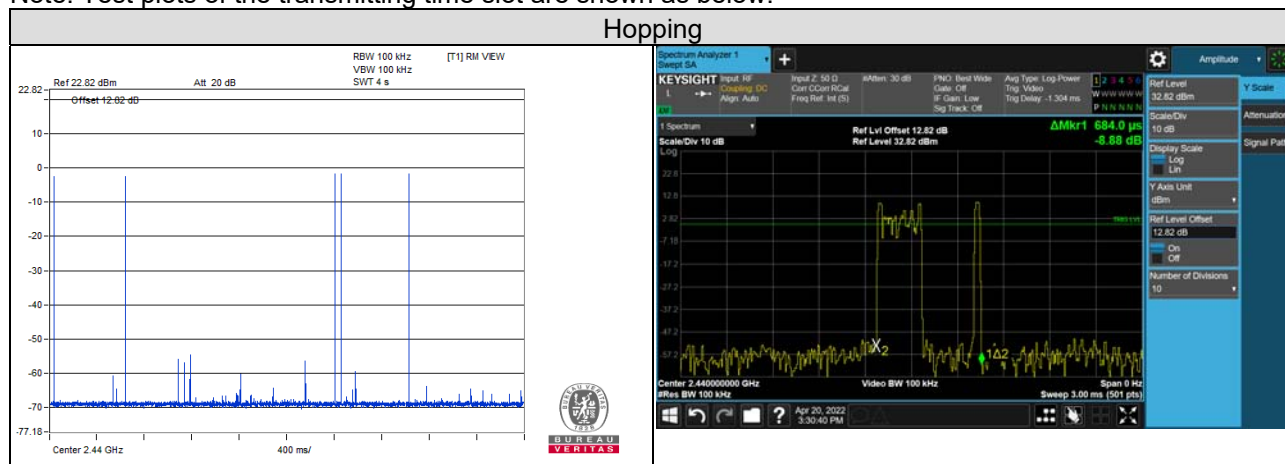
## 4.2.5 Test Results

### Mode A1

Accumulated Transmit Time							
Mode	Minimum Number of Hopping Channel	NTP* (Sec)	Number of Hop in NTP*	Dwell Time per Hop (msec)	Dwell Time in NTP* (msec)	Limit (msec)	Pass / Fail
Hopping	40	16	20	0.539	10.78	400	Pass

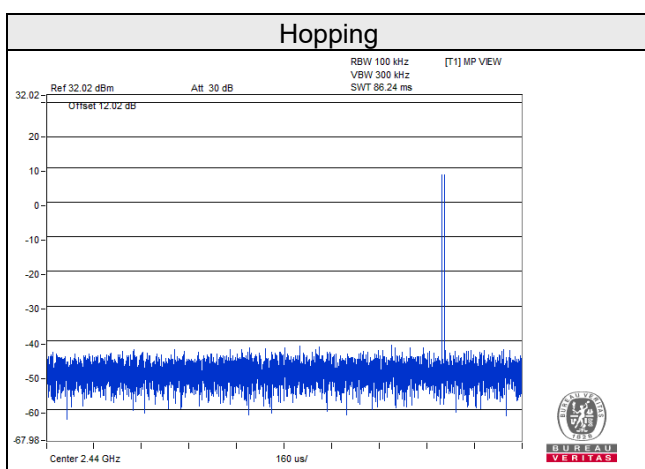
\*NTP: Number of transmission in a period (channel number \*0.4sec)

Note: Test plots of the transmitting time slot are shown as below.

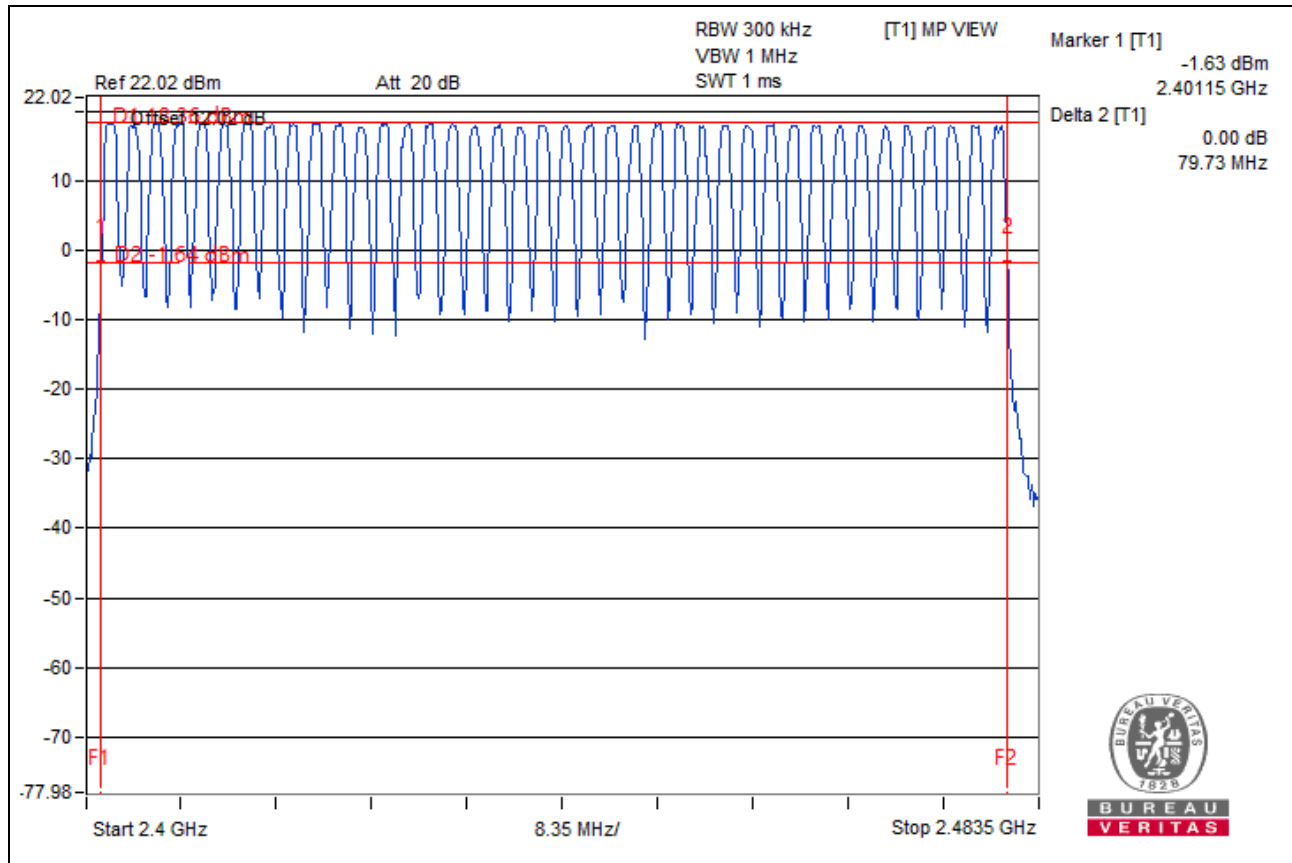


Frequency Occupation							
Mode	Actual Number of Hopping Channel	Dwell Time per Hop (msec)	T <sub>FO</sub> * (msec)	Number of Hop in T <sub>FO</sub> *	Dwell Time in T <sub>FO</sub> *	Limit-Minimum number of Hopping in T <sub>FO</sub> *	Pass / Fail
Hopping	40	0.539	86.24	2	1.078	1	Pass

\*T<sub>FO</sub>: 4 × Dwell Time × Actual number of hopping frequencies in use



Hopping sequence(s)		
Amount of Hopping frequency	Limit	Pass/Fail
40	≥15 hopping frequencies	Pass
Operating hopping Bandwidth (MHz)	Limit	Pass/Fail
79.73	≥58.45MHz	Pass

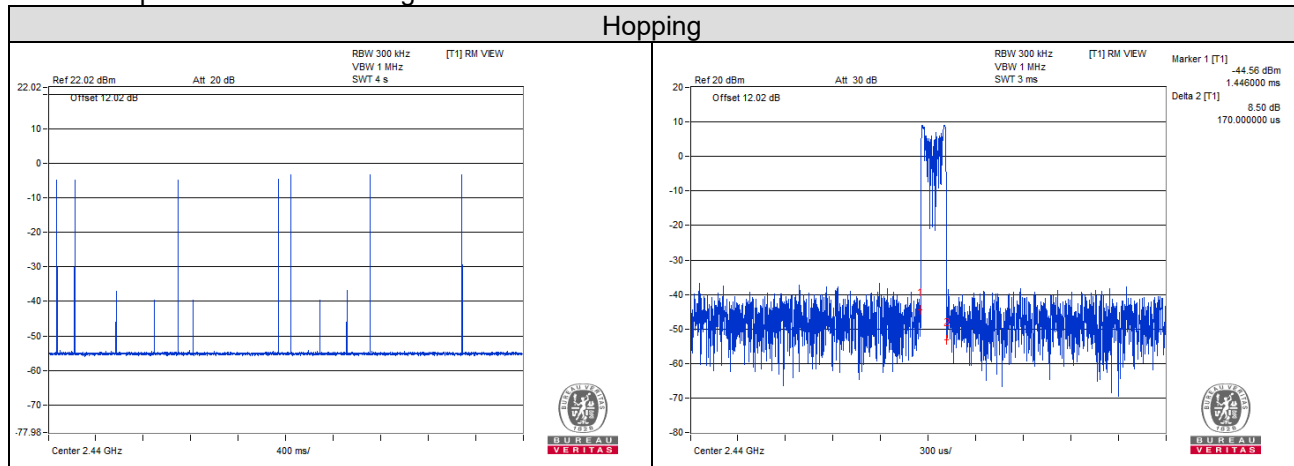


## Mode A2

Accumulated Transmit Time							
Mode	Minimum Number of Hopping Channel	NTP* (Sec)	Number of Hop in NTP*	Dwell Time per Hop (msec)	Dwell Time in NTP* (msec)	Limit (msec)	Pass / Fail
Hopping	37	14.8	25.9	0.17	4.403	400	Pass

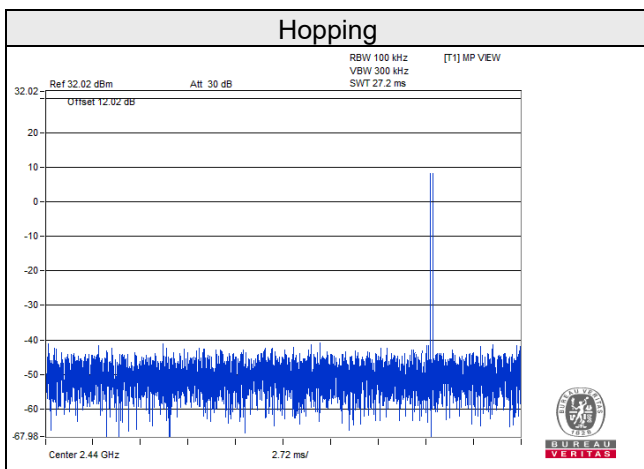
\*NTP: Number of transmission in a period (channel number \*0.4sec)

Note: Test plots of the transmitting time slot are shown as below.

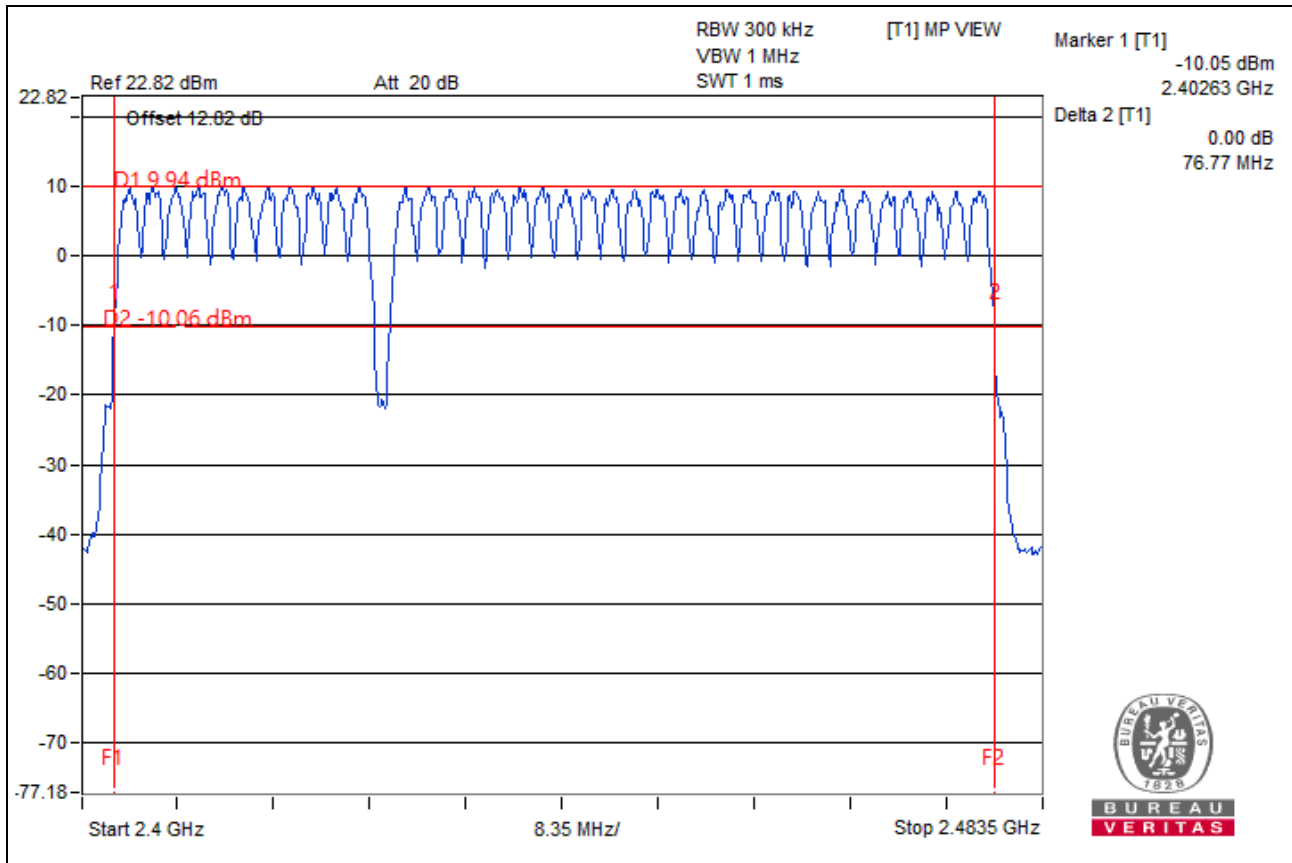


Frequency Occupation							
Mode	Actual Number of Hopping Channel	Dwell Time per Hop (msec)	T <sub>FO</sub> * (msec)	Number of Hop in T <sub>FO</sub> *	Dwell Time in T <sub>FO</sub> *	Limit-Minimum number of Hopping in T <sub>FO</sub> *	Pass / Fail
Hopping	37	0.17	25.16	2	0.34	1	Pass

\*T<sub>FO</sub>: 4 × Dwell Time × Actual number of hopping frequencies in use



Hopping sequence(s)		
Amount of Hopping frequency	Limit	Pass/Fail
37	≥15 hopping frequencies	Pass
Operating hopping Bandwidth (MHz)	Limit	Pass/Fail
76.77	≥58.45MHz	Pass



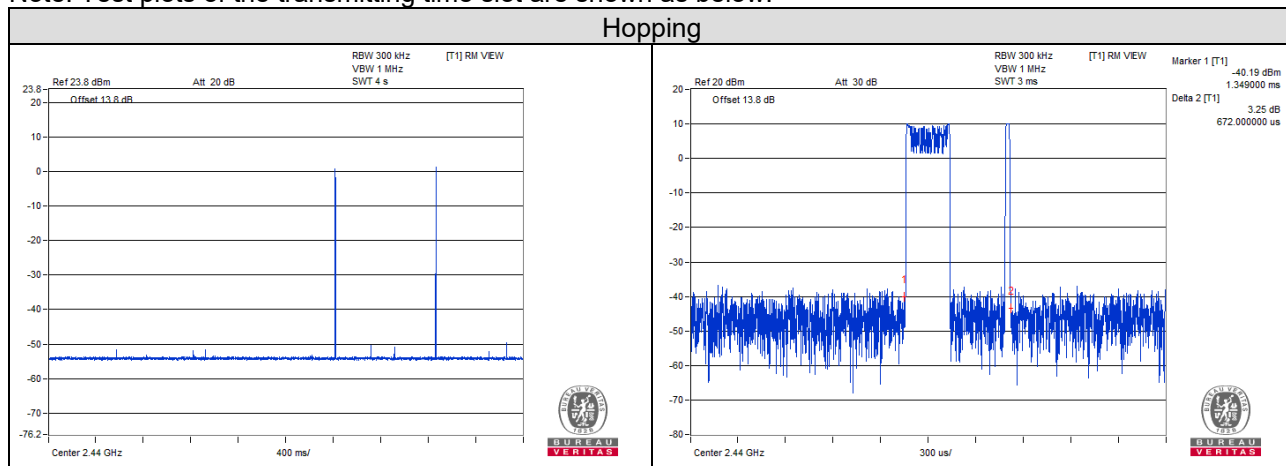


## Mode B1

Accumulated Transmit Time							
Mode	Minimum Number of Hopping Channel	NTP* (Sec)	Number of Hop in NTP*	Dwell Time per Hop (msec)	Dwell Time in NTP* (msec)	Limit (msec)	Pass / Fail
Hopping	40	16	8	0.672	5.376	400	Pass

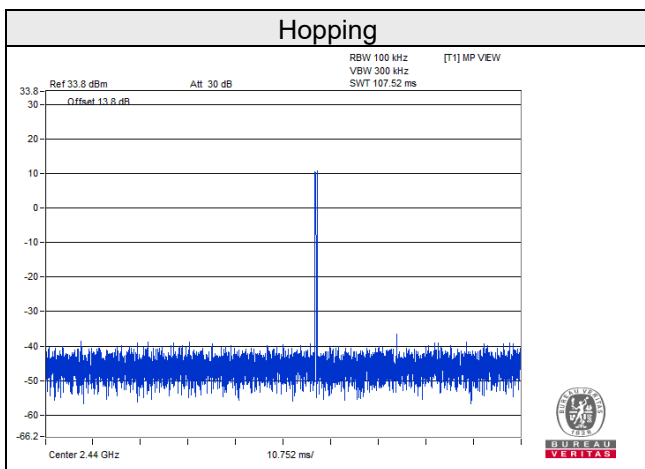
\*NTP: Number of transmission in a period (channel number \*0.4sec)

Note: Test plots of the transmitting time slot are shown as below.

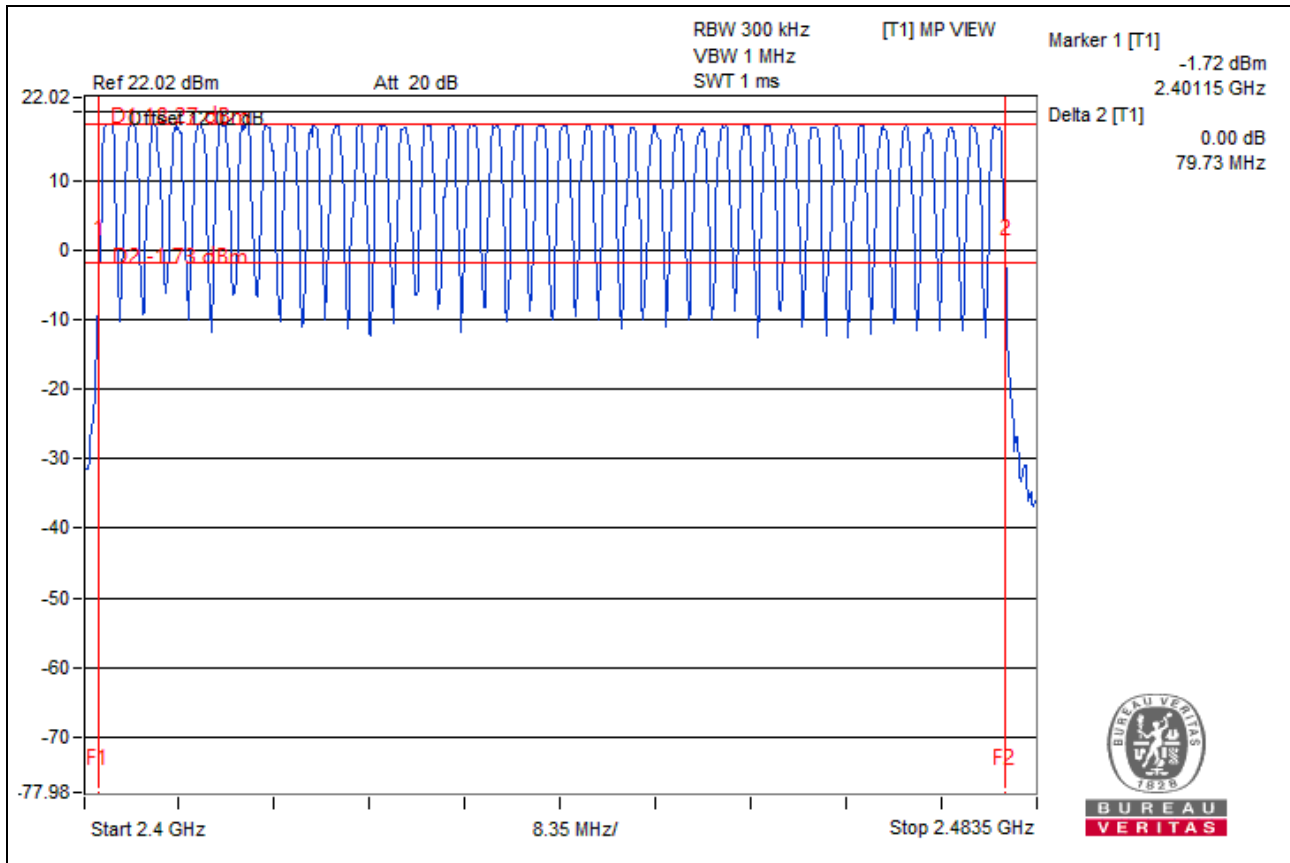


Frequency Occupation							
Mode	Actual Number of Hopping Channel	Dwell Time per Hop (msec)	T <sub>FO</sub> * (msec)	Number of Hop in T <sub>FO</sub> *	Dwell Time in T <sub>FO</sub> *	Limit-Minimum number of Hopping in T <sub>FO</sub> *	Pass / Fail
Hopping	40	0.672	107.52	1	0.672	1	Pass

\*T<sub>FO</sub>: 4 × Dwell Time × Actual number of hopping frequencies in use



Hopping sequence(s)		
Amount of Hopping frequency	Limit	Pass/Fail
40	≥15 hopping frequencies	Pass
Operating hopping Bandwidth (MHz)	Limit	Pass/Fail
79.73	≥58.45MHz	Pass

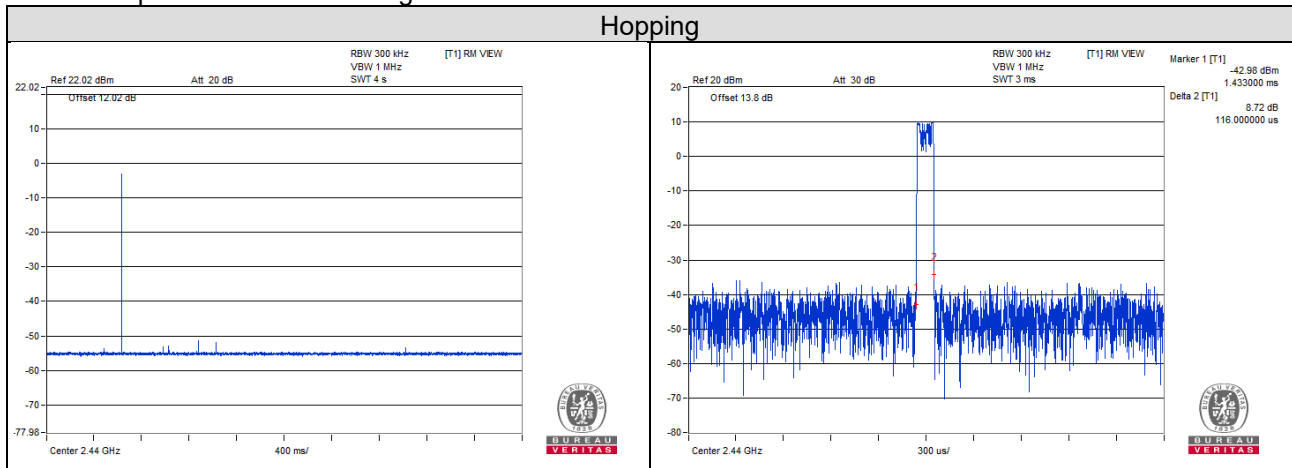


## Mode B2

Accumulated Transmit Time							
Mode	Minimum Number of Hopping Channel	NTP* (Sec)	Number of Hop in NTP*	Dwell Time per Hop (msec)	Dwell Time in NTP* (msec)	Limit (msec)	Pass / Fail
Hopping	37	14.8	3.7	0.116	0.4292	400	Pass

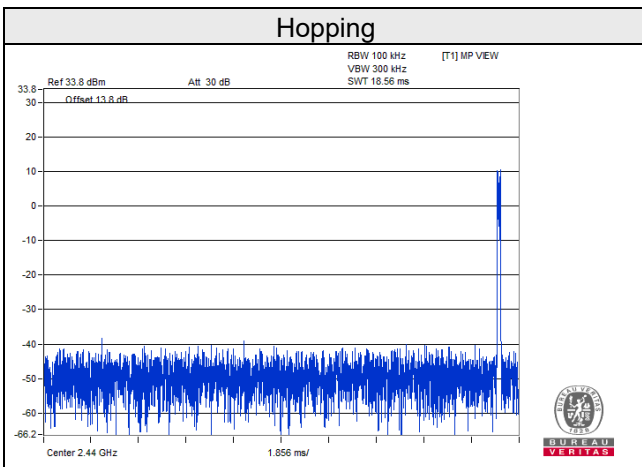
\*NTP: Number of transmission in a period (channel number \*0.4sec)

Note: Test plots of the transmitting time slot are shown as below.

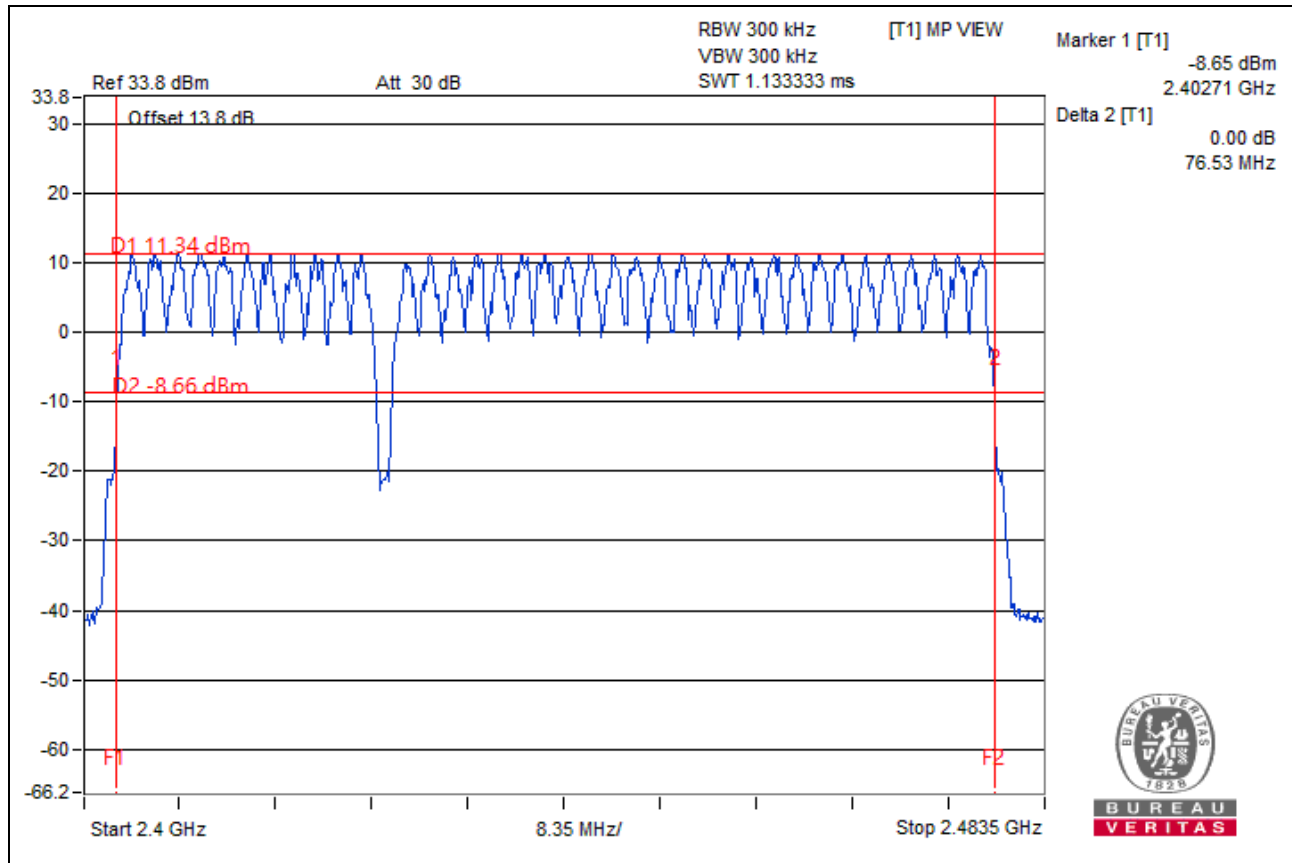


Frequency Occupation							
Mode	Actual Number of Hopping Channel	Dwell Time per Hop (msec)	T <sub>FO</sub> * (msec)	Number of Hop in T <sub>FO</sub> *	Dwell Time in T <sub>FO</sub> *	Limit-Minimum number of Hopping in T <sub>FO</sub> *	Pass / Fail
Hopping	37	0.116	17.168	1	0.116	1	Pass

\*T<sub>FO</sub>: 4 × Dwell Time × Actual number of hopping frequencies in use



Hopping sequence(s)		
Amount of Hopping frequency	Limit	Pass/Fail
37	≥15 hopping frequencies	Pass
Operating hopping Bandwidth (MHz)	Limit	Pass/Fail
76.53	≥58.45MHz	Pass



### 4.3 Adaptivity (Adaptive Frequency Hopping)

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 frequency hopping equipment

Requirement	Operational Mode	
	Using LBT based DAA (CCA using 'energy detect')	using other forms of DAA (non-LBT based)
Minimum Clear Channel Assessment (CCA) Time	18 us (see note 1)	NA
Maximum Channel Occupancy (COT) Time	60 ms (see note 6)	40ms (see note2)
Minimum Idle Period	100us (see note 7)	100us (see note 2)
Extended CCA check	See note 4	NA
Minimum time for unavailable	NA	(see note 3)
Short Control Signalling Transmissions	Maximum duty cycle of 10 % within an observation period of 50 ms (see note 5)	
Note 1: The CCA observation time shall be not less than 0,2 % of the Channel Occupancy Time with a minimum of 18 μs		
Note 2: For equipment using a dwell time > 40 ms that want to have other transmissions during the same hop (dwell time) an Idle Period (no transmissions) of minimum 5 % of the Channel Occupancy Period with a minimum of 100 μs shall be implemented.		
Note 3: The frequency shall remain unavailable for a minimum time equal to 1 second or 5 times the actual number of hopping frequencies multiplied with the Channel Occupancy Time whichever is the longest.		
Note 4: Observed for a random duration between the value defined for the CCA observation time and 5 % of the Channel Occupancy Time.		
Note 5: Adaptive equipment may or may not have Short Control Signaling Transmissions.		
Note 6: For LBT based frequency hopping equipment with a dwell time < 60 ms, the maximum Channel Occupancy Time is limited by the dwell time.		
Note 7: Minimum 5 % of the Channel Occupancy Time with a minimum of 100 us.		

##### Interference threshold level

Maximum transmit power ( $P_H$ ) 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 detection threshold level (TL) shall be equal or less than -70 dBm/MHz at the input to the receiver (assuming a 0 dBi receive antenna)</p> <p>Note 2: For power levels below 20 dBm e.i.r.p., the detection threshold level may be relaxed to <math>TL = -70 \text{ dBm/MHz} + 10 \times \log_{10} (100 \text{ mW} / P_{out})</math> (<math>P_{out}</math> in mW e.i.r.p.)</p>	

Unwanted signal parameters for Adaptive frequency hopping using LBT based DAA		
Wanted signal mean power from companion device (dBm)	Unwanted signal frequency (MHz)	Unwanted CW 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 2442 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: 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>		

Unwanted signal parameters for Adaptive frequency hopping using other forms of DAA (non-LBT based)		
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>		

#### 4.3.2 Test Procedure

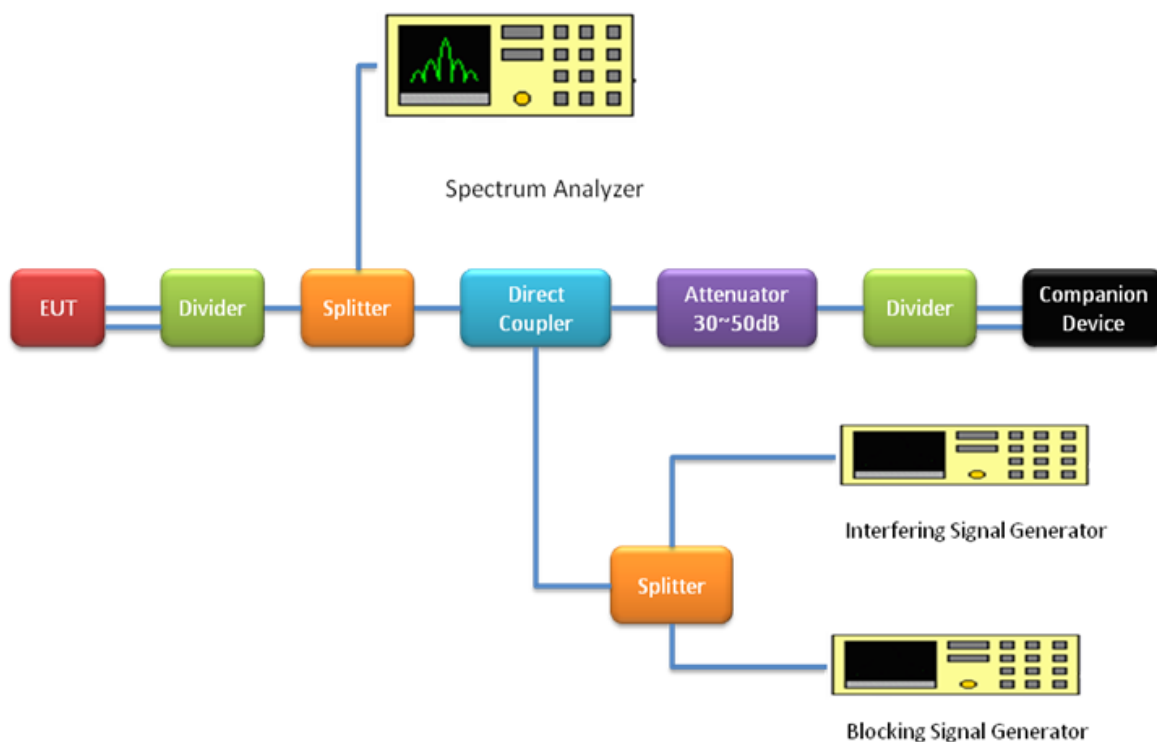
Refer to chapter 5.4.6 of EN 300 328 V2.2.2.

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	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	4.0.x (Gecko SDK)

#### 4.3.5 List of Measurements

UUT Operational Mode	Limit	
	The Maximum Channel Occupancy Time	The Minimum idle Period
Using non-LBT based DAA	Less than 40 ms	Minimum 5 % of the Channel Occupancy Time with a minimum of 100 $\mu$ s

Clause	Test Parameter	Remarks	Pass/Fail
4.3.1.6.1.2	Using LBT based DAA	Not Applicable	NA
4.3.1.6.2.2	Using other forms of DAA (non-LBT based)	Applicable	Pass
4.3.2.5.3	Short Control Signalling Transmissions	Applicable	Pass



### 4.3.6 Interference Threshold Level

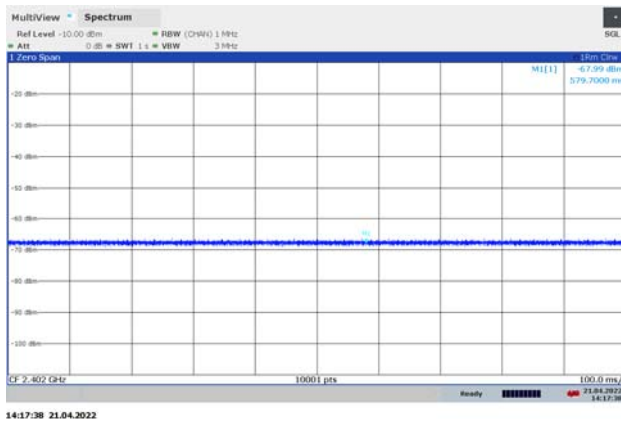
#### Mode A1

##### Detection Threshold Level

The maximum EIRP power is 19.81dBm and antenna gain is 1.82dBi.

Detection Threshold Level =  $-70\text{dBm/MHz} + 10 \cdot \log_{10} (100\text{mW} / P_{\text{out}} (95.72\text{mW})) + G (1.82\text{dBi}) = -67.99\text{dBm/MHz}$ .

The interference signal level to the UUT is -67.99dBm/MHz



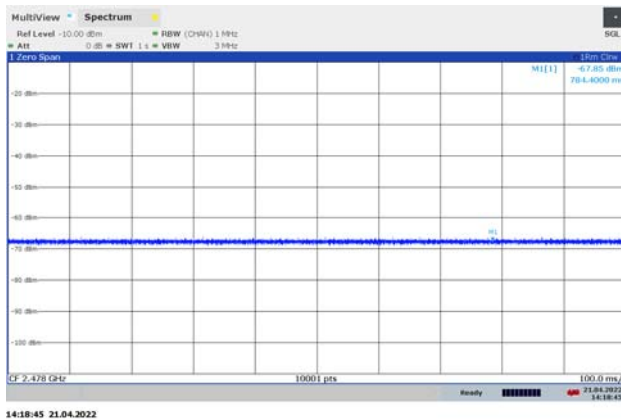
#### Mode A2

##### Detection Threshold Level

The maximum EIRP power is 19.67dBm and antenna gain is 1.82dBi.

Detection Threshold Level =  $-70\text{dBm/MHz} + 10 \cdot \log_{10} (100\text{mW} / P_{\text{out}} (92.68\text{mW})) + G (1.82\text{dBi}) = -67.85\text{dBm/MHz}$ .

The interference signal level to the UUT is -67.85dBm/MHz



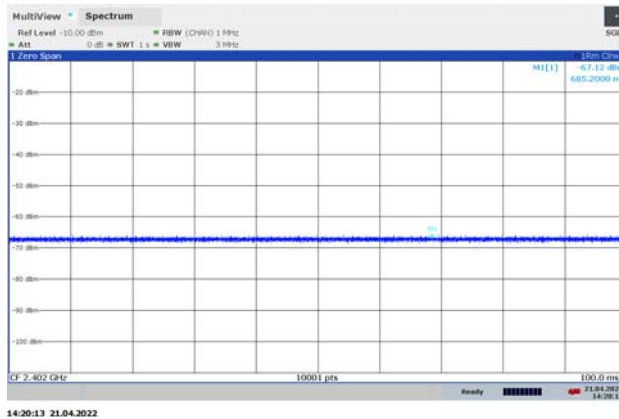
## Mode B1

### Detection Threshold Level

The maximum EIRP power is 19.92dBm and antenna gain is 2.8dBi.

Detection Threshold Level =  $-70\text{dBm/MHz} + 10 \cdot \log_{10} (100\text{mW} / P_{\text{out}} (98.17\text{mW})) + G (2.8\text{dBi}) = -67.12\text{dBm/MHz}$ .

The interference signal level to the UUT is -67.12dBm/MHz



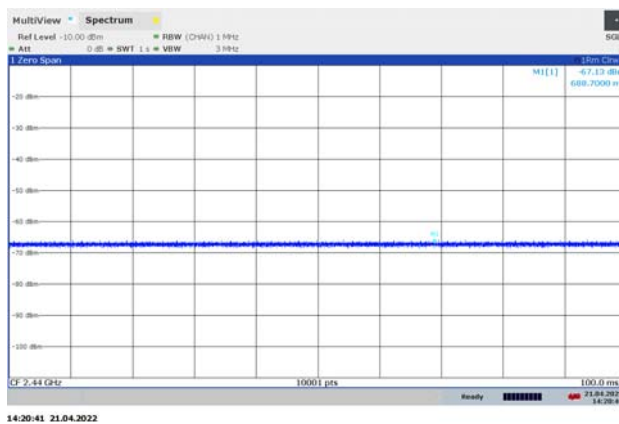
## Mode B2

### Detection Threshold Level

The maximum EIRP power is 19.93dBm and antenna gain is 2.8dBi.

Detection Threshold Level =  $-70\text{dBm/MHz} + 10 \cdot \log_{10} (100\text{mW} / P_{\text{out}} (98.40\text{mW})) + G (2.8\text{dBi}) = -67.13\text{dBm/MHz}$ .

The interference signal level to the UUT is -67.13dBm/MHz



#### 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   |

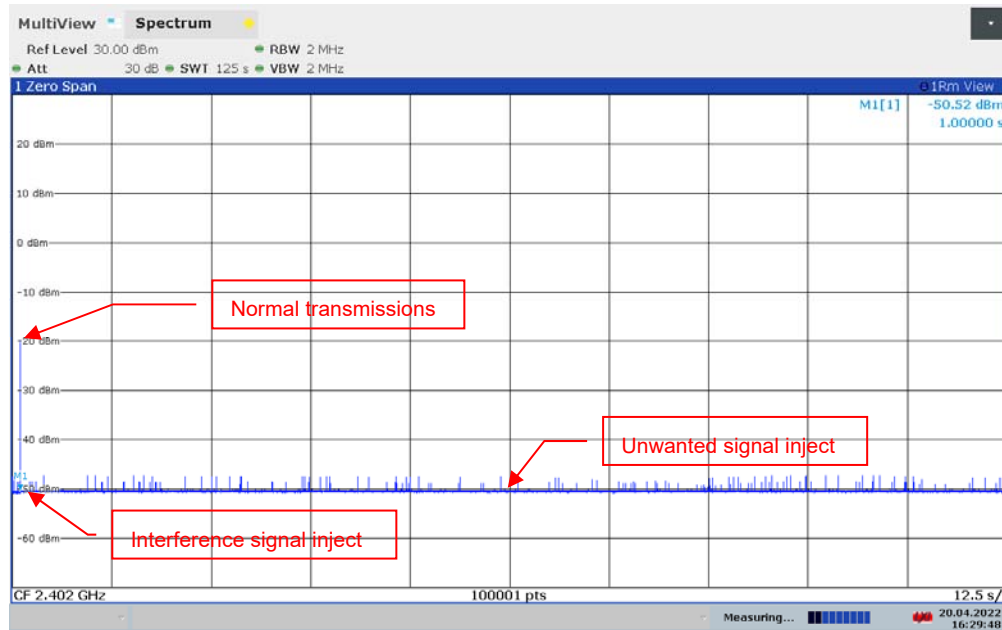
##### 4.3.7.1 Adaptive Result

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

Operational Mode	Operating Frequency (Low power Channel, MHz)	Operating Frequency (High power Channel, MHz)	Test Result
BT LE 1M	2402	2480	Pass
BT LE 2M	2404	2478	Pass

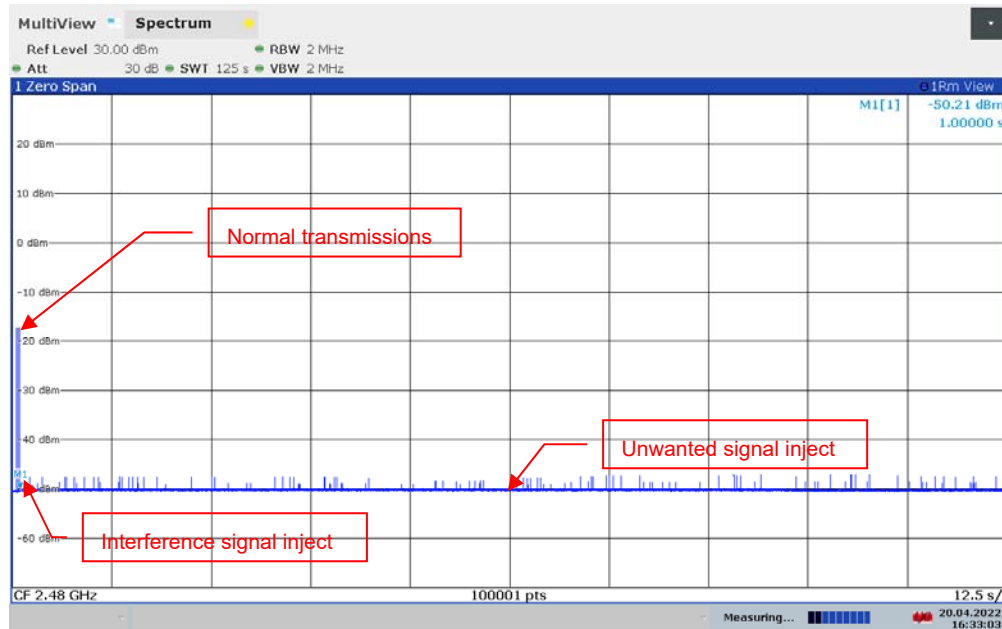
## Mode A1

2402MHz



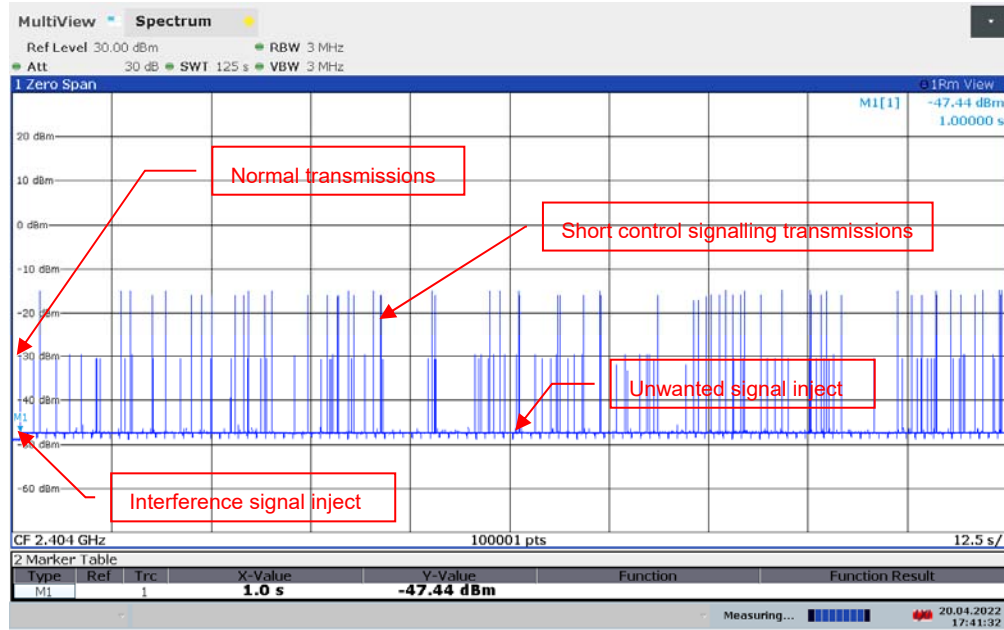
16:29:49 20.04.2022

2480MHz



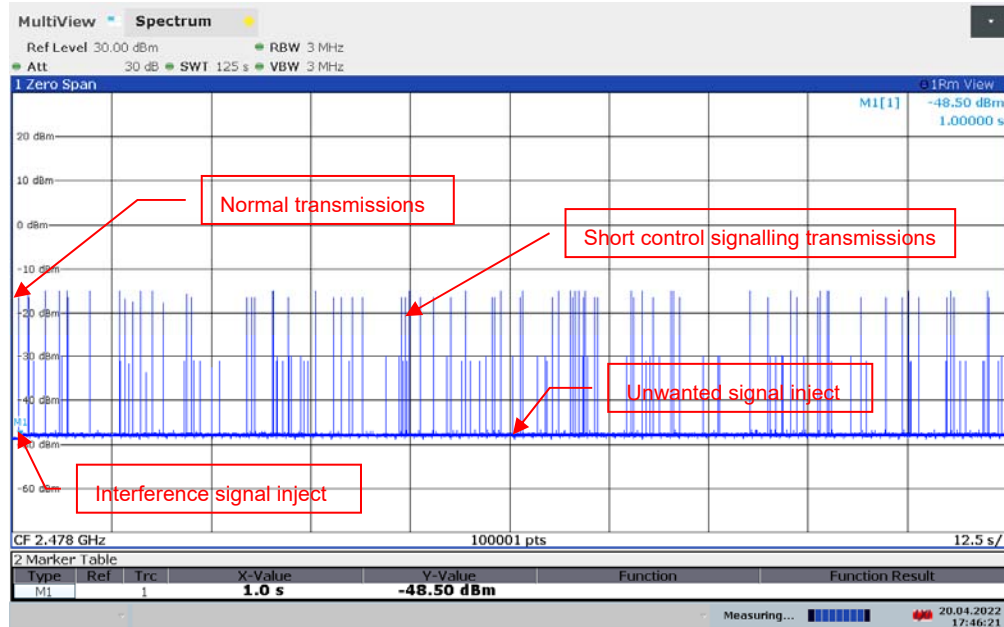
16:33:04 20.04.2022

## Mode A2 2404MHz



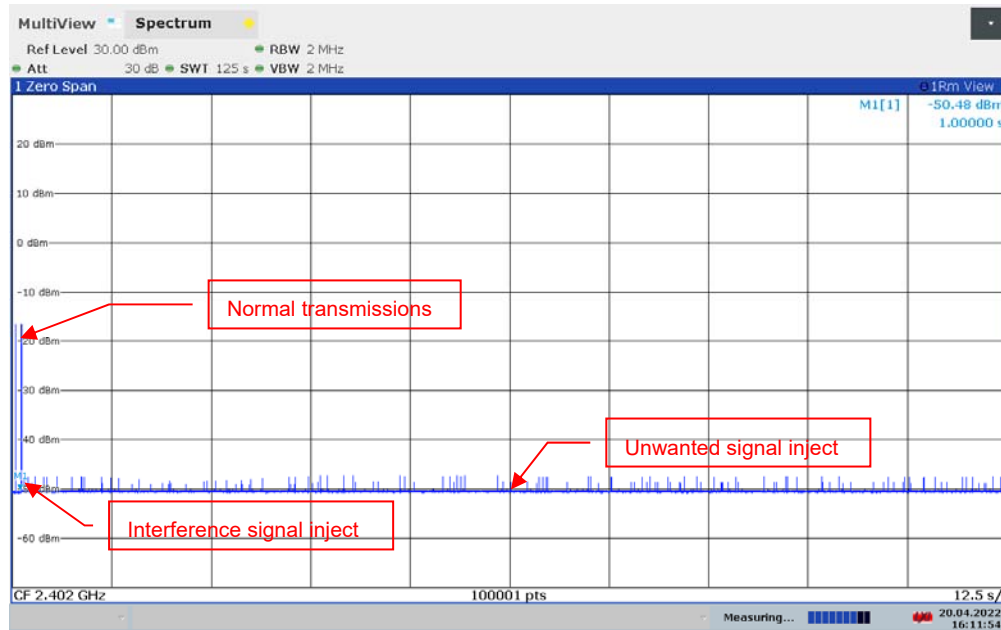
17:41:33 20.04.2022

## 2478MHz



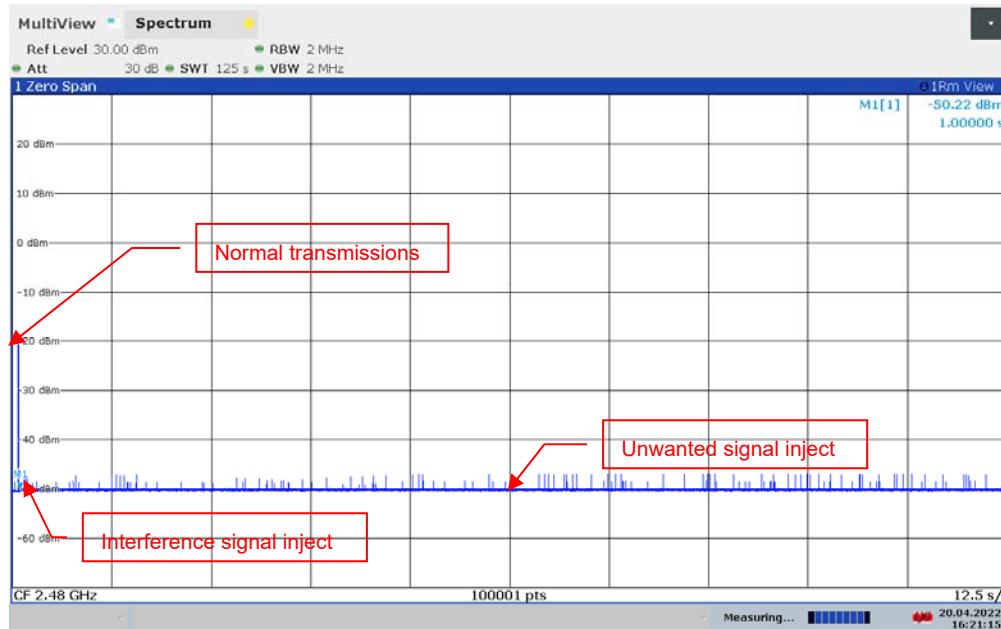
17:46:22 20.04.2022

## Mode B1 2402MHz



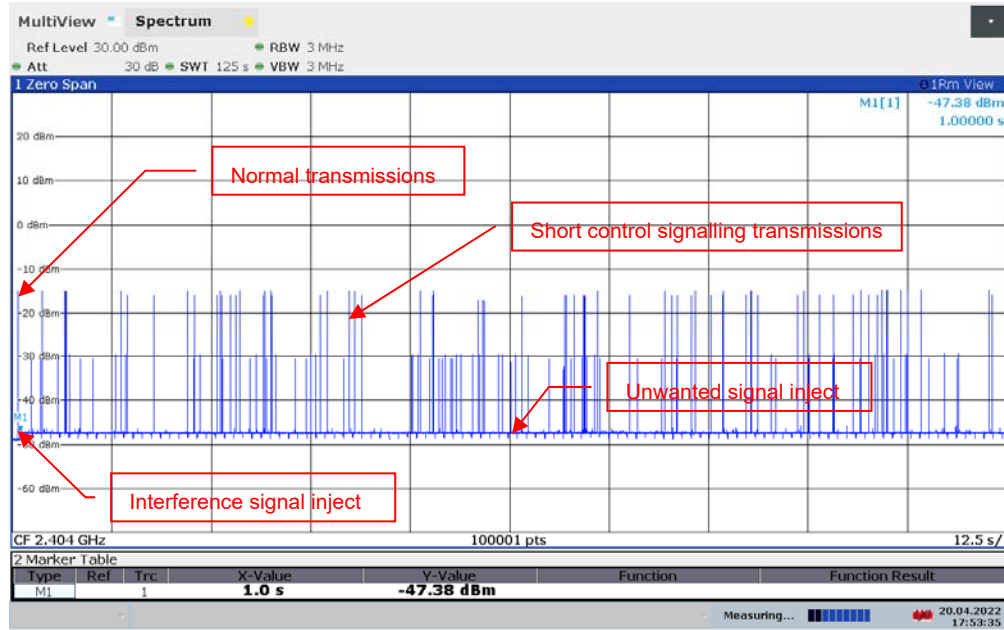
16:11:54 20.04.2022

## 2480MHz



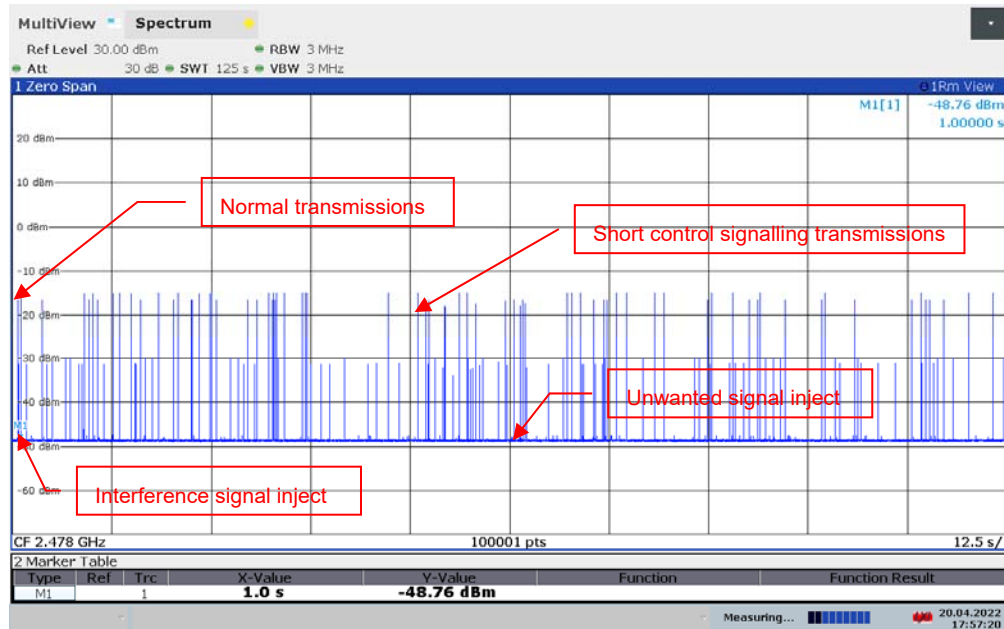
16:21:15 20.04.2022

## Mode B2 2404MHz



17:53:36 20.04.2022

## 2478MHz



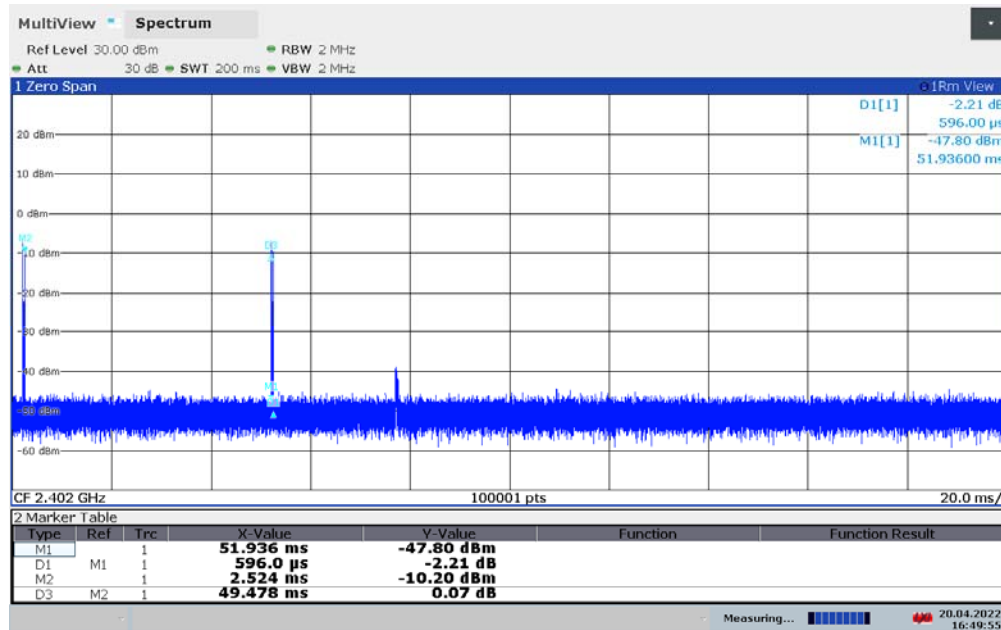
17:57:21 20.04.2022

### 4.3.7.2 The Channel Occupancy Time Result

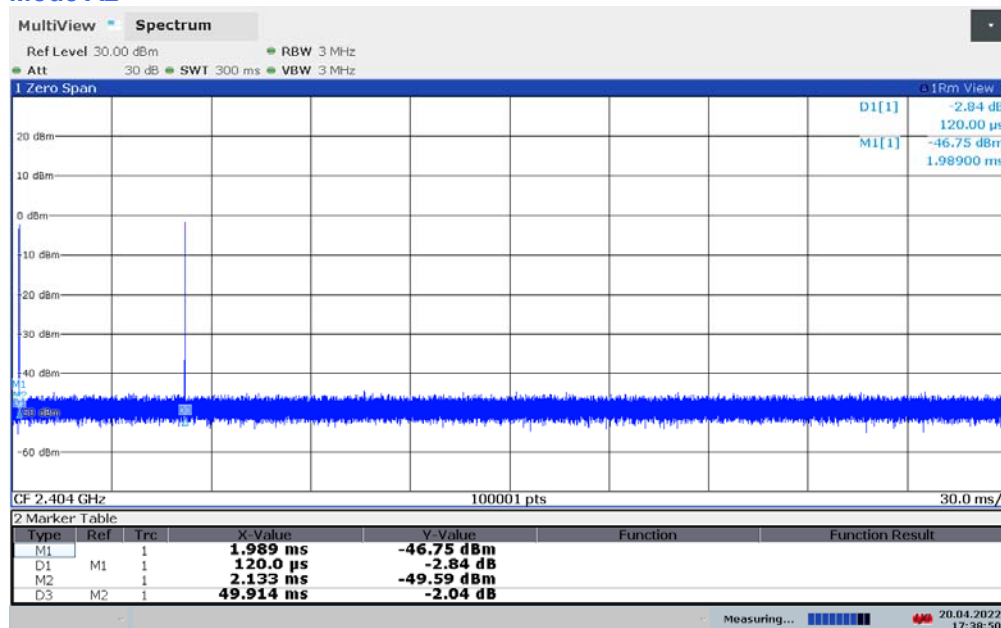
#### Operating Frequency Bands and Mode of EUT

Operational Mode	Operating Frequency Low power Channel (MHz)	The Channel Occupancy Time (ms)	Minimum Idle Period (us)	Test Result
A1: BT LE 1M	2402	0.596	49478	Pass
A2: BT LE 2M	2404	0.12	49914	Pass

#### Mode A1



#### Mode A2

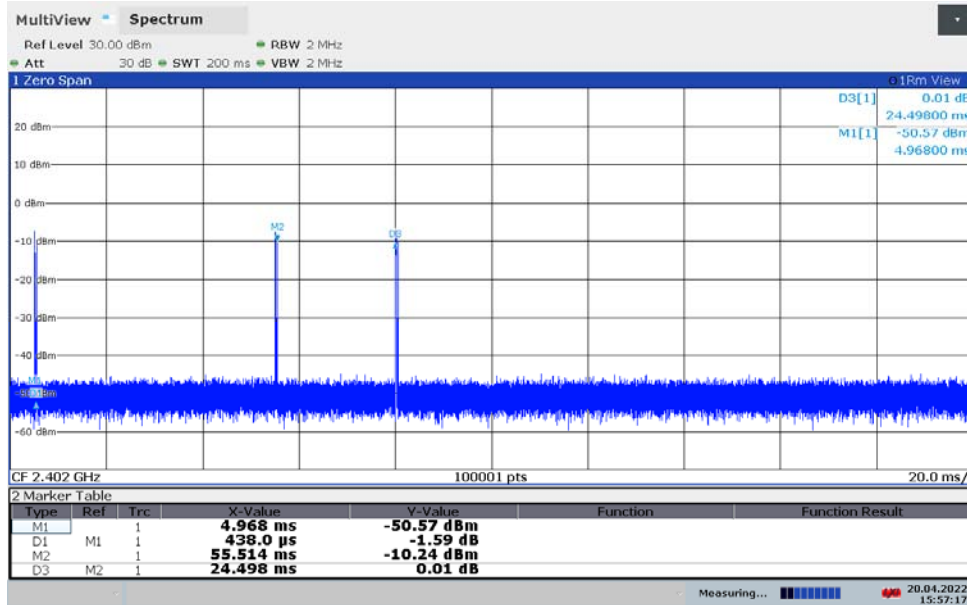


17:38:51 20.04.2022



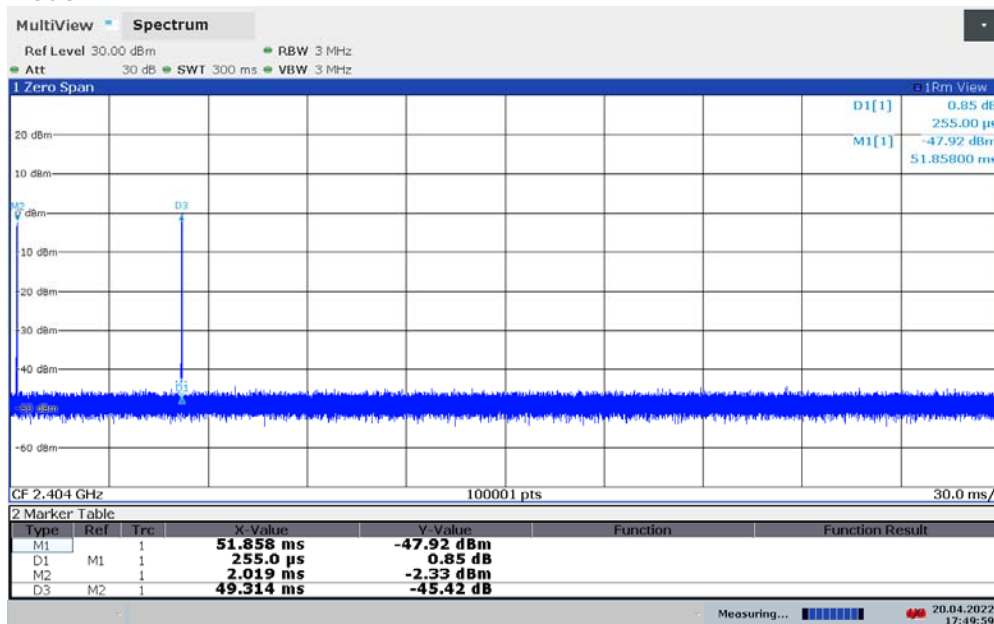
Operational Mode	Operating Frequency Low power Channel (MHz)	The Channel Occupancy Time (ms)	Minimum Idle Period (us)	Test Result
B1: BT LE 1M	2402	0.438	24498	Pass
B2: BT LE 2M	2404	0.255	49314	Pass

### Mode B1



15:57:17 20.04.2022

### Mode B2



17:50:00 20.04.2022

#### 4.3.7.3 Unwanted Signal Interference

##### Mode A1, B1

Channel	Channel Frequency (MHz)	Wanted Signal Mean Power from Companion Device (dBm/MHz)	Blocking Signal Frequency (MHz)	Blocking Signal Power (dBm)	Pass/Fail
0	2402	-50	2488.5	-35	Pass
39	2480	-50	2395.0	-35	Pass

##### Mode A2, B2

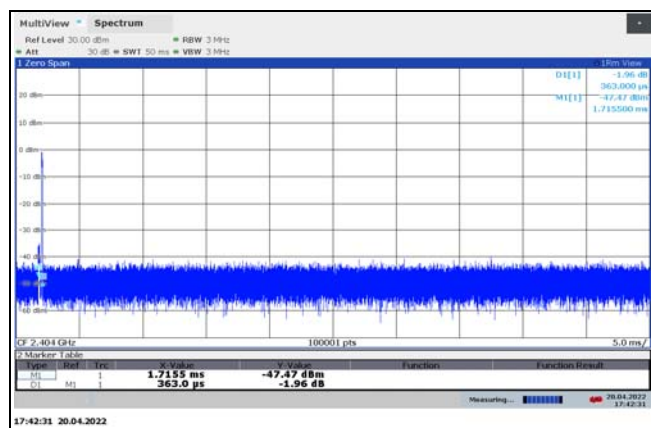
Channel	Channel Frequency (MHz)	Wanted Signal Mean Power from Companion Device (dBm/MHz)	Blocking Signal Frequency (MHz)	Blocking Signal Power (dBm)	Pass/Fail
1	2404	-50	2488.5	-35	Pass
38	2478	-50	2395.0	-35	Pass

#### 4.3.7.4 Short Control Signalling Transmissions Result

##### Mode A2

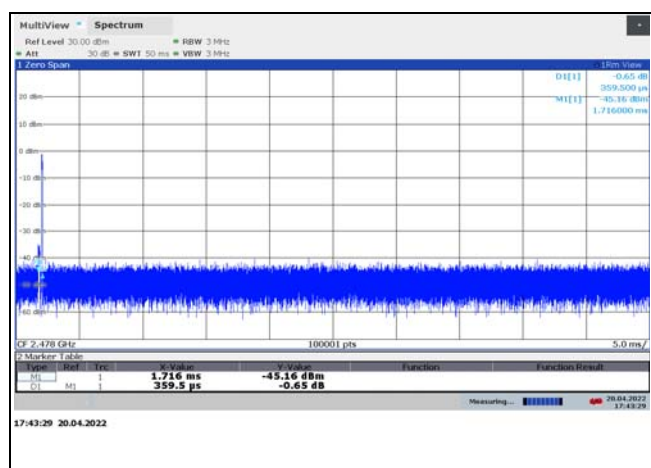
##### 2404MHz

Short Control Signalling Transmission Result		
SCST total on time (ms)	SCST Limit (ms)	Test Result
0.363	5	Pass



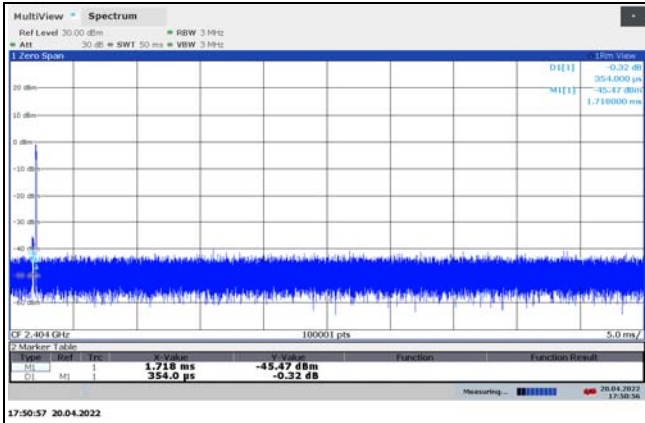
##### 2478MHz

Short Control Signalling Transmission Result		
SCST total on time (ms)	SCST Limit (ms)	Test Result
0.3595	5	Pass



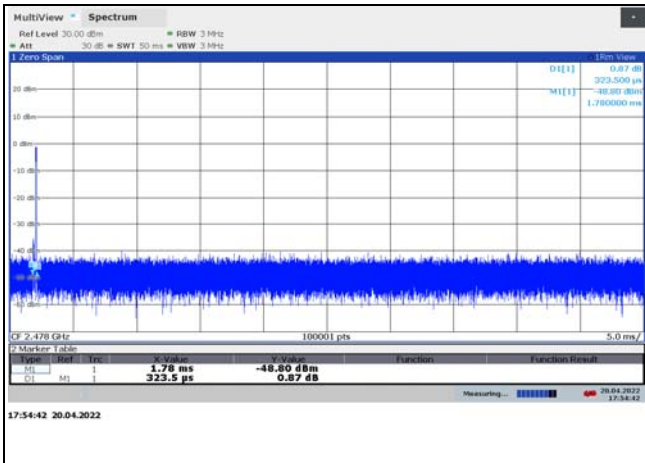
## 2404MHz

## Short Control Signalling Transmission Result



2478MHz

### Short Control Signalling Transmission Result



#### 4.4 Hopping Frequency Separation

##### 4.4.1 Limits of Hopping Frequency Separation

Condition	Limit
<input type="checkbox"/> Non-adaptive frequency hopping systems	The minimum Hopping Frequency Separation shall be equal to Occupied Channel Bandwidth of a single hop, with a minimum separation of 100 kHz.
<input checked="" type="checkbox"/> Adaptive frequency hopping systems	The minimum Hopping Frequency Separation shall be 100 kHz.

##### 4.4.2 Test Procedure

Refer to chapter 5.4.5 of 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

The measurement was performed at normal environmental conditions only. The measurement was performed on 2 adjacent hopping frequencies. 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. Controlling software (provided by manufacturer) has been activated to set the EUT on specific status.

## 4.4.5 Test Results

### Mode A1

Channel Number	Frequency (MHz)	Channel Separation (MHz)	Minimum Limit (MHz)	Pass /Fail
0	2402	2	0.1	Pass
39	2480	2	0.1	Pass

Note: The limitation is from OCB of a single hop and this value must greater and equal to 100kHz.



### Mode A2

Channel Number	Frequency (MHz)	Channel Separation (MHz)	Minimum Limit (MHz)	Pass /Fail
1	2404	2	0.1	Pass
38	2478	2	0.1	Pass

Note: The limitation is from OCB of a single hop and this value must greater and equal to 100kHz.



### Mode B1

Channel Number	Frequency (MHz)	Channel Separation (MHz)	Minimum Limit (MHz)	Pass /Fail
0	2402	2	0.1	Pass
39	2480	2	0.1	Pass

Note: The limitation is from OCB of a single hop and this value must greater and equal to 100kHz.



### Mode B2

Channel Number	Frequency (MHz)	Channel Separation (MHz)	Minimum Limit (MHz)	Pass /Fail
1	2404	2	0.1	Pass
38	2478	2	0.1	Pass

Note: The limitation is from OCB of a single hop and this value must greater and equal to 100kHz.



## 4.5 Power Spectral Density

### 4.5.1 Limit of Power Spectral Density

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

### 4.5.2 Test Procedures

Refer to chapter 5.4.3 of 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)	

### 4.5.3 Deviation of Test Standard

No deviation.

### 4.5.4 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.



#### 4.5.5 Test Results

##### Mode C1

Channel	Channel Frequency (MHz)	Power Density (dBm/1MHz) (EIRP)	Limit (dBm/1MHz) (EIRP)	Pass/Fail
0	2402	9.83	10	Pass
19	2440	9.75	10	Pass
39	2480	9.61	10	Pass

##### Mode C2

Channel	Channel Frequency (MHz)	Power Density (dBm/1MHz) (EIRP)	Limit (dBm/1MHz) (EIRP)	Pass/Fail
1	2404	8.87	10	Pass
19	2440	8.76	10	Pass
38	2478	8.64	10	Pass

## 4.6 Occupied Channel Bandwidth

### 4.6.1 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

### 4.6.2 Test Procedure

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

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

### 4.6.3 Deviation from Test Standard

No deviation.

### 4.6.4 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.

#### 4.6.5 Test Results

##### Mode A1

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	Measured Frequencies		Limit	Pass/Fail
			F <sub>L</sub> (MHz)	F <sub>H</sub> (MHz)		
0	2402	1.03	2401.49	2402.52	F <sub>L</sub> > 2400 MHz and F <sub>H</sub> < 2483.5 MHz	Pass
39	2480	1.03	2479.49	2480.52		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 A2

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	Measured Frequencies		Limit	Pass/Fail
			F <sub>L</sub> (MHz)	F <sub>H</sub> (MHz)		
1	2404	2.06	2402.98	2405.04	F <sub>L</sub> > 2400 MHz and F <sub>H</sub> < 2483.5 MHz	Pass
38	2478	2.06	2476.98	2479.04		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 B1

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	Measured Frequencies		Limit	Pass/Fail
			F <sub>L</sub> (MHz)	F <sub>H</sub> (MHz)		
0	2402	1.02	2401.50	2402.52	F <sub>L</sub> > 2400 MHz and F <sub>H</sub> < 2483.5 MHz	Pass
39	2480	1.02	2479.50	2480.52		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 B2

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	Measured Frequencies		Limit	Pass/Fail
			F <sub>L</sub> (MHz)	F <sub>H</sub> (MHz)		
1	2404	2.06	2402.99	2405.05	F <sub>L</sub> > 2400 MHz and F <sub>H</sub> < 2483.5 MHz	Pass
38	2478	2.06	2476.99	2479.05		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 C1

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	Measured Frequencies		Limit	Pass/Fail
			F <sub>L</sub> (MHz)	F <sub>H</sub> (MHz)		
0	2402	1.02	2401.50	2402.52	F <sub>L</sub> > 2400 MHz and F <sub>H</sub> < 2483.5 MHz	Pass
39	2480	1.02	2479.50	2480.52		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 C2

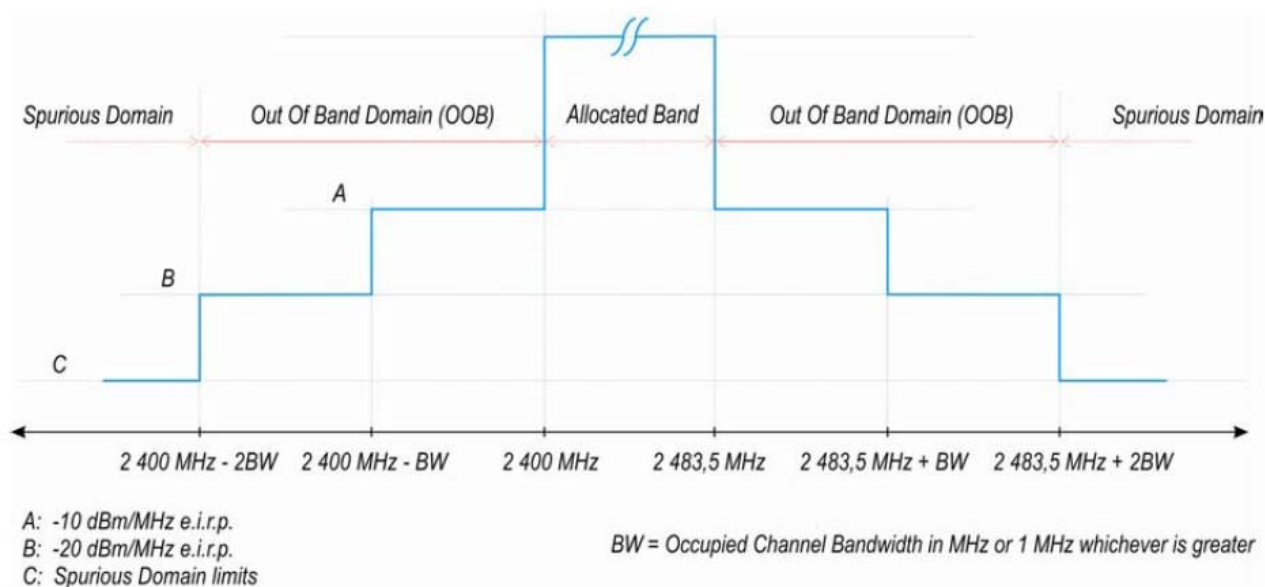
Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	Measured Frequencies		Limit	Pass/Fail
			F <sub>L</sub> (MHz)	F <sub>H</sub> (MHz)		
1	2404	2.08	2402.98	2405.06	F <sub>L</sub> > 2400 MHz and F <sub>H</sub> < 2483.5 MHz	Pass
38	2478	2.10	2476.97	2479.07		Pass

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.

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

### 4.7.1 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.



### 4.7.2 Test Procedure

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

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

### 4.7.3 Deviation from Test Standard

No deviation

### 4.7.4 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.

#### 4.7.5 Test Results

##### Mode A1

Channel	Frequency (MHz)	Out-Of-Band Domain			Limit (dBm/MHz)	Test Result
		Frequency Range (MHz)	Worst Frequency (MHz)	Emission Level (dBm/MHz)		
0	2402	2397.94 ~ 2398.97	2398.47	-32.43	-20	Pass
		2398.97 ~ 2400.00	2399.50	-17.24	-10	Pass
39	2480	2483.50 ~ 2484.53	2484.00	-33.38	-10	Pass
		2484.53 ~ 2485.56	2485.03	-36.83	-20	Pass

##### Mode A2

Channel	Frequency (MHz)	Out-Of-Band Domain			Limit (dBm/MHz)	Test Result
		Frequency Range (MHz)	Worst Frequency (MHz)	Emission Level (dBm/MHz)		
1	2404	2395.88 ~ 2397.94	2397.44	-38.60	-20	Pass
		2397.94 ~ 2400.00	2399.50	-32.41	-10	Pass
38	2478	2483.50 ~ 2485.56	2484.00	-36.06	-10	Pass
		2485.56 ~ 2487.62	2486.06	-40.40	-20	Pass

##### Mode B1

Channel	Frequency (MHz)	Out-Of-Band Domain			Limit (dBm/MHz)	Test Result
		Frequency Range (MHz)	Worst Frequency (MHz)	Emission Level (dBm/MHz)		
0	2402	2397.96 ~ 2398.98	2398.48	-42.69	-20	Pass
		2398.98 ~ 2400.00	2399.50	-35.41	-10	Pass
39	2480	2483.50 ~ 2484.52	2484.00	-42.99	-10	Pass
		2484.52 ~ 2485.54	2485.02	-47.46	-20	Pass

##### Mode B2

Channel	Frequency (MHz)	Out-Of-Band Domain			Limit (dBm/MHz)	Test Result
		Frequency Range (MHz)	Worst Frequency (MHz)	Emission Level (dBm/MHz)		
1	2404	2395.88 ~ 2397.94	2397.44	-48.81	-20	Pass
		2397.94 ~ 2400.00	2399.50	-41.74	-10	Pass
38	2478	2483.50 ~ 2485.56	2484.00	-46.65	-10	Pass
		2485.56 ~ 2487.62	2486.06	-49.88	-20	Pass

### Mode C1

Channel	Frequency (MHz)	Out-Of-Band Domain			Limit (dBm/MHz)	Test Result
		Frequency Range (MHz)	Worst Frequency (MHz)	Emission Level (dBm/MHz)		
0	2402	2397.96 ~ 2398.98	2398.50	-43.26	-20	Pass
		2398.98 ~ 2400.00	2399.50	-34.66	-10	Pass
39	2480	2483.50 ~ 2484.52	2484.00	-39.84	-10	Pass
		2484.52 ~ 2485.54	2485.00	-38.60	-20	Pass

### Mode C2

Channel	Frequency (MHz)	Out-Of-Band Domain			Limit (dBm/MHz)	Test Result
		Frequency Range (MHz)	Worst Frequency (MHz)	Emission Level (dBm/MHz)		
1	2404	2395.84 ~ 2397.92	2397.50	-47.67	-20	Pass
		2397.92 ~ 2400.00	2399.50	-36.81	-10	Pass
38	2478	2483.50 ~ 2485.60	2484.00	-43.66	-10	Pass
		2485.60 ~ 2487.70	2487.00	-44.11	-20	Pass

## 4.8 Transmitter Spurious Emissions in the spurious domain

### 4.8.1 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.

### 4.8.2 Test Procedure

Refer to chapter 5.4.9 of 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>	

### 4.8.3 Deviation from Test Standard

No deviation.

### 4.8.4 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.



#### 4.8.5 Test Results

##### Mode A1

##### Worst-case Data:

Frequency Range	30MHz ~ 1GHz	Operating Channel	0
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Spurious Emission Level				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
47.70	V	-64.32	-54.00	-10.32
48.38	H	-72.46	-54.00	-18.46
99.55	V	-69.34	-54.00	-15.34
99.65	H	-74.60	-54.00	-20.60
199.52	H	-70.44	-54.00	-16.44
199.52	V	-65.59	-54.00	-11.59
482.92	V	-66.30	-54.00	-12.30
520.02	H	-73.84	-54.00	-19.84
553.10	V	-72.34	-54.00	-18.34
595.30	H	-70.75	-54.00	-16.75
620.86	V	-68.21	-54.00	-14.21
660.05	H	-69.58	-54.00	-15.58

Frequency Range	1GHz ~ 12.75GHz	Operating Channel	0, 39
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Spurious Emission Level					
Channel	Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
0	4804.12	H	-56.01	-30.00	-26.01
	4804.52	V	-54.75	-30.00	-24.75
39	4960.39	V	-57.17	-30.00	-27.17
	4960.50	H	-55.70	-30.00	-25.70

## Mode A2

### Worst-case Data:

Frequency Range	30MHz ~ 1GHz	Operating Channel	1
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Spurious Emission Level				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
49.40	V	-64.93	-54.00	-10.93
53.09	H	-64.50	-54.00	-10.50
99.55	H	-73.48	-54.00	-19.48
99.55	V	-68.14	-54.00	-14.14
199.13	V	-68.01	-54.00	-14.01
199.18	H	-71.02	-54.00	-17.02
482.87	H	-72.16	-54.00	-18.16
484.86	V	-71.90	-54.00	-17.90
598.88	V	-71.05	-54.00	-17.05
600.05	H	-70.68	-54.00	-16.68
660.05	H	-71.42	-54.00	-17.42
667.37	V	-71.87	-54.00	-17.87

Frequency Range	1GHz ~ 12.75GHz	Operating Channel	1, 38
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Spurious Emission Level					
Channel	Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
1	4808.81	H	-59.10	-30.00	-29.10
	4808.83	V	-58.65	-30.00	-28.65
38	4956.05	V	-58.57	-30.00	-28.57
	4956.85	H	-57.11	-30.00	-27.11

## Mode B1

### Worst-case Data:

Frequency Range	30MHz ~ 1GHz	Operating Channel	0
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Spurious Emission Level				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
43.77	V	-71.82	-36.00	-35.82
52.99	H	-64.48	-54.00	-10.48
99.75	H	-70.35	-54.00	-16.35
103.97	V	-59.85	-54.00	-5.85
180.02	H	-71.46	-54.00	-17.46
180.02	V	-69.75	-54.00	-15.75
482.87	V	-69.66	-54.00	-15.66
540.00	H	-71.19	-54.00	-17.19
592.00	V	-72.21	-54.00	-18.21
594.08	H	-70.96	-54.00	-16.96
660.05	V	-68.84	-54.00	-14.84
662.47	H	-72.54	-54.00	-18.54

Frequency Range	1GHz ~ 12.75GHz	Operating Channel	0, 39
-----------------	-----------------	-------------------	-------

Spurious Emission Level					
Channel	Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
0	4804.31	H	-56.16	-30.00	-26.16
	4804.96	V	-56.52	-30.00	-26.52
39	4960.02	H	-55.92	-30.00	-25.92
	4960.72	V	-54.98	-30.00	-24.98

## Mode B2

### Worst-case Data:

Frequency Range	30MHz ~ 1GHz	Operating Channel	1
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Spurious Emission Level				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
58.91	V	-72.15	-54.00	-18.15
65.70	H	-71.68	-54.00	-17.68
85.29	H	-65.72	-36.00	-29.72
105.81	V	-62.98	-54.00	-8.98
180.02	H	-70.25	-54.00	-16.25
180.02	V	-70.89	-54.00	-16.89
482.92	H	-72.15	-54.00	-18.15
484.81	V	-70.38	-54.00	-16.38
540.00	H	-69.53	-54.00	-15.53
597.77	V	-72.25	-54.00	-18.25
620.91	H	-66.93	-54.00	-12.93
683.18	V	-71.49	-54.00	-17.49

Frequency Range	1GHz ~ 12.75GHz	Operating Channel	1, 38
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Spurious Emission Level					
Channel	Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
1	4808.86	V	-58.32	-30.00	-28.32
	4808.92	H	-56.61	-30.00	-26.61
38	4956.07	H	-59.32	-30.00	-29.32
	4956.11	V	-58.52	-30.00	-28.52

## Mode C1

### Worst-case Data:

Frequency Range	30MHz ~ 1GHz	Operating Channel	0
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Spurious Emission Level				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
49.59	V	-73.28	-54.00	-19.28
49.69	H	-72.89	-54.00	-18.89
87.09	V	-73.06	-36.00	-37.06
99.79	H	-72.15	-54.00	-18.15
180.02	V	-70.68	-54.00	-16.68
182.01	H	-78.92	-54.00	-24.92
515.07	V	-75.94	-54.00	-21.94
517.45	H	-75.25	-54.00	-21.25
588.41	V	-73.72	-54.00	-19.72
592.00	H	-72.57	-54.00	-18.57
670.96	H	-73.31	-54.00	-19.31
679.06	V	-72.37	-54.00	-18.37

Frequency Range	1GHz ~ 12.75GHz	Operating Channel	0, 39
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Spurious Emission Level					
Channel	Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
0	4804.41	H	-57.24	-30.00	-27.24
	4804.87	V	-58.27	-30.00	-28.27
39	4960.45	V	-59.99	-30.00	-29.99
	4960.62	H	-59.89	-30.00	-29.89

## Mode C2

### Worst-case Data:

Frequency Range	30MHz ~ 1GHz	Operating Channel	1
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Spurious Emission Level				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
48.62	H	-74.17	-54.00	-20.17
59.15	V	-65.72	-54.00	-11.72
91.26	V	-69.02	-54.00	-15.02
99.55	H	-75.57	-54.00	-21.57
180.02	V	-70.47	-54.00	-16.47
199.22	H	-77.39	-54.00	-23.39
486.89	H	-74.62	-54.00	-20.62
511.63	V	-75.18	-54.00	-21.18
588.70	H	-72.90	-54.00	-18.90
592.19	V	-73.75	-54.00	-19.75
666.16	H	-73.21	-54.00	-19.21
670.57	V	-73.03	-54.00	-19.03

Frequency Range	1GHz ~ 12.75GHz	Operating Channel	1, 38
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Spurious Emission Level					
Channel	Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
1	4808.60	V	-57.92	-30.00	-27.92
	4808.92	H	-57.66	-30.00	-27.66
38	4956.24	V	-60.32	-30.00	-30.32
	4956.28	H	-59.87	-30.00	-29.87

## 4.9 Receiver Spurious Emissions

### 4.9.1 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.

### 4.9.2 Test Procedure

Refer to chapter 5.4.10 of 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>	

### 4.9.3 Deviation from Test Standard

No deviation.

### 4.9.4 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.

#### 4.9.5 Test Results

##### Mode A1

##### Worst-case Data:

Frequency Range	30MHz ~ 1GHz	Operating Channel	0
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Spurious Emission Level				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
49.40	H	-70.57	-57.00	-13.57
50.61	V	-68.92	-57.00	-11.92
166.29	H	-67.74	-57.00	-10.74
166.29	V	-64.78	-57.00	-7.78
300.01	H	-66.37	-57.00	-9.37
332.56	V	-63.49	-57.00	-6.49
420.01	H	-68.76	-57.00	-11.76
486.12	V	-71.52	-57.00	-14.52
660.05	H	-70.41	-57.00	-13.41
668.05	V	-72.27	-57.00	-15.27
838.20	H	-68.17	-57.00	-11.17
841.20	V	-69.28	-57.00	-12.28

Frequency Range	1GHz ~ 12.75GHz	Operating Channel	0, 39
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Spurious Emission Level					
Channel	Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
0	4804.31	H	-59.78	-47.00	-12.78
	4804.58	V	-59.50	-47.00	-12.50
39	4960.01	H	-59.02	-47.00	-12.02
	4960.78	V	-58.78	-47.00	-11.78



## Mode A2

### Worst-case Data:

Frequency Range	30MHz ~ 1GHz	Operating Channel	1
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Spurious Emission Level				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
41.50	V	-70.08	-57.00	-13.08
50.03	H	-72.63	-57.00	-15.63
166.29	H	-73.12	-57.00	-16.12
166.29	V	-64.82	-57.00	-7.82
332.61	H	-69.18	-57.00	-12.18
346.24	V	-66.27	-57.00	-9.27
415.11	H	-72.72	-57.00	-15.72
482.92	V	-68.18	-57.00	-11.18
596.99	H	-71.92	-57.00	-14.92
623.28	V	-70.36	-57.00	-13.36
854.01	H	-70.45	-57.00	-13.45
857.50	V	-69.16	-57.00	-12.16

Frequency Range	1GHz ~ 12.75GHz	Operating Channel	1, 38
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Spurious Emission Level					
Channel	Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
1	4808.22	V	-58.75	-47.00	-11.75
	4808.52	H	-58.53	-47.00	-11.53
38	4956.56	V	-59.28	-47.00	-12.28
	4956.63	H	-59.46	-47.00	-12.46

## Mode B1

### Worst-case Data:

Frequency Range	30MHz ~ 1GHz	Operating Channel	0
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Spurious Emission Level				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
56.24	H	-71.01	-57.00	-14.01
59.97	V	-71.33	-57.00	-14.33
180.02	V	-69.14	-57.00	-12.14
232.35	H	-68.37	-57.00	-11.37
300.01	H	-65.89	-57.00	-8.89
332.56	V	-65.70	-57.00	-8.70
420.01	H	-66.58	-57.00	-9.58
484.76	V	-66.40	-57.00	-9.40
540.00	H	-69.44	-57.00	-12.44
620.86	V	-69.94	-57.00	-12.94
871.03	V	-69.15	-57.00	-12.15
890.14	H	-68.55	-57.00	-11.55

Frequency Range	1GHz ~ 12.75GHz	Operating Channel	0, 39
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Spurious Emission Level					
Channel	Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
0	4804.11	H	-58.11	-47.00	-11.11
	4804.58	V	-58.89	-47.00	-11.89
39	4960.77	V	-60.00	-47.00	-13.00
	4960.93	H	-59.74	-47.00	-12.74

## Mode B2

### Worst-case Data:

Frequency Range	30MHz ~ 1GHz	Operating Channel	1
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Spurious Emission Level				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
58.76	H	-65.78	-57.00	-8.78
59.34	V	-71.23	-57.00	-14.23
180.02	V	-67.91	-57.00	-10.91
232.40	H	-67.64	-57.00	-10.64
332.61	V	-65.08	-57.00	-8.08
344.97	H	-65.12	-57.00	-8.12
483.79	H	-73.03	-57.00	-16.03
484.86	V	-64.33	-57.00	-7.33
602.28	H	-73.04	-57.00	-16.04
623.48	V	-68.60	-57.00	-11.60
842.56	V	-69.47	-57.00	-12.47
859.54	H	-69.39	-57.00	-12.39

Frequency Range	1GHz ~ 12.75GHz	Operating Channel	1, 38
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Spurious Emission Level					
Channel	Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
1	4808.12	V	-59.53	-47.00	-12.53
	4808.46	H	-59.16	-47.00	-12.16
38	4956.24	V	-59.55	-47.00	-12.55
	4956.38	H	-60.16	-47.00	-13.16

## Mode C1

### Worst-case Data:

Frequency Range	30MHz ~ 1GHz	Operating Channel	0
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Spurious Emission Level				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
47.36	V	-66.73	-57.00	-9.73
99.75	H	-73.40	-57.00	-16.40
166.00	H	-75.55	-57.00	-18.55
180.02	V	-70.40	-57.00	-13.40
232.79	H	-69.50	-57.00	-12.50
332.51	H	-68.14	-57.00	-11.14
345.12	V	-68.29	-57.00	-11.29
569.93	V	-74.28	-57.00	-17.28
596.85	H	-73.31	-57.00	-16.31
679.06	V	-72.02	-57.00	-15.02
831.55	V	-70.00	-57.00	-13.00
857.55	H	-70.46	-57.00	-13.46

Frequency Range	1GHz ~ 12.75GHz	Operating Channel	0, 39
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Spurious Emission Level					
Channel	Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
0	4804.82	H	-58.93	-47.00	-11.93
	4804.96	V	-59.17	-47.00	-12.17
39	4960.31	V	-60.38	-47.00	-13.38
	4960.32	H	-59.83	-47.00	-12.83

## Mode C2

### Worst-case Data:

Frequency Range	30MHz ~ 1GHz	Operating Channel	1
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Spurious Emission Level				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
46.88	V	-68.51	-57.00	-11.51
48.58	H	-76.00	-57.00	-19.00
180.02	V	-70.57	-57.00	-13.57
232.79	H	-70.29	-57.00	-13.29
331.93	V	-67.91	-57.00	-10.91
332.46	H	-70.58	-57.00	-13.58
379.85	V	-72.99	-57.00	-15.99
473.22	H	-73.41	-57.00	-16.41
594.76	V	-73.06	-57.00	-16.06
621.34	H	-70.99	-57.00	-13.99
851.68	V	-70.78	-57.00	-13.78
879.47	H	-70.67	-57.00	-13.67

Frequency Range	1GHz ~ 12.75GHz	Operating Channel	1, 38
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Spurious Emission Level					
Channel	Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
1	4808.55	H	-58.75	-47.00	-11.75
	4808.93	V	-59.11	-47.00	-12.11
38	4956.35	H	-60.25	-47.00	-13.25
	4956.73	V	-60.62	-47.00	-13.62

#### 4.10 Receiver Blocking

##### 4.10.1 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 + $10 \times \log_{10}(\text{OCBW})$ ) or -68 dBm whichever is less (see note 2)	2 380 2 504	-34	CW
(-139 dBm + $10 \times \log_{10}(\text{OCBW})$ ) or -74 dBm whichever is less (see note 3)	2 300 2 330 2 360 2 524 2 584 2 674		

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  $P_{\min} + 26$  dB where  $P_{\min}$  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: 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  $P_{\min} + 20$  dB where  $P_{\min}$  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 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.

#### 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  $P_{\min} + 26 \text{ dB}$  where  $P_{\min}$  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  $P_{\min} + 26 \text{ dB}$  where  $P_{\min}$  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.

#### 4.10.2 Test Procedure

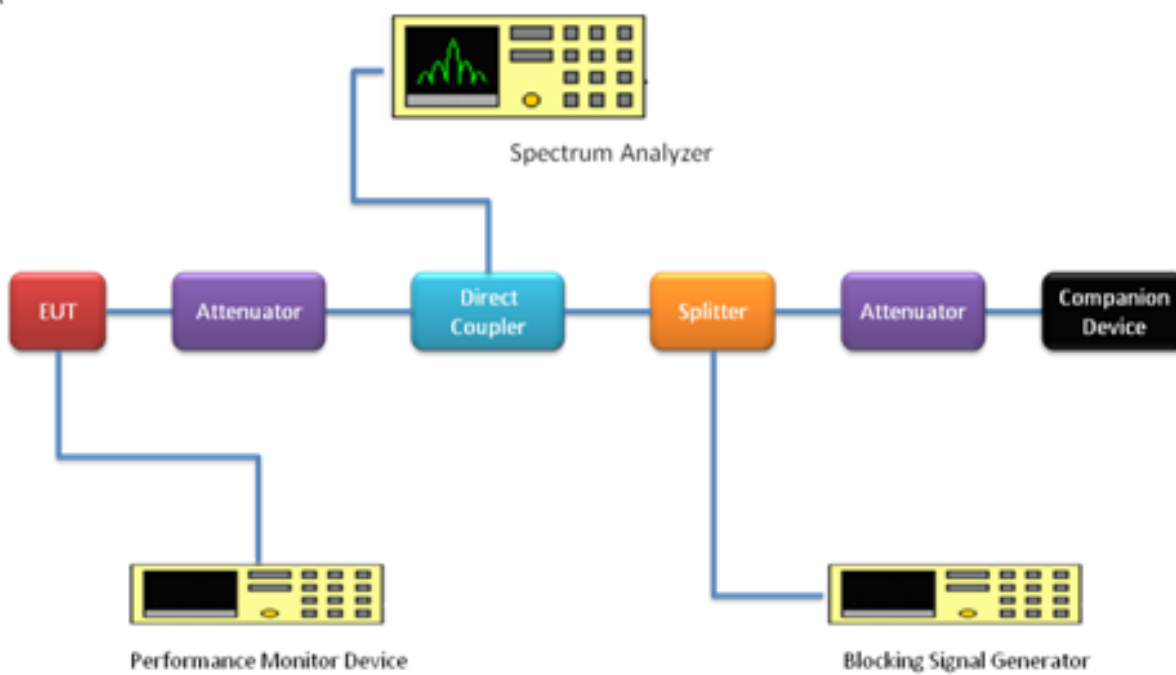
Refer to chapter 5.4.11 of EN 300 328 V2.2.2.

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

#### 4.10.3 Deviation from Test Standard

No deviation.

#### 4.10.4 Test Setup Configuration





#### 4.10.5 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 A1

Receiver blocking performance when operating at the lowest and highest channels							
CH 0	OCBW	1.03 MHz	Antenna Gain:	1.82 dBi	Blocking signal Power	<input checked="" type="checkbox"/> at the antenna connector	
CH 39	OCBW	1.03 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
BT LE 1M	0	-71.05	2380	-	-32.18	0.7	Pass
		-77.05	2300	-	-32.18	1.6	Pass
			2330	-	-32.18	1.4	Pass
			2360	-	-32.18	2.1	Pass
	39	-71.05	2504	-	-32.18	0.3	Pass
		-77.05	2524	-	-32.18	0.8	Pass
			2584	-	-32.18	2.3	Pass
			2674	-	-32.18	1.6	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 B1

Receiver blocking performance when operating at the lowest and highest channels							
CH 0 OCBW	1.03 MHz	Antenna Gain:	1.82 dBi	Blocking signal Power	<input checked="" type="checkbox"/> at the antenna connector		
CH 39 OCBW	1.03 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
BT LE 1M	0	-71.05	2380	-	-32.18	0.7	Pass
		-77.05	2300	-	-32.18	1.6	Pass
			2330	-	-32.18	1.4	Pass
			2360	-	-32.18	2.1	Pass
	39	-71.05	2504	-	-32.18	0.3	Pass
		-77.05	2524	-	-32.18	0.8	Pass
			2584	-	-32.18	2.3	Pass
			2674	-	-32.18	1.6	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.

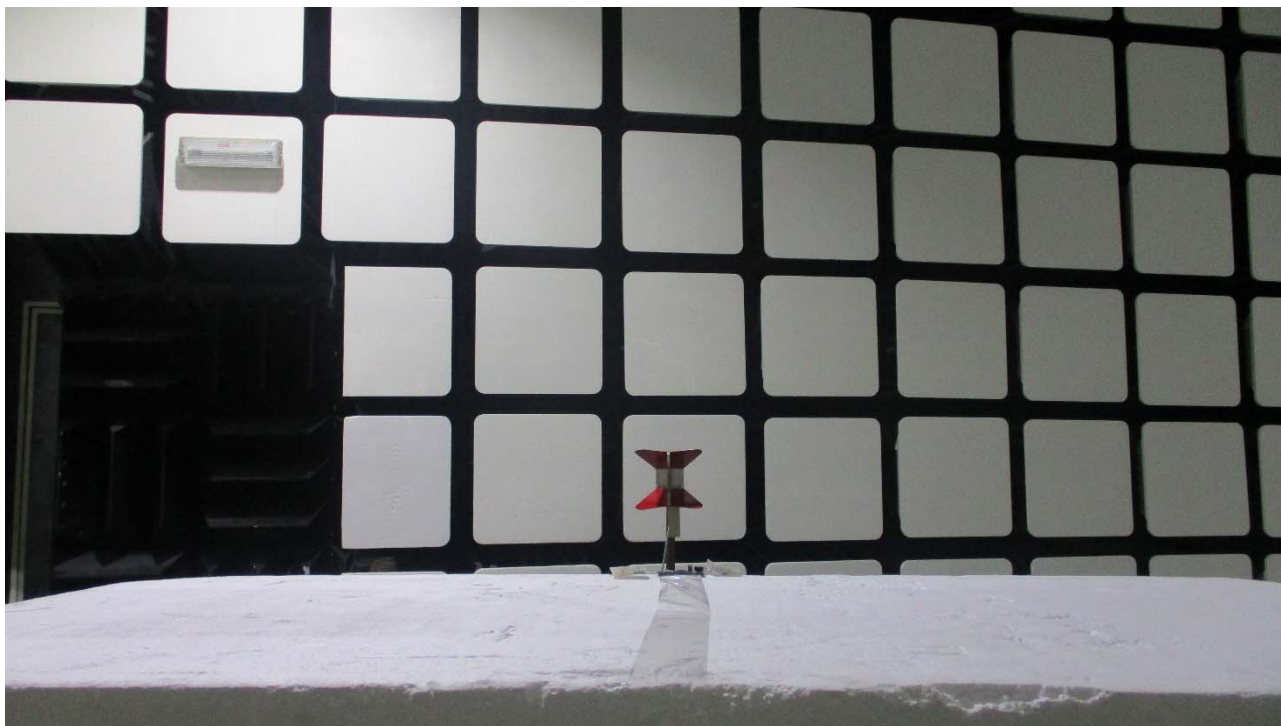
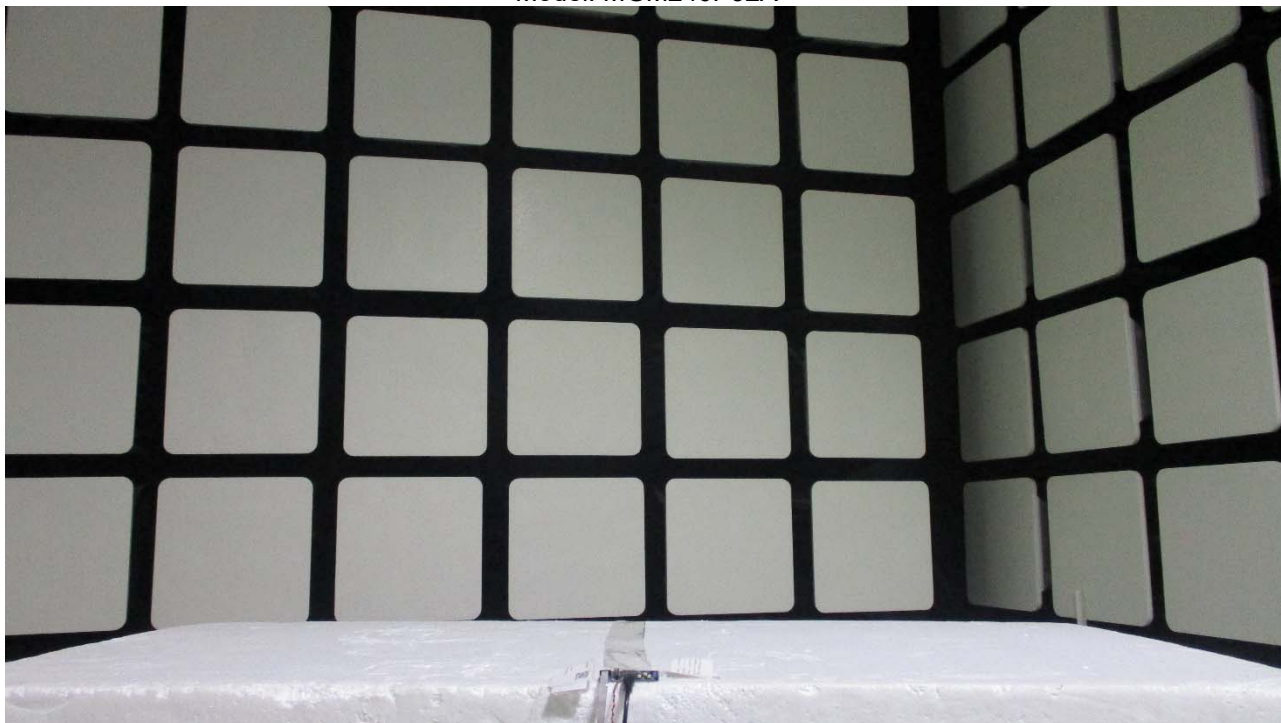
Receiver Category		
<input type="checkbox"/> Category 1	<input checked="" type="checkbox"/> Category 2	<input type="checkbox"/> Category 3
Minimum performance criterion	<input checked="" type="checkbox"/> PER $\leq$ 10%	
	<input type="checkbox"/> Alternative performance criteria (See note)	
Note: The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

#### Mode C1

Receiver blocking performance when operating at the lowest and highest channels							
CH 0	OCBW	1.02 MHz	Antenna Gain:	1.82 dBi	Blocking signal Power	<input checked="" type="checkbox"/> at the antenna connector	
CH 39	OCBW	1.02 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
BT LE 1M	0	-67.09	2380	-	-32.18	1.2	Pass
		-67.09	2300	-	-32.18	0.6	Pass
	39	-67.09	2504	-	-32.18	0.5	Pass
		-67.09	2584	-	-32.18	1.3	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

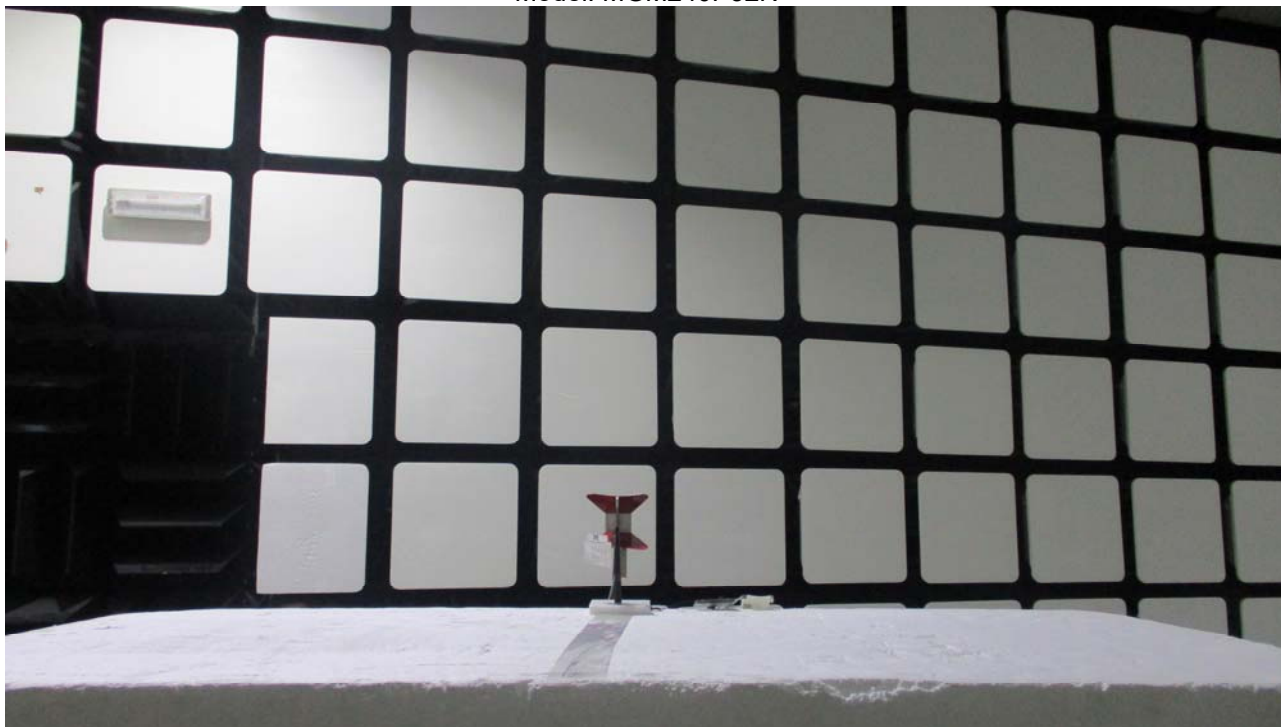
TX / RX Spurious Emission Test  
Model: MGM240P32A

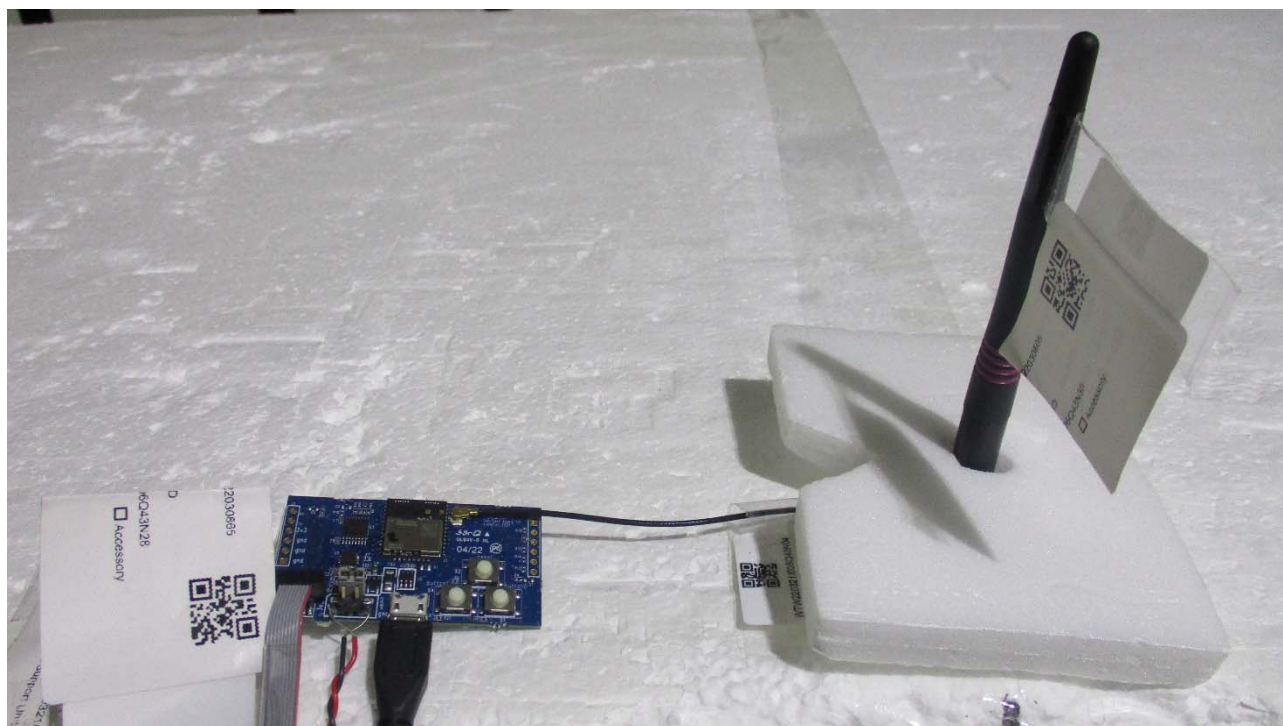




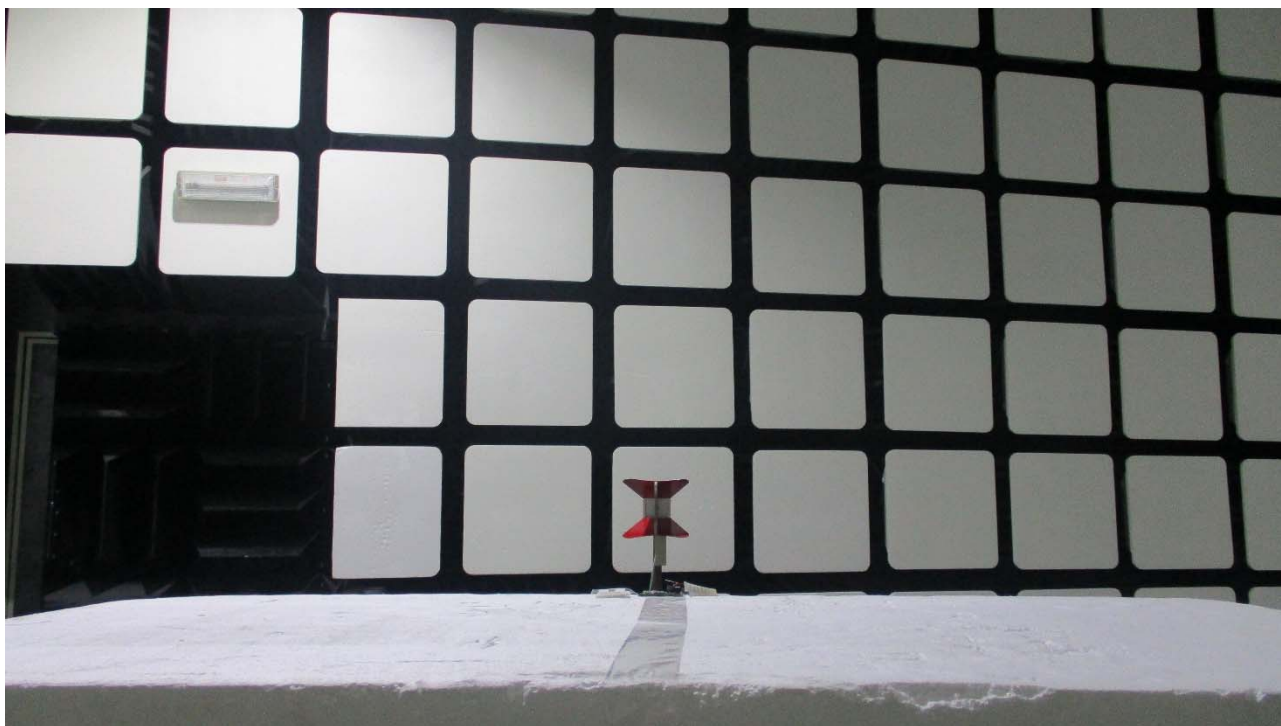
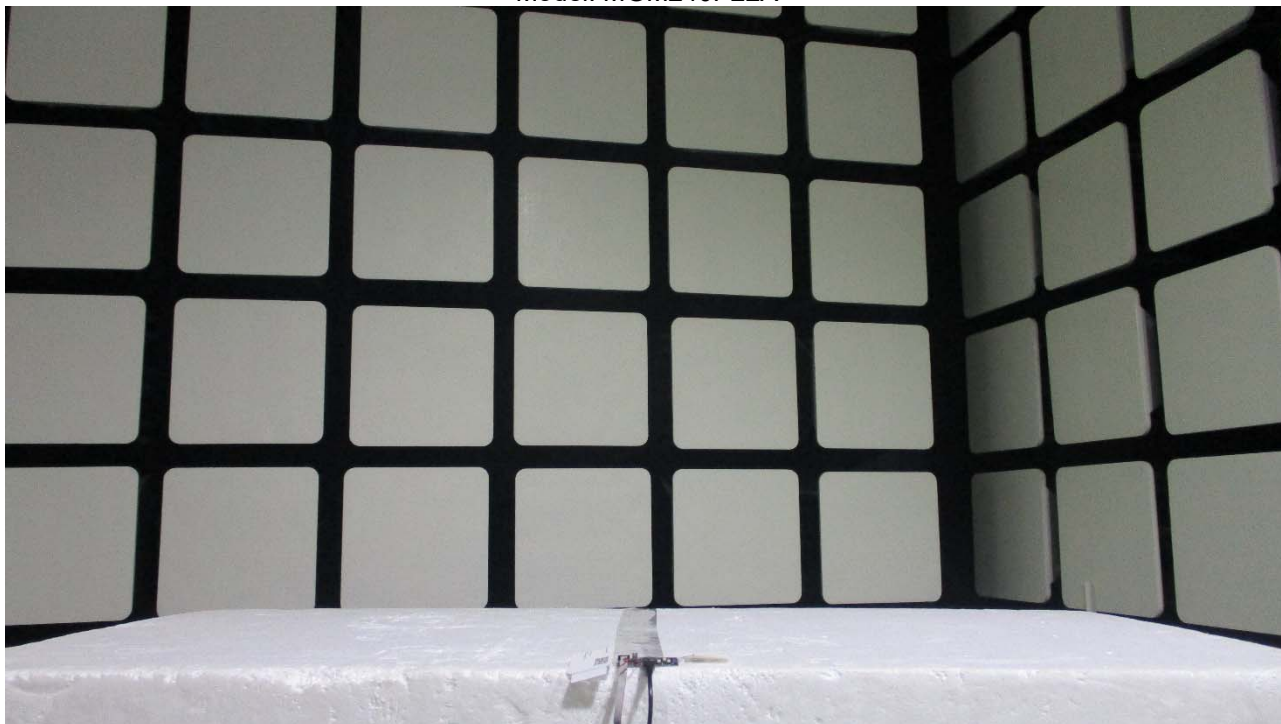


TX / RX Spurious Emission Test  
Model: MGM240P32N





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.

If you have any comments, please feel free to contact us at the following:

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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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