



**EN 300 328 V2.2.2  
AS/NZS 4268:2017 A1**

**TEST REPORT**

*For*

**WiFi Module**

**MODEL NUMBER: VS19250**

**REPORT NUMBER: 4790425813-1**

**ISSUE DATE: June 1, 2022**

*Prepared for*

**ViewSonic Corporation  
10 Pointe Dr., Suite 200, Brea, CA 92821, USA**

*Prepared by*

**UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch**

**Building 10, Innovation Technology Park, No. 1, Li Bin Road, Song Shan Lake Hi-Tech Development Zone Dongguan, 523808, People's Republic of China**

**Tel: +86 769 22038881**

**Fax: +86 769 33244054**

**Website: [www.ul.com](http://www.ul.com)**



Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
V0	06/01/2022	Initial Issue	

Note: This is a copy report base on 4790081439-9 which is issued by UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch on November 11, 2021. The customer wants to add a new applicant and change the model name but everything about the EUT remain unchanged, so we update the test report without any test. For other data, please refer to the original report.



Summary of Test Results			
Clause	Test Item	Limit/ Requirements	Results
<b>TRANSMITTER PARAMETERS</b>			
4.3.2.2	RF Output Power	20 dBm	Pass
4.3.2.3	Power Spectral Density	10 dBm/MHz	Pass
4.3.2.4	Duty cycle, Tx-Sequence, Tx-Gap	The Duty Cycle $\leq$ the maximum value declared by the manufacturer. Tx-Sequence $\leq$ 10 ms Tx-gap $\leq$ 3.5 ms	N/A (Note 2)
4.3.2.5	Medium Utilization (MU) factor	Less than 10 %	N/A (Note 2)
4.3.2.6	Adaptivity	Refer to ETSI EN 300 328 V2.2.2 Clause 4.3.2.6.2.2 & 4.3.2.6.2.3 & 4.3.2.6.2.4	N/A (Note 1)
4.3.2.7	Occupied Channel Bandwidth	Within the band given in table 1	Pass
4.3.2.8	Transmitter unwanted emission in the OOB domain	Refer to ETSI EN 300 328 V2.2.2 Figure 3	Pass
4.3.2.9	Transmitter unwanted emissions in the spurious domain	Refer to ETSI EN 300 328 V2.2.2 Table 12	Pass
<b>RECEIVER PARAMETERS</b>			
4.3.2.10	Receiver Spurious Emissions	Refer to ETSI EN 300 328 V2.2.2 Table 13	Pass
4.3.2.11	Receiver Blocking	Refer to ETSI EN 300 328 V2.2.2 Clause 4.3.2.11.4	Pass
4.3.2.12	Geo-location capability	Refer to ETSI EN 300 328 V2.2.2 Clause 4.3.2.12.3	Not Support
<p>Note:</p> <ol style="list-style-type: none"> <li>1. N/A means not applicable.</li> <li>2. These requirements do not apply for equipment with a 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.</li> <li>3. This requirement does not apply to adaptive non-FHSS equipment unless operating in a non-adaptive mode.</li> <li>4. This test report is only published to and used by the applicant, and it is not for evidence purpose in China.</li> <li>5. The measurement result for the sample received is &lt;Pass&gt; according to &lt; EN 300 328 V2.2.2 and AS/NZS 4268:2017 A1 &gt; when &lt;Accuracy Method&gt; decision rule is applied.</li> </ol>			

## TABLE OF CONTENTS

<b>1. ATTESTATION OF TEST RESULTS .....</b>	<b>6</b>
<b>2. TEST METHODOLOGY .....</b>	<b>7</b>
<b>3. FACILITIES AND ACCREDITATION .....</b>	<b>7</b>
<b>4. CALIBRATION AND UNCERTAINTY .....</b>	<b>8</b>
4.1. <i>MEASURING INSTRUMENT CALIBRATION .....</i>	<i>8</i>
4.2. <i>MEASUREMENT UNCERTAINTY.....</i>	<i>8</i>
<b>5. EQUIPMENT UNDER TEST .....</b>	<b>9</b>
5.1. <i>DESCRIPTION OF EUT .....</i>	<i>9</i>
5.2. <i>RECEIVER CATEGORY .....</i>	<i>9</i>
5.3. <i>CHANNEL LIST.....</i>	<i>10</i>
5.4. <i>MAXIMUM AVERAGE EIRP.....</i>	<i>10</i>
5.5. <i>TEST CHANNEL CONFIGURATION.....</i>	<i>10</i>
5.6. <i>THE WORSE CASE POWER SETTING PARAMETER.....</i>	<i>10</i>
5.7. <i>DESCRIPTION OF AVAILABLE ANTENNAS .....</i>	<i>11</i>
5.8. <i>DESCRIPTION OF TEST SETUP.....</i>	<i>12</i>
5.9. <i>TEST SYSTEM CONFIGURATION .....</i>	<i>13</i>
5.10. <i>DESCRIPTION OF THE EQUIPMENT UNDER TESTED.....</i>	<i>14</i>
<b>6. MEASURING INSTRUMENT AND SOFTWARE USED .....</b>	<b>16</b>
<b>7. TEST PROCEDURES AND RESULTS .....</b>	<b>17</b>
7.1. <i>NORMAL AND EXTREME CONDITIONS.....</i>	<i>17</i>
7.2. <i>OCCUPIED CHANNEL BANDWIDTH .....</i>	<i>18</i>
7.3. <i>RF OUTPUT POWER.....</i>	<i>19</i>
7.4. <i>POWER SPECTRAL DENSITY.....</i>	<i>21</i>
7.5. <i>TRANSMITTER UNWANTED EMISSIONS IN THE OUT-OF-BAND DOMAIN .....</i>	<i>22</i>
7.6. <i>TRANSMITTER UNWANTED EMISSIONS IN THE SPURIOUS DOMAIN .....</i>	<i>24</i>
7.7. <i>RECEIVER SPURIOUS EMISSIONS .....</i>	<i>27</i>
7.8. <i>RECEIVER BLOCKING .....</i>	<i>30</i>
<b>8. GEO-LOCATION CAPABILITY .....</b>	<b>34</b>
<b>9. Appendix .....</b>	<b>35</b>
9.1. <i>Appendix A: RF Output Power .....</i>	<i>35</i>
9.1.1. <i>Test Result .....</i>	<i>35</i>



---

9.2.	<i>Appendix B: Power Spectral Density</i> .....	36
9.2.1.	Test Result .....	36
9.2.2.	Test Graphs .....	37
9.3.	<i>Appendix C: Occupied Channel Bandwidth</i> .....	39
9.3.1.	Test Result .....	39
9.3.2.	Test Graphs .....	40
9.4.	<i>Appendix D: Transmitter Unwanted Emissions In The Out-Of-Band Domain</i> .....	42
9.4.1.	Test Result .....	42
9.4.2.	Test Graphs .....	43
9.5.	<i>Appendix E: Transmitter Unwanted Emissions In The Spurious Domain</i> .....	46
9.5.1.	Conducted Test Result-Pre-scan .....	46
9.5.2.	Conducted Test Graphs-Pre-scan.....	46
9.5.3.	Radiated Test Result .....	48
9.6.	<i>Appendix F: Receiver Spurious Emissions</i> .....	54
9.6.1.	Conducted Test Result-Pre-scan .....	54
9.6.2.	Conducted Test Graphs-Pre-scan.....	54
9.6.3.	Radiated Test Result .....	56
9.7.	<i>Appendix G: Receiver Blocking</i> .....	58
9.7.1.	Test Result .....	58
	<i>RADIATED SPURIOUS EMISSIONS TEST PHOTOS</i> .....	59



# 1. ATTESTATION OF TEST RESULTS

## Applicant Information

Company Name: ViewSonic Corporation  
Address: 10 Pointe Dr., Suite 200, Brea, CA 92821, USA

## Manufacturer Information

Company Name: ViewSonic Corporation  
Address: 10 Pointe Dr., Suite 200, Brea, CA 92821, USA

## EUT Information

EUT Name: WiFi Module  
Model: VS19250  
Sample Received Date: August 31, 2021  
Sample Status: Normal  
Sample ID: 4175726  
Date of Tested: September 6, 2021 ~ September 24, 2021

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
ETSI EN 300 328 V2.2.2 (2019-07)	PASS
AS/NZS 4268:2017 A1	PASS

Prepared By:

Denny Huang  
Project Engineer

Checked By:

Shawn Wen  
Laboratory Leader

Approved By:

Stephen Guo  
Laboratory Manager



## 2. TEST METHODOLOGY

All tests were performed in accordance with the procedures documented in ETSI EN 300 328 V2.2.2 (2019-07) and AS/NZS 4268:2017 A1.

## 3. FACILITIES AND ACCREDITATION

<p>Accreditation Certificate</p>	<p><b>A2LA (Certificate No.: 4102.01)</b>          UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been assessed and proved to be in compliance with A2LA.</p> <p><b>FCC (FCC Designation No.: CN1187)</b>          UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. Has been recognized to perform compliance testing on equipment subject to the Commission's Declaration of Conformity (DoC) and Certification rules</p> <p><b>ISED (Company No.: 21320)</b>          UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been registered and fully described in a report filed with Industry Canada. The Company Number is 21320.</p> <p><b>VCCI (Registration No.: G-20019, R-20004, C-20012 and T-20011)</b>          UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been assessed and proved to be in compliance with VCCI, the Membership No. is 3793.          Facility Name:          Chamber D, the VCCI registration No. is G-20019 and R-20004          Shielding Room B, the VCCI registration No. is C-20012 and T-20011</p>
----------------------------------	---

Note: All tests measurement facilities use to collect the measurement data are located at Building 10, Innovation Technology Park, Song Shan Lake Hi tech Development Zone, Dongguan, 523808, China

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations and is traceable to recognized national standards.

### 4.2. MEASUREMENT UNCERTAINTY

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

Test Case	Description	Limit	Uncertainties
5.3.2.2.1.1	RF Output Power	±1.5 dB	1.15
5.3.2.2.1.2	Duty Cycle	±5 %	0.03
	Tx Sequence	±5 %	0.03
	Tx Gap	±5 %	0.03
5.3.2.2.1.3	Medium Utilisation	±5 %	0.10
5.3.3.2.1	Power Spectral Density	±3 dB	1.21
5.3.4.2.1	Accumulated Dwell Time	±5 %	0.05
	Minimum Frequency Occupation Time	±5 %	0.15
5.3.5.2.1	Hopping Frequency Separation	-	0.24
5.3.8.2.1	Occupied Channel Bandwidth	±5 %	1.71
5.3.9..2.1	Out-of-band emissions	±3 dB	1.39
5.3.10.2.1	Transmitter unwanted emissions in the spurious domain		
	30 MHz to 1 GHz	±3 dB	0.64
	1 GHz to 12.75GHz	±3 dB	1.68
5.3.11.2.1	Receiver Spurious emission		
	30 MHz to 1 GHz	±3 dB	0.64
	1 GHz to 12.75GHz	±3 dB	1.68

Test Item	Uncertainty
Uncertainty for Radiation Emission test	4.62 dB (30 MHz-1 GHz)
	3.50 dB (1 GHz-18 GHz)
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level using a coverage factor of k=2.	



## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

EUT Name	WiFi Module	
Model	VS19250	
Technology	Bluetooth - Low Energy	
Transmit Frequency Range	2402 MHz ~ 2480 MHz	
Modulation	GFSK	
Data Rate	LE 1M	1 Mbps
	LE 2M	2 Mbps
Ratings	DC 5 V	
Wireless Module	AIC8800D	

### 5.2. RECEIVER CATEGORY

EUT belong to	Receiver category	Relevant receiver clauses
<input type="checkbox"/>	1	Adaptive equipment with a maximum RF output power greater than 10 dBm e.i.r.p.
<input checked="" type="checkbox"/>	2	Non-adaptive equipment with a Medium Utilization (MU) factor greater than 1 % and less than or equal to 10 % or adaptive equipment with a maximum RF output power of 10 dBm e.i.r.p.
<input type="checkbox"/>	3	Non-adaptive equipment with a maximum Medium Utilization (MU) factor of 1 % or adaptive equipment with a maximum RF output power of 0 dBm e.i.r.p.

**5.3. CHANNEL LIST**

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

**5.4. MAXIMUM AVERAGE EIRP**

Test Mode	Frequency (MHz)	Channel Number	Max AVG EIRP (dBm)
LE 1M	2402 ~ 2480	0-39[40]	7.28
LE 2M	2402 ~ 2480	0-39[40]	7.29

**5.5. TEST CHANNEL CONFIGURATION**

Test Mode	Test Channel	Frequency
LE 1M	CH 0(Low Channel), CH 19(MID Channel), CH 39(High Channel)	2402 MHz, 2440 MHz, 2480 MHz
LE 2M	CH 0(Low Channel), CH 19(MID Channel), CH 39(High Channel)	2402 MHz, 2440 MHz, 2480 MHz

**5.6. THE WORSE CASE POWER SETTING PARAMETER**

The Worse Case Power Setting Parameter under 2400 ~ 2483.5MHz Band				
Test Software		SecureCRT		
Test Mode	Transmit Antenna Number	Test Channel		
		CH 0	CH 19	CH 39
LE 1M	1	Default	Default	Default
LE 2M	1	Default	Default	Default



### 5.7. DESCRIPTION OF AVAILABLE ANTENNAS

Antenna	Frequency (MHz)	Antenna Type	MAX Antenna Gain (dBi)
1	2402 ~ 2480	PCB	3.15

Test Mode	Transmit and Receive Mode	Description
LE 1M	<input checked="" type="checkbox"/> 1TX, 1RX	Antenna 1 can be used as transmitting/receiving antenna.
LE 2M	<input checked="" type="checkbox"/> 1TX, 1RX	Antenna 1 can be used as transmitting/receiving antenna.

Note: The value of the antenna gain was declared by customer.

## 5.8. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

Item	Equipment	Brand Name	Model Name	Remarks
1	Laptop	Lenovo	XIAOXIN 5000	/
2	Main Board	/	/	/
3	Serial to USB Board	/	/	/
3	AC Power Adapter	/	/	

### I/O CABLES

Cable No	Port	Connector Type	Cable Type	Cable Length(m)	Remarks
1	USB	/	Unshielded	1.0	/

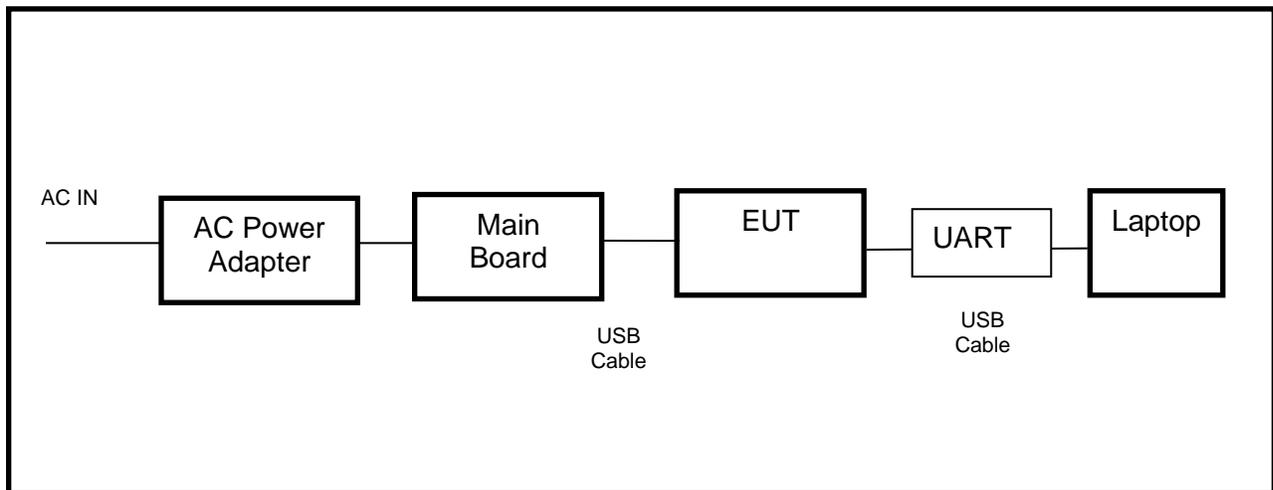
### ACCESSORIES

Item	Accessory	Brand Name	Model Name	Description
/	/	/	/	/

### TEST SETUP

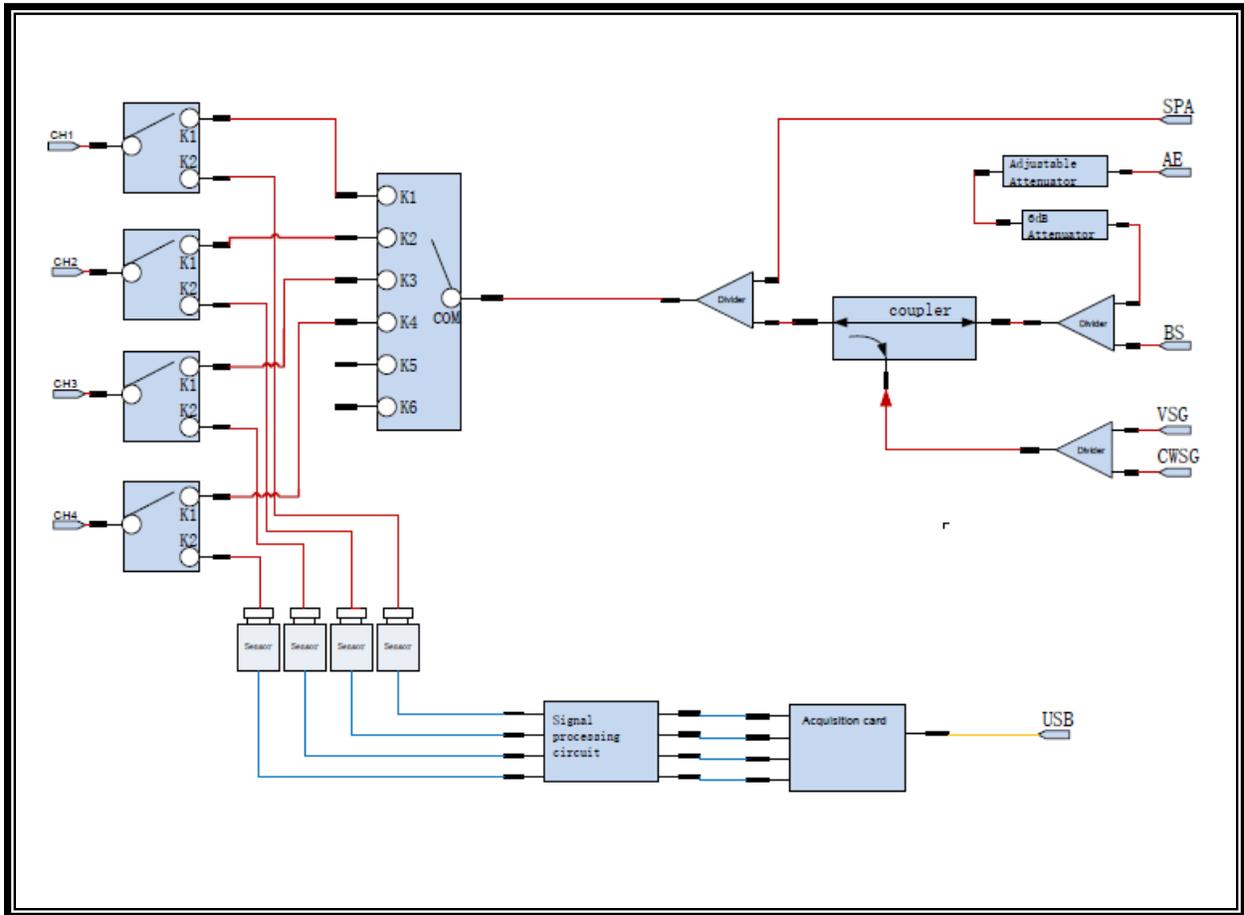
The EUT can work in engineering mode with a software through a Laptop.

### SETUP DIAGRAM FOR TESTS



### 5.9. TEST SYSTEM CONFIGURATION

Tonsend SRD Test System



### 5.10. DESCRIPTION OF THE EQUIPMENT UNDER TESTED

(INFORMATION AS REQUIRED BY EN 300 328 V2.2.2, CLAUSE 5.4.1)

<b>a)</b>	<b>Modulation Type</b>		
	<input type="checkbox"/> FHSS		
	<input checked="" type="checkbox"/> non-FHSS		
<b>b)</b>	FHSS Equipment Description		
	The Number of Hopping Frequencies	The Maximum	/
		The Minimum	/
	The (average) dwell time	/	
<b>c)</b>	<b>Adaptive / Non-adaptive Equipment</b>		
	<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		
<b>d)</b>	<b>Adaptive Equipment Description</b>		
	The maximum Channel Occupancy Time implemented by the equipment		/
	<input checked="" type="checkbox"/> The equipment has implemented an LBT mechanism		
	<input type="checkbox"/> The equipment has implemented a DAA mechanism		
	<input type="checkbox"/> The equipment can operate in more than one adaptive mode		
<b>e)</b>	<b>The different transmit operating modes</b>		
	<input checked="" type="checkbox"/> Operating mode 1 (single antenna)	<input checked="" type="checkbox"/> Equipment with only one antenna	
		<input type="checkbox"/> Equipment with two diversity antennas but only one antenna active at any moment in time	
		<input type="checkbox"/> Smart Antenna Systems with two or more antennas, but operating in a (legacy) mode where only one antenna is used (e.g. IEEE 802.11™ legacy mode in smart antenna systems)	
	<input type="checkbox"/> Operating mode 2: Smart Antenna Systems - Multiple Antennas without beam forming	<input type="checkbox"/> Single spatial stream/Standard throughput/(e.g. IEEE 802.11™ legacy mode)	
		<input type="checkbox"/> High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 1	
	<input type="checkbox"/> Operating mode 3: Smart Antenna Systems - Multiple Antennas with beam forming	<input type="checkbox"/> High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 2	
		<input type="checkbox"/> Single spatial stream/Standard throughput (e.g. IEEE 802.11™ legacy mode)	
		<input type="checkbox"/> High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 1	
		<input type="checkbox"/> High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 2	
<b>f)</b>	<b>In case of Smart Antenna Systems</b>		
	The number of Receive chains	1	
	The number of Transmit chains	1	
	In case of beam forming, the maximum (additional) beam forming gain:	/	
<b>g)</b>	<b>Operating Frequency Range(s) of the equipment</b>		
	Operating Frequency Range	2402 MHz to 2480 MHz	
<b>h)</b>	<b>Nominal Channel Bandwidth(s)</b>		
	Occupied Channel Bandwidth	2.0556 MHz	



<b>i)</b>	<b>Type of Equipment</b>				
	<input checked="" type="checkbox"/> Stand-Alone				
	<input type="checkbox"/> Plug-in radio Equipment				
	<input type="checkbox"/> Combined Equipment				
<b>j)</b>	<b>The extreme operating conditions that apply to the equipment</b>				
	Operating temperature range		0 °C to 40 °C		
<b>k)</b>	<b>The intended combination(s) of the radio equipment power settings and one or more antenna assemblies and their corresponding e.i.r.p levels</b>				
	Antenna Type	<input checked="" type="checkbox"/> Integral Antenna	Antenna Gain	3.15 dBi	
		<input type="checkbox"/> Dedicated Antennas (equipment with antenna connector)	<input type="checkbox"/> Single power level with corresponding antenna(s)	Gain	
				<input type="checkbox"/> Multiple power settings and corresponding antenna(s)	Power Level 1
			Power Level 2		
			Power Level 3		
<b>l)</b>	<b>The nominal voltages of the stand-alone radio equipment or the nominal voltages of the combined (host) equipment or test jig in case of plug-in devices:</b>				
	Details provided are for the	<input checked="" type="checkbox"/> Testing of stand-alone equipment			
		<input type="checkbox"/> Combined equipment			
		<input type="checkbox"/> Test jig			
	Supply Voltage	<input type="checkbox"/> AC mains	State AC voltage		
		<input checked="" type="checkbox"/> DC	State DC voltage	<input type="checkbox"/> Internal Power Supply	
				<input type="checkbox"/> External Power Supply or AC/DC adapter	
				<input type="checkbox"/> Battery	
			<input checked="" type="checkbox"/> Other	DC 5 V	
<b>m)</b>	<b>The equipment type</b>				
	<input checked="" type="checkbox"/> Bluetooth®				
	<input type="checkbox"/> IEEE 802.11™ [i.3]				
	<input type="checkbox"/> Proprietary				
<b>n)</b>	<b>Geo-location capability supported by the equipment</b>		<input type="checkbox"/> Yes		
			<input type="checkbox"/> The geographical location determined by the equipment as defined in clause 4.3.1.13.2 or clause 4.3.2.12.2 is not accessible to the user.		
			<input checked="" type="checkbox"/> No		

**6. MEASURING INSTRUMENT AND SOFTWARE USED**

Tonsend RF Test System					
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Due. Date
Wideband Radio Communication Tester	R&S	CMW500	155523	Nov.20,2020	Nov.19,2021
PXA Signal Analyzer	Keysight	N9030A	MY55410512	Nov.20,2020	Nov.19,2021
MXG Vector Signal Generator	Keysight	N5182B	MY56200284	Nov.20,2020	Nov.19,2021
MXG Vector Signal Generator	Keysight	N5172B	MY56200301	Nov.20,2020	Nov.19,2021
Software					
Description	Manufacturer	Name		Version	
Tonsend SRD Test System	Tonsend	JS1120-3 RF Test System		2.6.77.0518	

RSE Test System					
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Due. Date
Spectrum Analyzer	R&S	FSV40	101117	Nov.20,2020	Nov.19,2021
Trilog broadband antenna	Schwarzbeck	VULB9163	01061	Feb.28,2020	Feb.28,2023
Horn Antenna	ETS-Lindgren	3117	00213191	Feb.28,2020	Feb.28,2023
Preamplifier	TDK	PA-02-001-3000	TRS-305-00067	Nov.12,2020	Nov.11,2021
Preamplifier	TDK	PA-02-0118	TRS-305-00067	Nov.20,2020	Nov.19,2021
High Gain Horn Antenna	Schwarzbeck	BBHA-9170	697	July 20, 2021	July 19, 2024
Preamplifier	TDK	PA-02-2	TRS-307-00002	Nov.12,2020	Nov.11,2021
Preamplifier	TDK	PA-02-3	TRS-308-00002	Nov.12,2020	Nov.11,2021
Band Reject Filter	Wainwright	WRCJV8-2350-2400-2483.5-2533.5-40SS	4	Nov.12,2020	Nov.11,2021
Highpass Filter	Wainwright	WHKX10-2700-3000-1800-40SS	24	Nov.12,2020	Nov.11,2021
Software					
Description	Manufacturer	Name		Version	
For TDK RSE Test System	TDK	TDK Emission lab		V10.81	



## 7. TEST PROCEDURES AND RESULTS

### 7.1. NORMAL AND EXTREME CONDITIONS

#### LIMITS

None; for reporting purposes only.

#### RESULTS

	Normal Test Conditions	Extreme Test Conditions
Relative Humidity	45% ~ 55%	N/A
Atmospheric Pressure	100 kPa ~ 102 kPa	N/A
Temperature	T <sub>nom</sub> (Normal Temperature): 22 °C ~ 28 °C	LT (Low Temperature): 0 °C
		HT (High Temperature): 40 °C
Supply Voltage	V <sub>nom</sub> (Normal Voltage): DC 5 V	N/A
		N/A

## 7.2. OCCUPIED CHANNEL BANDWIDTH

### LIMITS

OCCUPIED CHANNEL BANDWIDTH	
Condition	Limit
All types of equipment	Each hopping frequency shall be within the 2400 to 2483.5 MHz band
Additional requirement	For non-adaptive non-FHSS equipment with e.i.r.p. greater than 10 dBm Each hopping frequency shall be equal to or less than 20 MHz

### TEST PROCEDURE

Refer to ETSI EN 300 328 V2.2.2 (2019-07) clause 5.4.7

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

Connect the UUT to the spectrum analyser and use the following settings:

Center Frequency	The center frequency of the channel under test
Frequency Span	2 × Nominal Channel Bandwidth
Detector	RMS
RBW	~ 1 % of the span without going below 1 %
VBW	3 × RBW
Trace	Max hold
Sweep Time	1s

### TEST ENVIRONMENT

Temperature	27.3 °C	Relative Humidity	54.4 %
Atmosphere Pressure	101 kPa	Test Voltage	DC 5 V

### RESULTS

Please refer to appendix C.



### 7.3. RF OUTPUT POWER

**LIMIT**

RF OUTPUT POWER	
Condition	Limit
<input type="checkbox"/> Non-adaptive non-FHSS Equipment	For non-adaptive non-FHSS equipment, where the manufacturer has declared an RF output power of less than 20 dBm e.i.r.p., the RF output power shall be equal to or less than that declared value.
<input checked="" type="checkbox"/> Adaptive non-FHSS Equipment	non-FHSS equipment shall be equal to or less than 20 dBm.

**TEST PROCEDURE**

Refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.2

The power sensor was used for power measurement, and it use a fast power sensor with a minimum sensitivity of -40 dBm and capable of minimum 1 MS/s.

The test software was used to control the power detector and the sampling unit.

For adaptive equipment, the measurement duration shall be long enough to ensure a minimum number of bursts (at least 10) are captured.

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

**CALCULATIONS**

Add the (stated) antenna assembly gain G in dBi of the individual antenna.

- In case of smart antenna systems operating in mode with beamforming (see clause 5.3.2.2.4), add the additional beamforming gain Y in dB.
- If more than one antenna assembly is intended for this power setting, the maximum overall antenna gain (G or G + Y) shall be used.
- The RF Output Power (Pout) shall be calculated using the formula below:

$$P_{out} = A + G + Y$$

**TEST ENVIRONMENT**

Temperature	27.3 °C	Relative Humidity	54.4 %
Atmosphere Pressure	101 kPa	Test Voltage	DC 5 V



**RESULTS**

Please refer to appendix A.



## 7.4. POWER SPECTRAL DENSITY

### LIMIT

Power Spectral Density	
Condition	Limit
All types of non-FHSS equipment	10 dBm/MHz

### TEST PROCEDURE

Refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.3

R&S EMC32 software is used to control the spectrum analyzer to use the following settings:

Start Frequency	2400 MHz
Stop Frequency	2483.5 MHz
Detector	RMS
Sweep Point	> 8 350; for spectrum analysers not supporting this number of sweep points, the frequency band may be segmented
RBW	10 kHz
VBW	30 kHz
Trace Mode	Max Hold
Sweep Time	For non-continuous transmissions: $2 \times \text{Channel Occupancy Time} \times \text{number of sweep points}$ For non-adaptive equipment use the maximum TX-sequence time in the formula above instead of the Channel Occupancy Time For continuous transmissions: 10 s; the sweep time may be increased further until a value where the sweep time has no further impact anymore on the RMS value of the signal

The test software acquires the trace data and calculate the Spectral Density in 1MHz.

### TEST ENVIRONMENT

Temperature	27.3 °C	Relative Humidity	54.4 %
Atmosphere Pressure	101 kPa	Test Voltage	DC 5 V

### RESULTS

Please refer to appendix B.

## 7.5. TRANSMITTER UNWANTED EMISSIONS IN THE OUT-OF-BAND DOMAIN

### LIMITS

Transmitter Unwanted Emissions in The Out-Of-Band Domain	
Condition	Limit
Under Normal Test Condition	The transmitter unwanted emissions in the out-of-band domain shall not exceed the values provided by the mask in figure 3.

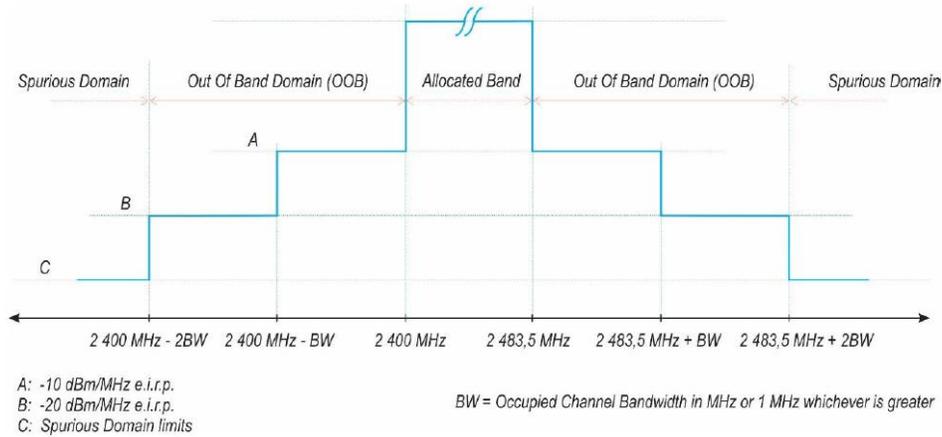


Figure 3: Transmit mask

### TEST PROCEDURE

Refer to ETSI EN 300 328 V2.2.2 (2019-07) clause 5.4.8

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

Connect the UUT to the spectrum analyser and use the following settings:

Span	Zero Span
Filter Mode	Channel Filter
Trace Mode	Max Hold
Trigger Mode	Video
Detector	RMS
Sweep Points	Sweep time [μs] / (1 μs) with a maximum of 30 000
RBW / VBW	1MHz / 3MHz
Measurement Mode	Time Domain Power
Sweep Time	> 120 % of the duration of the longest burst detected during the measurement of the RF Output Power



**TEST ENVIRONMENT**

Temperature	27.3 °C	Relative Humidity	54.4 %
Atmosphere Pressure	101 kPa	Test Voltage	DC 5 V

**RESULTS**

Please refer to appendix D.



## 7.6. TRANSMITTER UNWANTED EMISSIONS IN THE SPURIOUS DOMAIN

### LIMITS

The transmitter unwanted emissions in the spurious domain shall not exceed the values given in table 12.

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

**Table 12: Transmitter limits for spurious emissions**

Frequency range	Maximum power	Bandwidth
30 MHz to 47 MHz	-36 dBm	100 kHz
47 MHz to 74 MHz	-54 dBm	100 kHz
74 MHz to 87,5 MHz	-36 dBm	100 kHz
87,5 MHz to 118 MHz	-54 dBm	100 kHz
118 MHz to 174 MHz	-36 dBm	100 kHz
174 MHz to 230 MHz	-54 dBm	100 kHz
230 MHz to 470 MHz	-36 dBm	100 kHz
470 MHz to 694 MHz	-54 dBm	100 kHz
694 MHz to 1 GHz	-36 dBm	100 kHz
1 GHz to 12,75 GHz	-30 dBm	1 MHz

### TEST PROCEDURE

Refer to Refer to ETSI EN 300 328 V2.2.2 (2019-07) clause 5.4.9

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

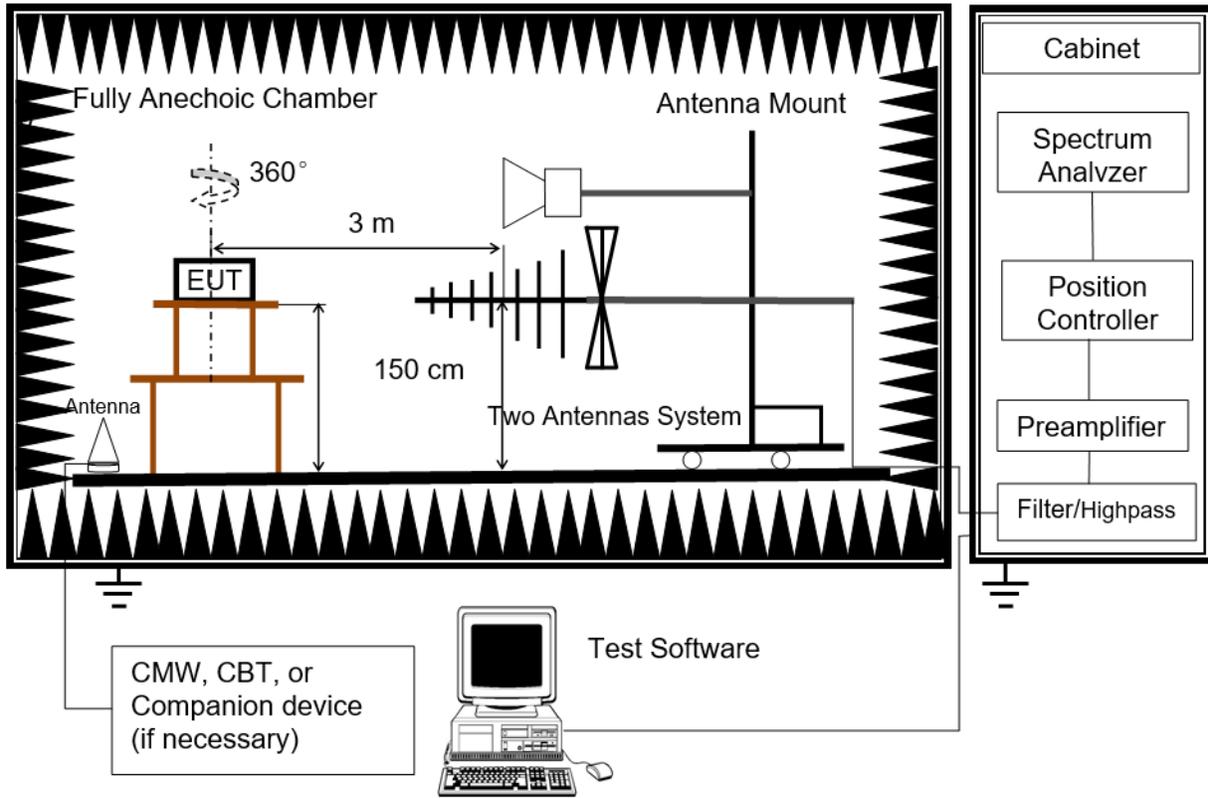
Spectrum analyser settings for pre-scan:

RBW	100 kHz (< 1 GHz) / 1 MHz (> 1 GHz)
VBW	300 kHz (< 1 GHz) / 3 MHz (> 1 GHz)
Detector Mode	Peak
Filter type	3 dB (Gaussian)
Trace Mode	Max hold
Sweep Points	$\geq 19\,400$ (< 1 GHz); $\geq 23\,500$ (> 1 GHz); for spectrum analysers not supporting this high number of sweep points, the frequency band may be segmented.
Sweep Time	For non continuous transmissions (duty cycle less than 100 %), the sweep time shall be sufficiently long, such that for each 100 kHz frequency step, the measurement time is greater than two transmissions of the UUT, on any channel. For FHSS equipment operating in a normal operating (hopping not disabled) mode, the sweep time shall be further increased to capture multiple transmissions on any of the hopping frequencies. The above sweep time setting may result in long measuring times in case of FHSS equipment. To avoid such long measuring times, an FFT analyser may be used.

Spectrum analyser settings for the emissions identified during the pre-scan:

Measurement Mode	Time Domain Power
Centre Frequency	Frequency of the emission identified during the pre-scan
RBW	100 kHz (< 1 GHz) / 1 MHz (> 1 GHz)
VBW	300 kHz (< 1 GHz) / 3 MHz (> 1 GHz)
Frequency Span	Zero Span
Sweep Mode	Single Sweep
Detector Mode	RMS
Trace Mode	Max hold
Trigger Mode	Video (burst signals) or Manual (continuous signals)
Sweep Points	Sweep time [ $\mu$ s] / (1 $\mu$ s) with a maximum of 30 000
Sweep Time	> 120 % of the duration of the longest burst detected during the measurement of the RF Output Power

**TEST SETUP**



**TEST ENVIRONMENT**

For Conducted measurement:

Temperature	27.3 °C	Relative Humidity	54.4 %
Atmosphere Pressure	101 kPa	Test Voltage	DC 5 V

For Radiated measurement

Temperature	24.5 °C	Relative Humidity	66 %
Atmosphere Pressure	101 kPa	Test Voltage	DC 5 V

**RESULTS**

Please refer to appendix E.

## 7.7. RECEIVER SPURIOUS EMISSIONS

### LIMITS

The spurious emissions of the receiver shall not exceed the values given in table 13. In case of non-FHSS equipment with antenna connectors, these limits apply to emissions at the antenna port (conducted). For emissions radiated by the cabinet or for emissions radiated by integral antenna equipment (without antenna connectors), these limits are e.r.p. for emissions up to 1 GHz and e.i.r.p. for emissions above 1 GHz.

**Table 13: Spurious emission limits for receivers**

Frequency range	Maximum power	Bandwidth
30 MHz to 1 GHz	-57 dBm	100 kHz
1 GHz to 12,75 GHz	-47 dBm	1 MHz

### TEST PROCEDURE

Please refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.10

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

Please refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.10

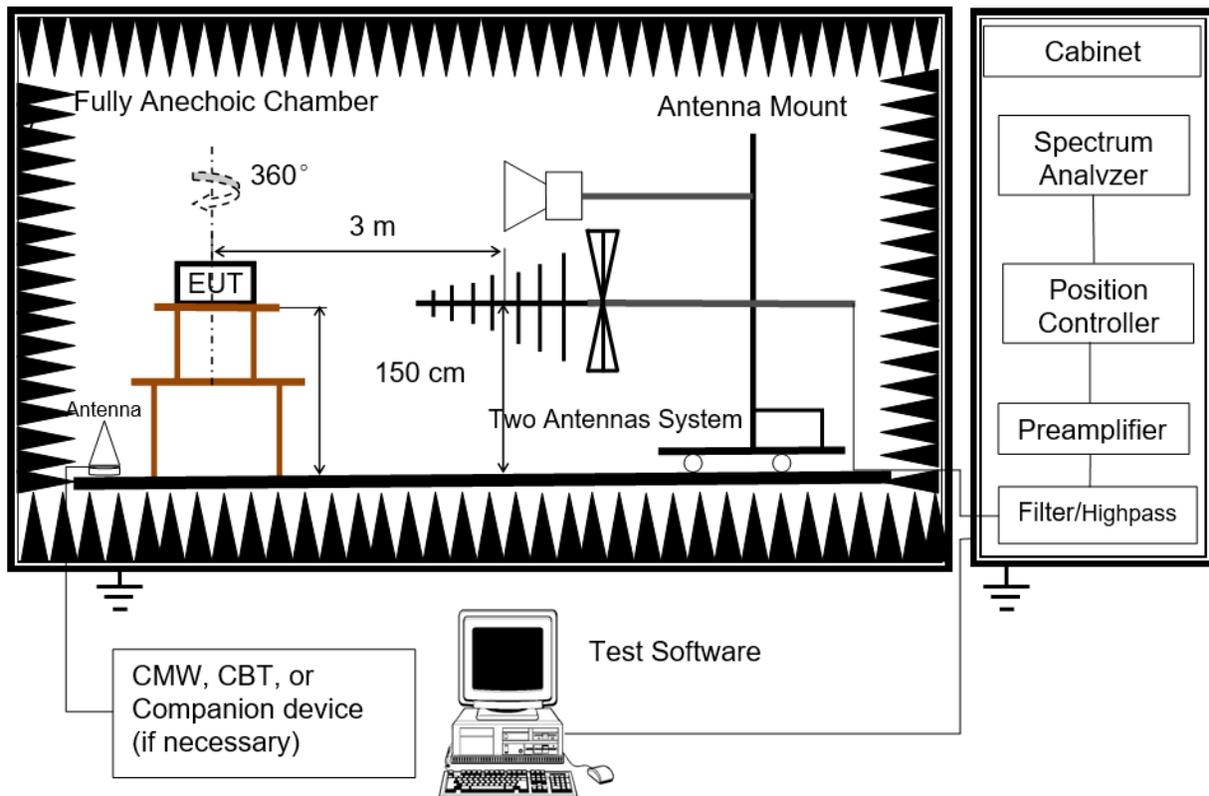
Spectrum analyser settings for pre-scan:

RBW	100 kHz (< 1 GHz) / 1 MHz (> 1 GHz)
VBW	300 kHz (< 1 GHz) / 3 MHz (> 1 GHz)
Detector Mode	Peak
Filter type	3 dB (Gaussian)
Trace Mode	Max hold
Sweep Points	$\geq 19\,400$ (< 1 GHz); $\geq 23\,500$ (> 1 GHz); for spectrum analysers not supporting this high number of sweep points, the frequency band may be segmented.
Sweep Time	Auto

Spectrum analyser settings for the emissions identified during the pre-scan:

Measurement Mode	Time Domain Power
Centre Frequency	Frequency of the emission identified during the pre-scan
RBW	100 kHz (< 1 GHz) / 1 MHz (> 1 GHz)
VBW	300 kHz (< 1 GHz) / 3 MHz (> 1 GHz)
Frequency Span	Zero Span
Sweep Mode	Single Sweep
Detector Mode	RMS
Trace Mode	Max hold
Trigger Mode	Video (burst signals) or Manual (continuous signals)
Sweep Points	$\geq 30\ 000$
Sweep Time	30 ms

**TEST SETUP**





**TEST ENVIRONMENT**

For Conducted measurement:

Temperature	27.3 °C	Relative Humidity	54.4 %
Atmosphere Pressure	101 kPa	Test Voltage	DC 5 V

For Radiated measurement

Temperature	24.5 °C	Relative Humidity	66 %
Atmosphere Pressure	101 kPa	Test Voltage	DC 5 V

**RESULTS**

Please refer to appendix F.

## 7.8. RECEIVER BLOCKING

### LIMITS

#### Performance Criteria

For equipment that supports a PER or FER test to be performed, the minimum performance criterion shall be a PER or FER less than or equal to 10 %.

For equipment that does not support a PER or a FER test to be performed, the minimum performance criterion shall be no loss of the wireless transmission function needed for the intended use of the equipment.

While maintaining the minimum performance criteria as defined in clause 4.3.2.11.3, the blocking levels at specified frequency offsets shall be equal to or greater than the limits defined for the applicable receiver category provided in table 14, table 15 or table 16.

Receiver Category 1

**Table 14: Receiver Blocking parameters for Receiver Category 1 equipment**

Wanted signal mean power from companion device (dBm) (see notes 1 and 4)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 4)	Type of blocking signal
$(-133 \text{ dBm} + 10 \times \log_{10}(\text{OCBW}))$ or $-68 \text{ dBm}$ whichever is less (see note 2)	2 380 2 504	-34	CW
$(-139 \text{ dBm} + 10 \times \log_{10}(\text{OCBW}))$ or $-74 \text{ dBm}$ 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 <math>P_{\text{min}} + 26 \text{ dB}</math> where <math>P_{\text{min}}</math> 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 <math>P_{\text{min}} + 20 \text{ dB}</math> where <math>P_{\text{min}}</math> 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

**Table 15: Receiver Blocking parameters receiver Category 2 equipment**

Wanted signal mean power from companion device (dBm) (see notes 1 and 3)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 3)	Type of blocking signal
(-139 dBm + 10 × log <sub>10</sub> (OCBW) + 10 dB) or (-74 dBm + 10 dB) whichever is less (see note 2)	2 380 2 504 2 300 2 584	-34	CW
<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 P<sub>min</sub> + 26 dB where P<sub>min</sub> 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: 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 3

**Table 16: Receiver Blocking parameters receiver Category 3 equipment**

Wanted signal mean power from companion device (dBm) (see notes 1 and 3)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 3)	Type of blocking signal
(-139 dBm + 10 × log <sub>10</sub> (OCBW) + 20 dB) or (-74 dBm + 20 dB) whichever is less (see note 2)	2 380 2 504 2 300 2 584	-34	CW
<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 P<sub>min</sub> + 30 dB where P<sub>min</sub> 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: 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>			

## TEST PROCEDURE

Please refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.11

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

Step 1:

- For non-FHSS equipment, the UUT shall be set to the lowest operating channel on which the blocking test has to be performed (see clause 5.4.11.1).

Step 2:

- The blocking signal generator is set to the first frequency as defined in the appropriate table corresponding to the receiver category and type of equipment.

Step 3:

- With the blocking signal generator switched off, a communication link is established between the UUT and the associated companion device using the test setup shown in figure 6.

- Unless the option provided in note 2 of the applicable table referred to in clause 5.4.11.2.1 is used, the level of the wanted signal shall be set to the value provided in the table corresponding to the receiver category and type of equipment. The test procedure defined in clause 5.4.2, and more in particular clause 5.4.2.2.1.2, can be used to measure the (conducted) level of the wanted signal however no correction shall be made for antenna gain of the companion device (step 6 in clause 5.4.2.2.1.2 shall be ignored). This level may be measured directly at the output of the companion device and a correction is made for the coupling loss into the UUT. The actual level for the wanted signal shall be recorded in the test report.

- When the option provided in note 2 of the applicable table referred to in clause 5.4.11.2.1 is used, the attenuation of the variable attenuator shall be increased in 1 dB steps to a value at which the minimum performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is still met. The resulting level for the wanted signal at the input of the UUT is P<sub>min</sub>. This signal level (P<sub>min</sub>) is increased by the value provided in note 2 of the applicable table corresponding to the receiver category and type of equipment.

Step 4:

- The blocking signal at the UUT is set to the level provided in the table corresponding to the receiver category and type of equipment.

- If the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 are met then proceed to step 6.

Step 5:

- If the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is not met, step 3 and step 4 shall be repeated after that the frequency of the blocking signal set in step 2 has been increased with a value equal to the Occupied Channel Bandwidth except:

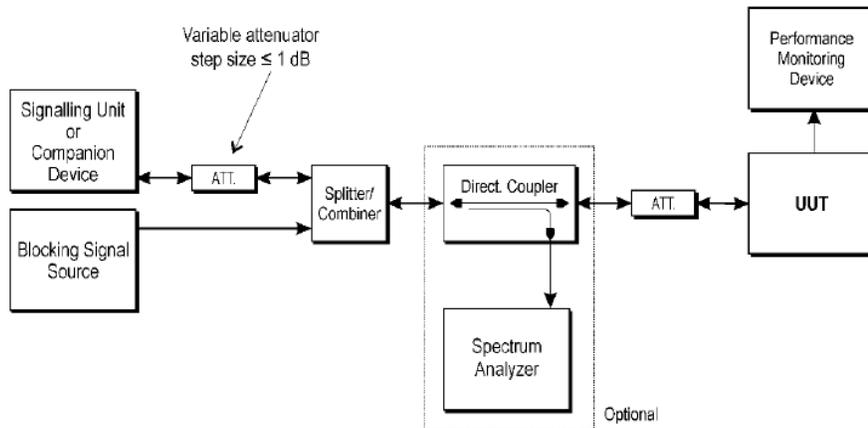
- For the blocking frequency 2 380 MHz, where this frequency offset shall be less than or equal to 10 MHz. If this frequency offset is more than 7 MHz, the level of the wanted signal shall be increased by 3 dB.

- For the blocking frequency 2 503,5 MHz, where this frequency offset shall be less than or equal to 10 MHz. If this frequency offset is more than 7 MHz, the level of the wanted signal shall be decreased by 3 dB.

- If the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is still not met, step 3 and step 4 shall be repeated after that the frequency of the blocking signal set in step 2 has been decreased with a value equal to the Occupied Channel Bandwidth except:

- For the blocking frequency 2 380 MHz, where this frequency offset shall be less than or equal to 10 MHz. If this frequency offset is more than 7 MHz, the level of the wanted signal shall be decreased by 3 dB.
  - For the blocking frequency 2 503,5 MHz, where this frequency offset shall be less than or equal to 10 MHz. If this frequency offset is more than 7 MHz, the level of the wanted signal shall be increased by 3 dB.
  - If the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is still not met, the UUT fails to comply with the Receiver Blocking requirement and step 6 and step 7 are no longer required.
  - It shall be recorded in the test report whether the shift of blocking frequencies as described in the present step was used.
- Step 6:
- Repeat step 4 and step 5 for each remaining combination of frequency and level for the blocking signal as provided in the table corresponding to the receiver category and type of equipment.
- Step 7:
- For non-FHSS equipment, repeat step 2 to step 6 with the UUT operating at the highest operating channel on which the blocking test has to be performed (see clause 5.4.11.1).
- Step 8:
- It shall be assessed and recorded in the test report whether the UUT complies with the Receiver Blocking requirement.

**TEST SETUP**



**TEST ENVIRONMENT**

Temperature	24.5 °C	Relative Humidity	56.8 %
Atmosphere Pressure	101 kPa	Test Voltage	DC 5 V

**RESULTS**

Please refer to appendix G.



## 8. GEO-LOCATION CAPABILITY

### REQUIREMENTS

Geo-location capability is a feature of the equipment to determine its geographical location with the purpose to configure itself according to the regulatory requirements applicable at the geographical location where it operates.

The geo-location capability may be present in the equipment or in an external device (temporary) associated with the equipment operating at the same geographical location during the initial power up of the equipment. The geographical location may also be available in equipment already installed and operating at the same geographical location.

### GEO-LOCATION CAPABILITY FUNCTION DESCRIBE FOR EUT

Not Support.

### CONCLUSION

N/A

## 9. Appendix

### 9.1. Appendix A: RF Output Power

#### 9.1.1. Test Result

Test Condition	Test Mode	Antenna	Channel	EIRP[dBm]	Limit[dBm]	Verdict
NTNV	BLE_1M	Ant1	2402	6.91	20	PASS
			2440	6.95	20	PASS
			2480	7.28	20	PASS
	BLE_2M	Ant1	2402	6.92	20	PASS
			2440	6.96	20	PASS
			2480	7.29	20	PASS

Test Condition	Test Mode	Antenna	Channel	EIRP[dBm]	Limit[dBm]	Verdict
LTVN	BLE_1M	Ant1	2402	6.58	20	PASS
			2440	6.59	20	PASS
			2480	6.93	20	PASS
	BLE_2M	Ant1	2402	6.55	20	PASS
			2440	6.61	20	PASS
			2480	6.94	20	PASS

Test Condition	Test Mode	Antenna	Channel	EIRP[dBm]	Limit[dBm]	Verdict
HTNV	BLE_1M	Ant1	2402	6.59	20	PASS
			2440	6.62	20	PASS
			2480	6.98	20	PASS
	BLE_2M	Ant1	2402	6.61	20	PASS
			2440	6.65	20	PASS
			2480	6.89	20	PASS

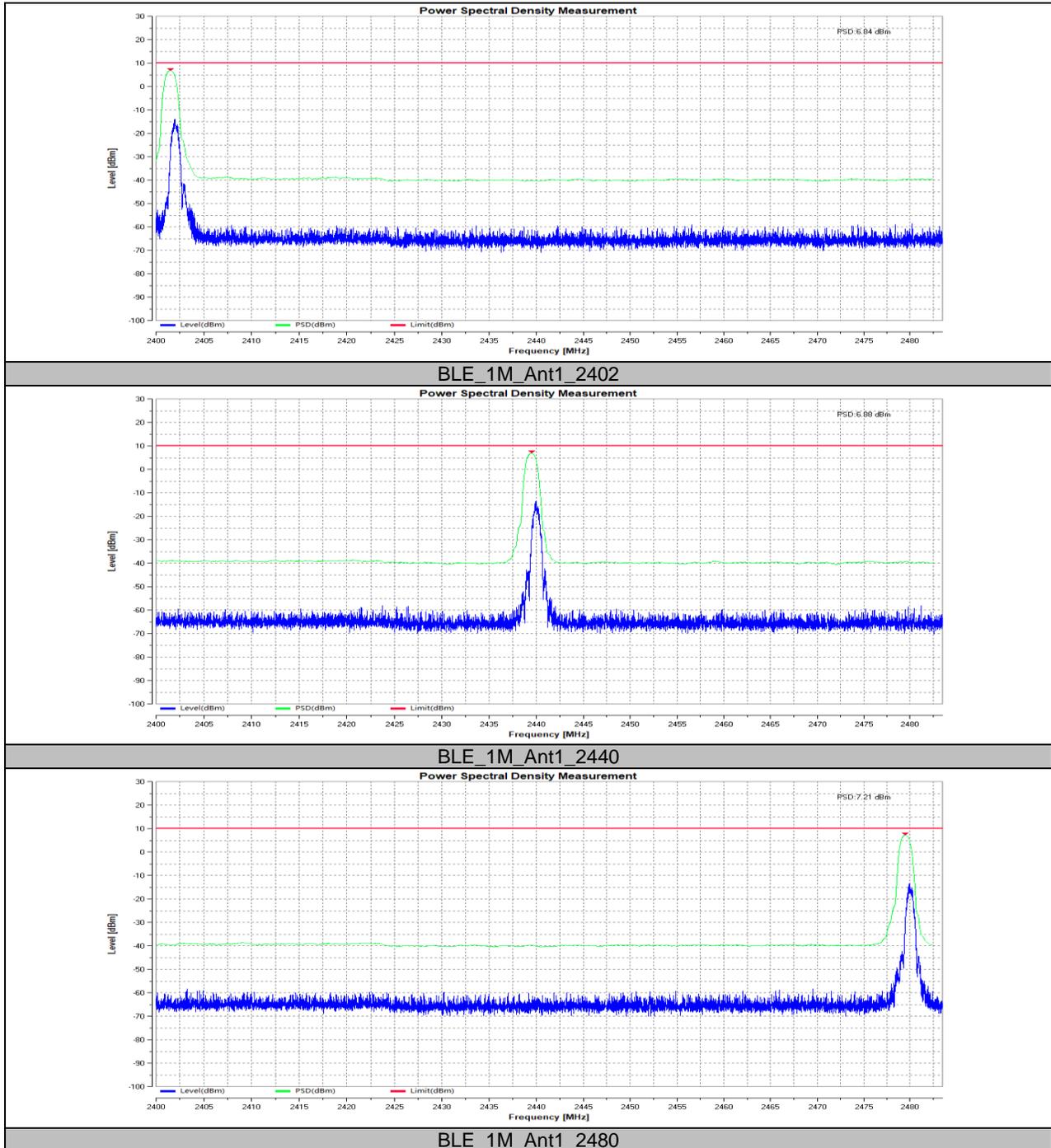


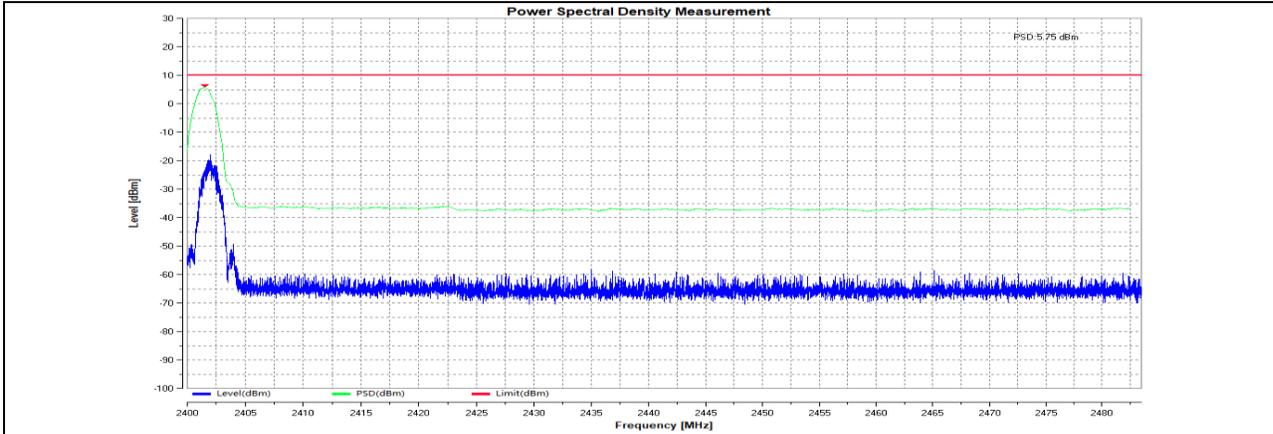
## 9.2. Appendix B: Power Spectral Density

### 9.2.1. Test Result

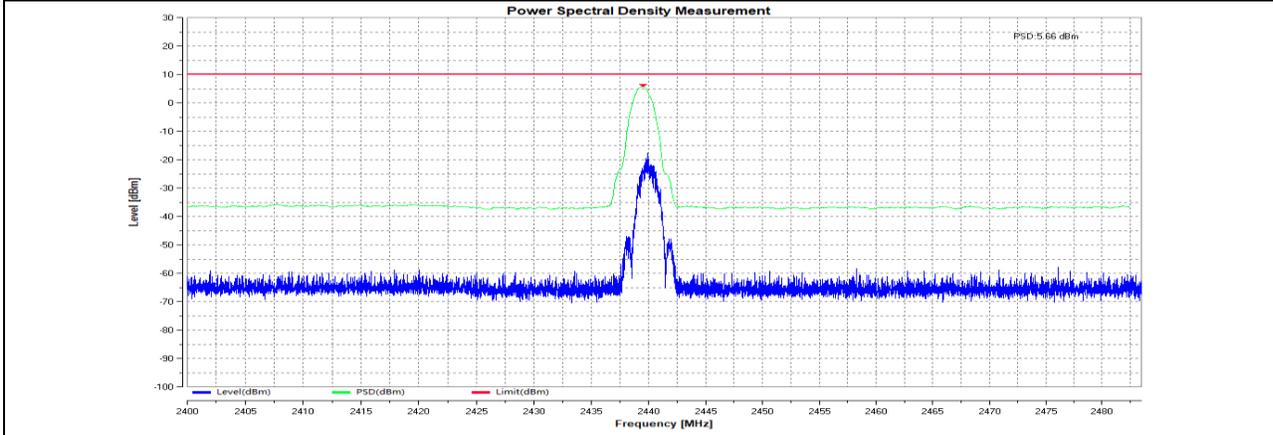
Test Mode	Antenna	Channel	PSD[dBm/MHz]	Limit[dBm/MHz]	Verdict
BLE_1M	Ant1	2402	6.84	10	PASS
		2440	6.88	10	PASS
		2480	7.21	10	PASS
BLE_2M	Ant1	2402	5.75	10	PASS
		2440	5.66	10	PASS
		2480	6.16	10	PASS

### 9.2.2. Test Graphs

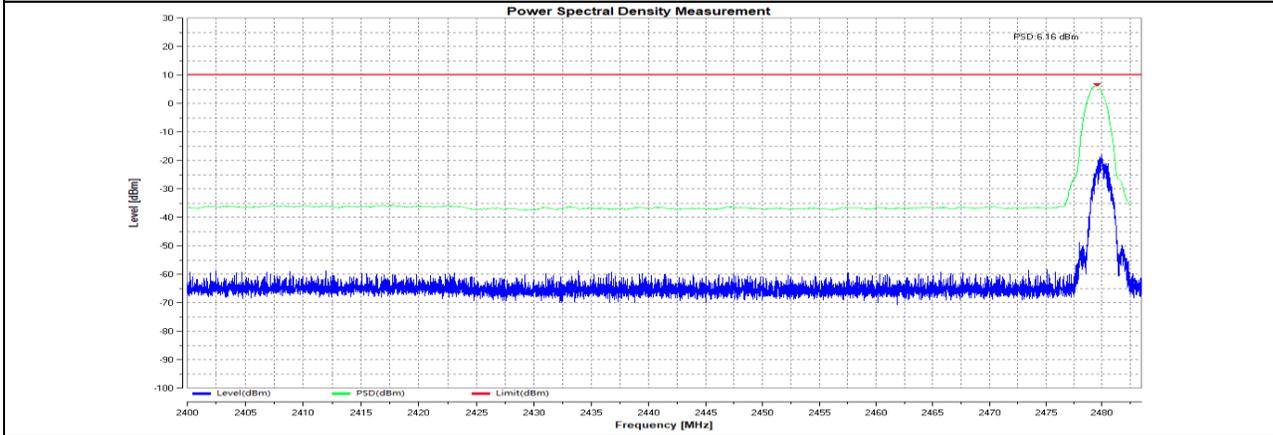




BLE\_2M\_Ant1\_2402



BLE\_2M\_Ant1\_2440



BLE\_2M\_Ant1\_2480



### 9.3. Appendix C: Occupied Channel Bandwidth

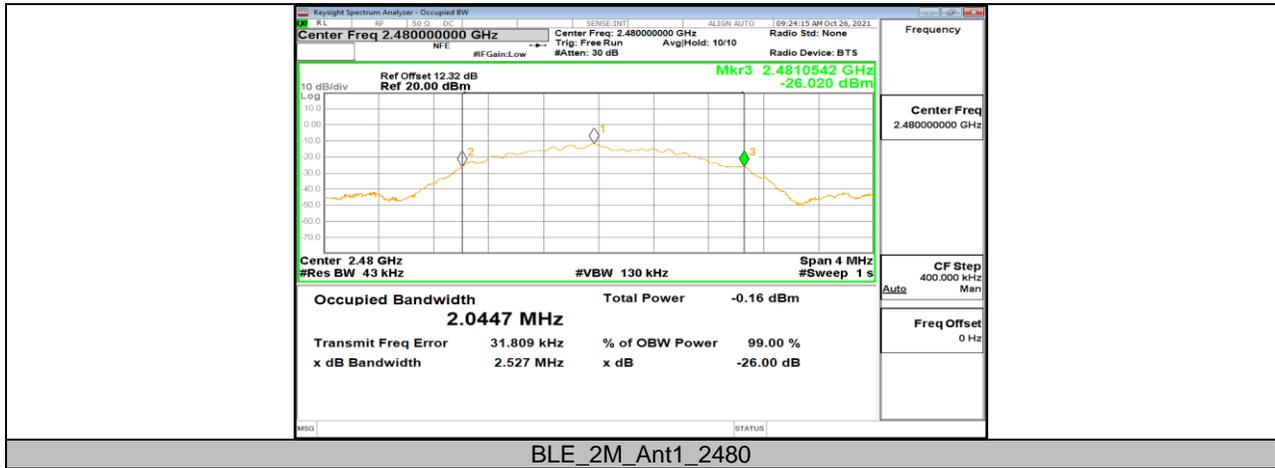
#### 9.3.1. Test Result

Test Mode	Antenna	Channel	OCB[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1M	Ant1	2402	1.0403	2401.5000	2402.5403	2400 to 2483.5	PASS
		2480	1.0422	2479.4994	2480.5416	2400 to 2483.5	PASS
BLE_2M	Ant1	2402	2.0556	2400.9984	2403.0540	2400 to 2483.5	PASS
		2480	2.0447	2479.0095	2481.0542	2400 to 2483.5	PASS



### 9.3.2. Test Graphs



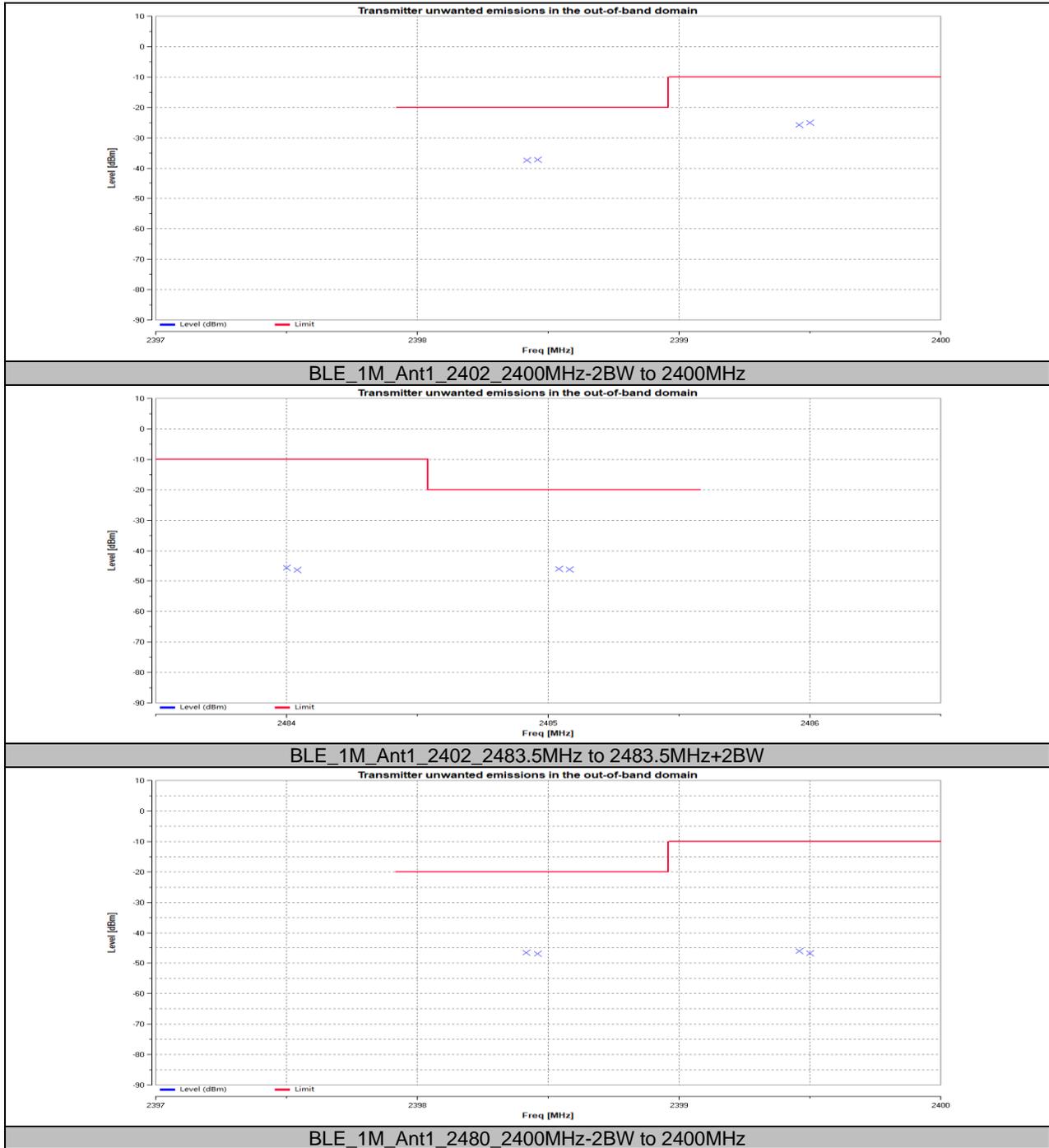


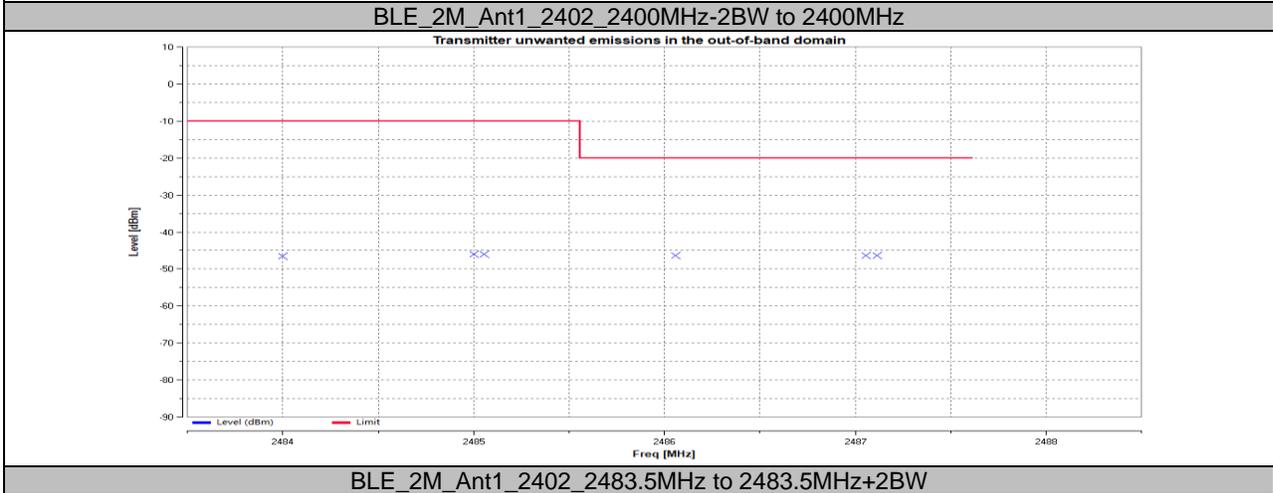
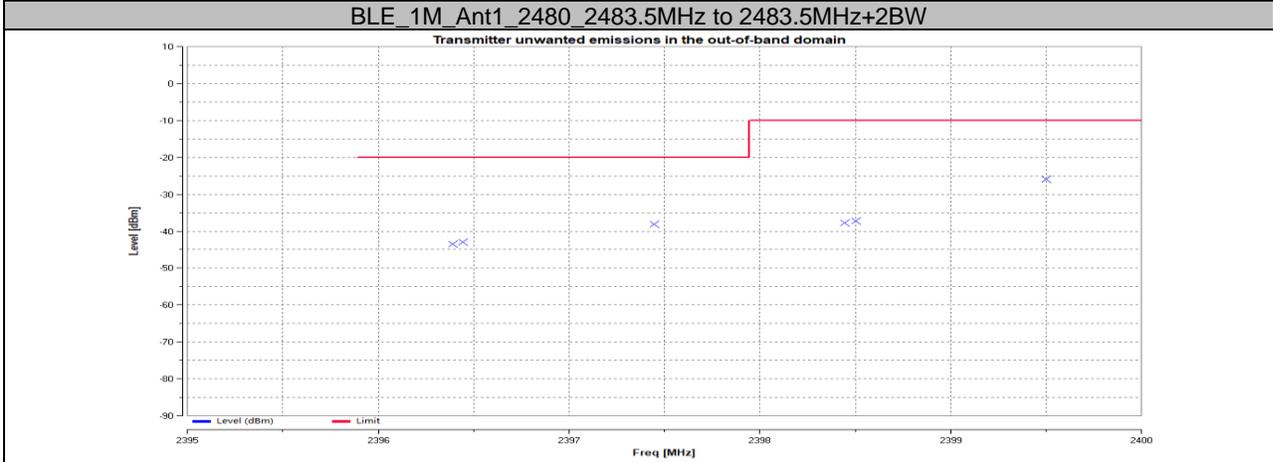
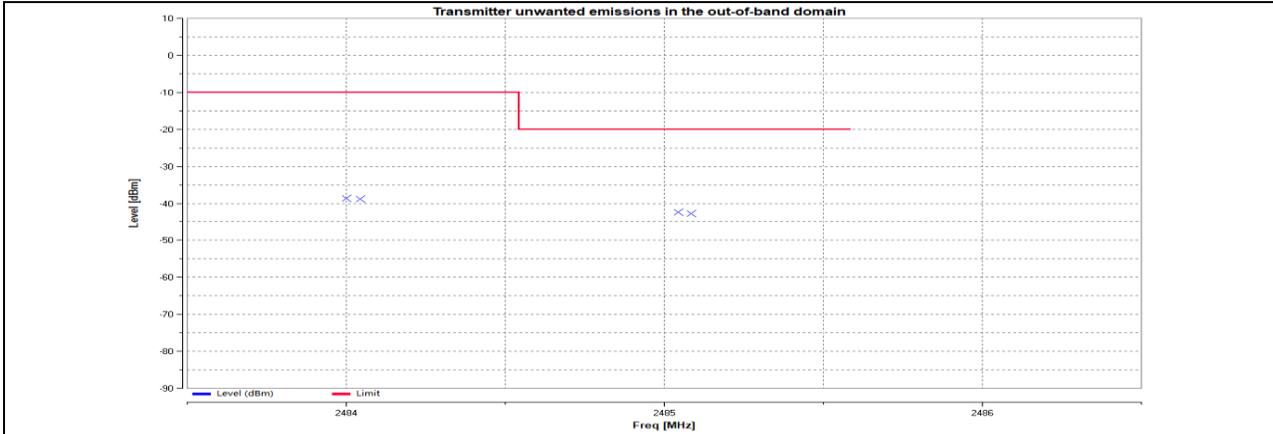
## 9.4. Appendix D: Transmitter Unwanted Emissions In The Out-Of-Band Domain

### 9.4.1. Test Result

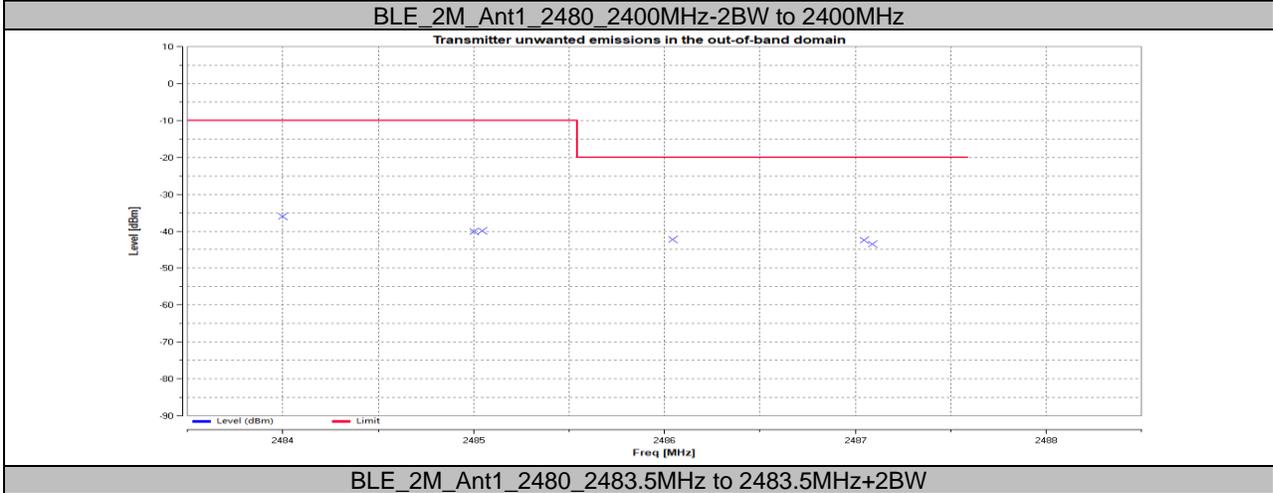
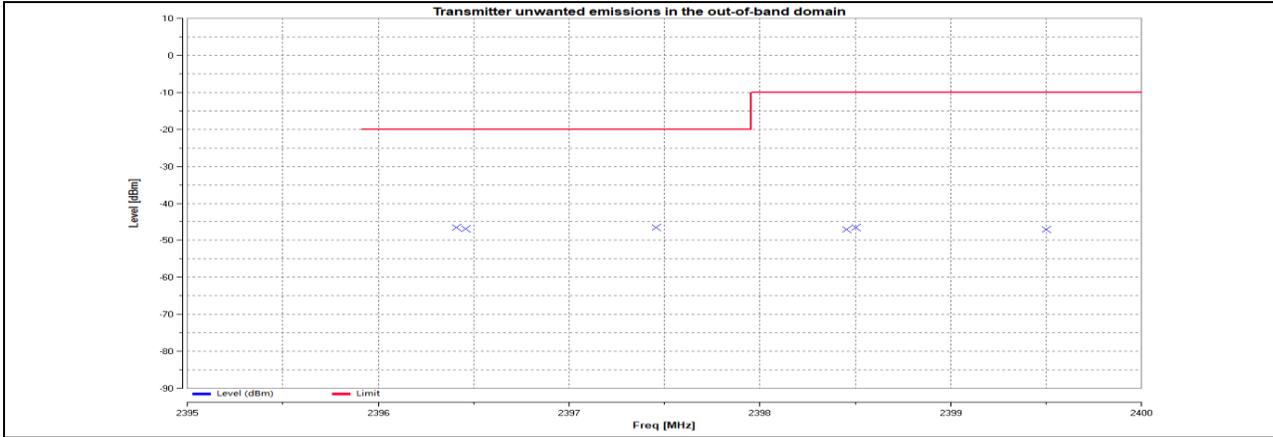
Test Mode	Antenna	Channel	Freq. [MHz]	Level[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	2398.4194	-37.43	-20.00	PASS
			2398.4597	-37.22	-20.00	PASS
			2399.4597	-25.69	-10.00	PASS
			2399.5	-25.14	-10.00	PASS
			2484	-45.66	-10.00	PASS
			2484.0403	-46.34	-10.00	PASS
			2485.0403	-46.06	-20.00	PASS
			2485.0806	-46.25	-20.00	PASS
		2480	2398.4156	-46.47	-20.00	PASS
			2398.4578	-46.83	-20.00	PASS
			2399.4578	-46.06	-10.00	PASS
			2399.5	-46.74	-10.00	PASS
			2484	-38.59	-10.00	PASS
			2484.0422	-38.86	-10.00	PASS
			2485.0422	-42.39	-20.00	PASS
			2485.0844	-42.75	-20.00	PASS
BLE_2M	Ant1	2402	2396.3888	-43.43	-20.00	PASS
			2396.4444	-42.97	-20.00	PASS
			2397.4444	-38.12	-20.00	PASS
			2398.4444	-37.72	-10.00	PASS
			2398.5	-37.28	-10.00	PASS
			2399.5	-25.87	-10.00	PASS
			2484	-46.60	-10.00	PASS
			2485	-45.91	-10.00	PASS
			2485.0556	-45.95	-10.00	PASS
			2486.0556	-46.37	-20.00	PASS
			2487.0556	-46.28	-20.00	PASS
			2487.1112	-46.33	-20.00	PASS
		2480	2396.4106	-46.47	-20.00	PASS
			2396.4553	-46.89	-20.00	PASS
			2397.4553	-46.59	-20.00	PASS
			2398.4553	-47.13	-10.00	PASS
			2398.5	-46.53	-10.00	PASS
			2399.5	-46.98	-10.00	PASS
			2484	-35.99	-10.00	PASS
			2485	-40.04	-10.00	PASS
			2485.0447	-39.94	-10.00	PASS
			2486.0447	-42.27	-20.00	PASS
			2487.0447	-42.42	-20.00	PASS
			2487.0894	-43.55	-20.00	PASS

### 9.4.2. Test Graphs





BLE\_2M\_Ant1\_2402\_2483.5MHz to 2483.5MHz+2BW

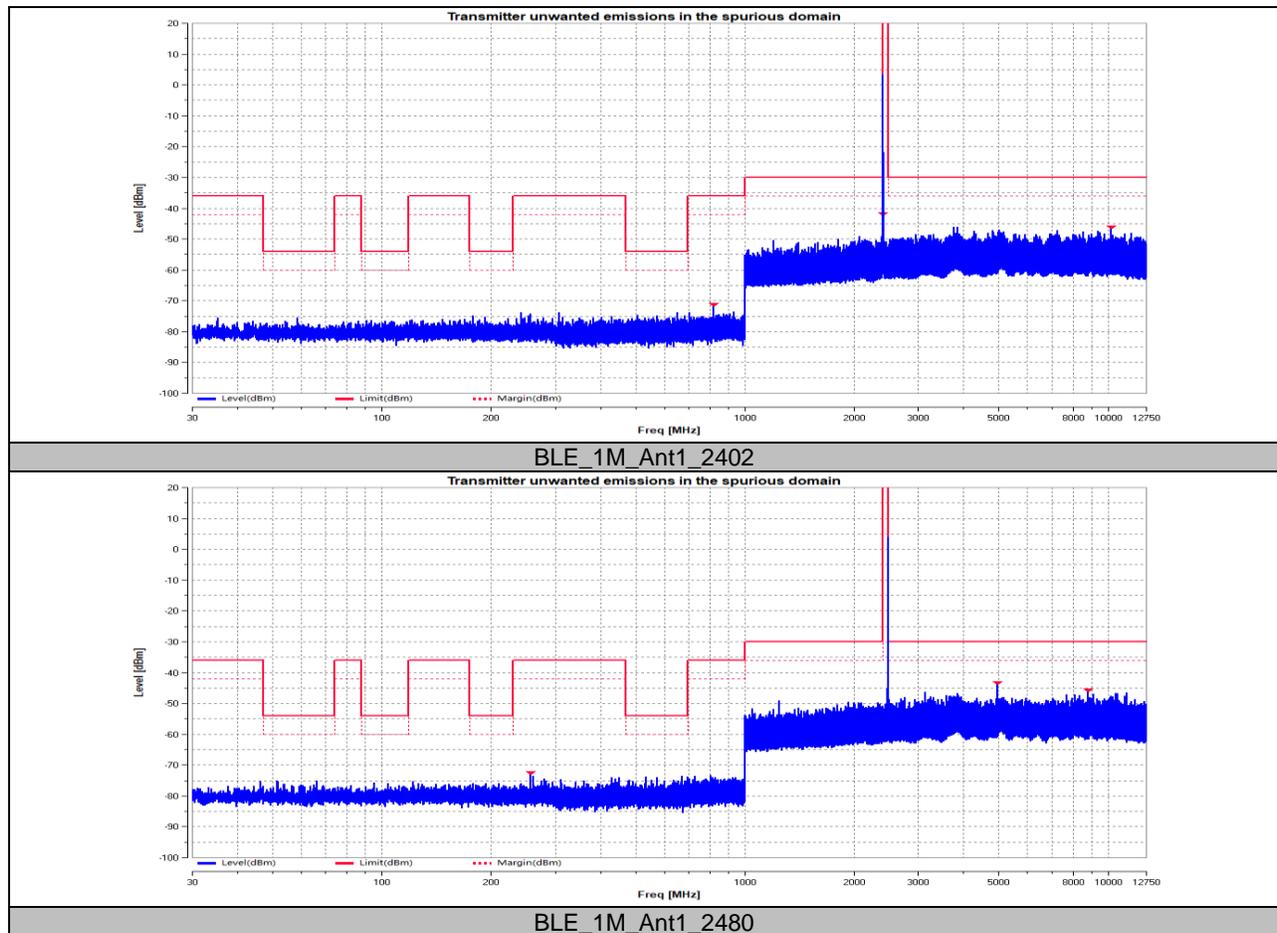


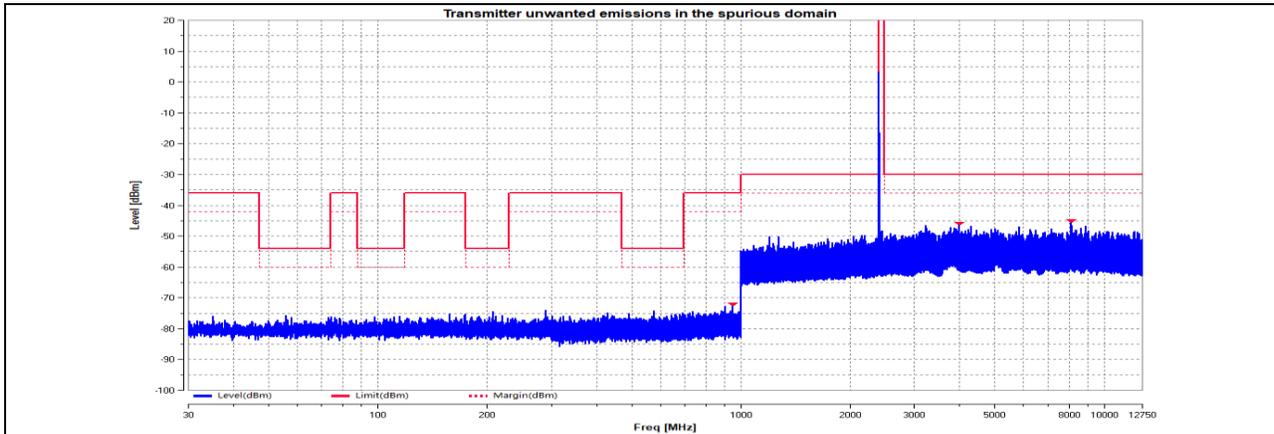
## 9.5. Appendix E: Transmitter Unwanted Emissions In The Spurious Domain

### 9.5.1. Conducted Test Result-Pre-scan

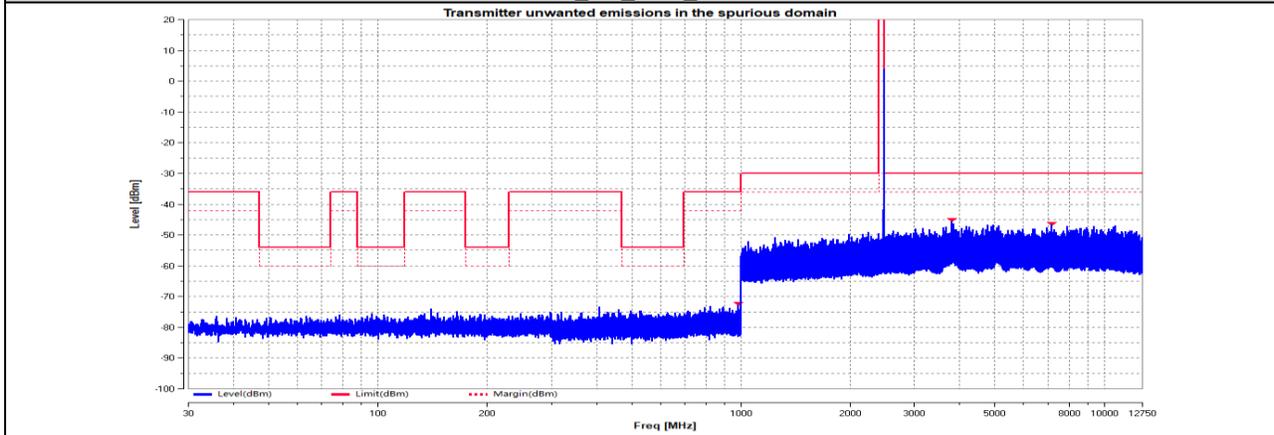
Test Mode	Antenna	Channel	Freq. [MHz]	Level[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	819.96	-71.8	-36	PASS
			2397.91	-42.55	-30	PASS
			10213.34	-46.8	-30	PASS
		2480	256.08	-73.24	-36	PASS
			4960.13	-43.89	-30	PASS
			8820.88	-46.33	-30	PASS
BLE_2M	Ant1	2402	951.5	-72.73	-36	PASS
			3993.3	-46.6	-30	PASS
			8116.9	-45.66	-30	PASS
		2480	983.48	-73.04	-36	PASS
			3816.89	-45.61	-30	PASS
			7176.53	-46.87	-30	PASS

### 9.5.2. Conducted Test Graphs-Pre-scan





BLE\_2M\_Ant1\_2402

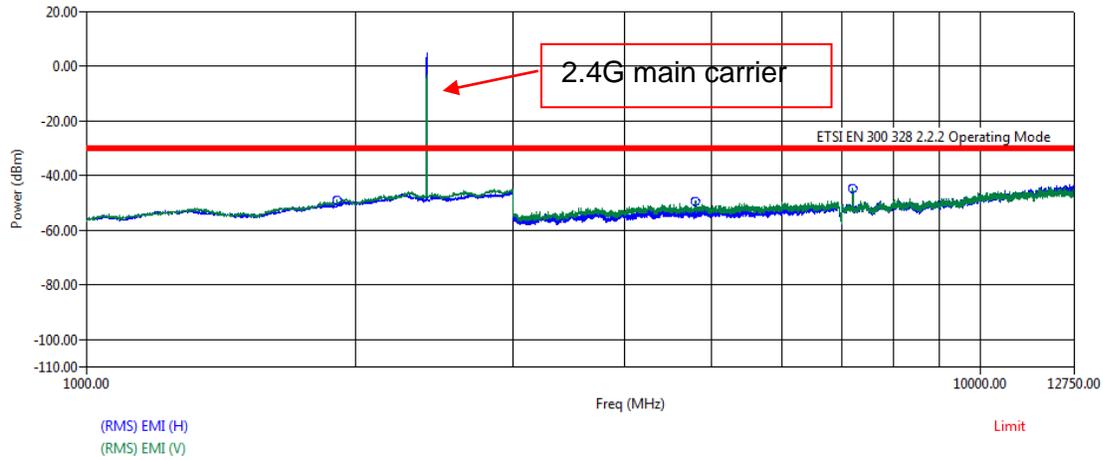


BLE\_2M\_Ant1\_2480



### 9.5.3. Radiated Test Result

Transmitter unwanted emissions in the spurious domain above 1 GHz			
Measurement Method	Radiated	Polar:	Horizontal/Vertical
Test Mode:	LE 1M	Test Channel:	CH 0



Freq (MHz)	(RMS) Trace (H) (dBuV)	ERP Factor (H) (dB)	Transducer (H) (dB)	Cable (H) (dB)	Preamp (H) (dB)	(RMS) EMI (H) (dBm)	Limit (dBm)	(RMS) Margin (H) (dB)
1905.50	7.53	-64.61	0.00	6.42	0.00	-50.66	-30.00	-20.66
4803.50	41.87	-61.07	0.00	10.19	43.32	-52.32	-30.00	-22.32
7205.50	44.47	-62.30	0.00	12.76	42.13	-47.20	-30.00	-17.20

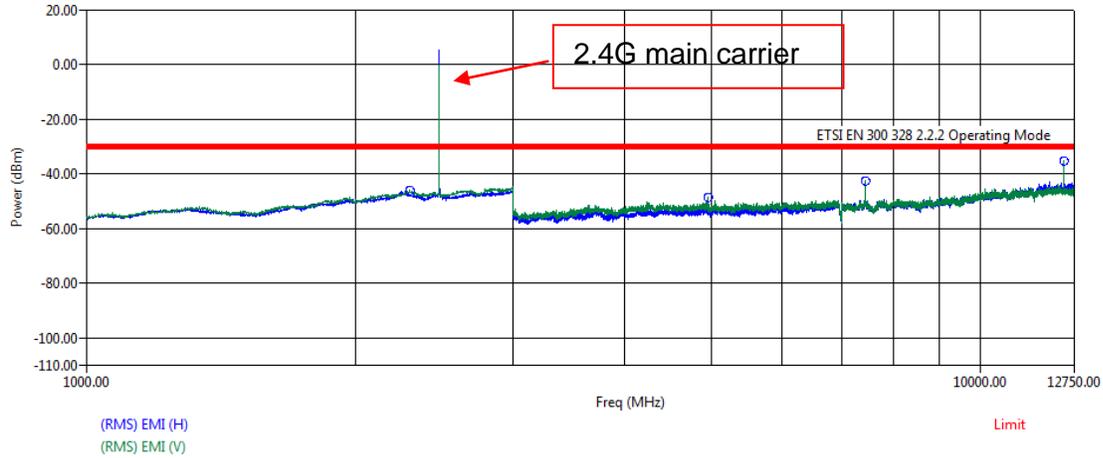
Freq (MHz)	(RMS) Trace (V) (dBuV)	ERP Factor (V) (dB)	Transducer (V) (dB)	Cable (V) (dB)	Preamp (V) (dB)	(RMS) EMI (V) (dBm)	Limit (dBm)	(RMS) Margin (V) (dB)
1905.50	8.33	-63.83	0.00	6.42	0.00	-49.08	-30.00	-19.08
4803.50	42.82	-59.06	0.00	10.19	43.32	-49.35	-30.00	-19.35
7205.50	47.27	-62.41	0.00	12.76	42.13	-44.51	-30.00	-14.51

Note: EMI=Trace + Cable(Loss) + ERP Factor + Transducer  
Margin=EMI – Limit

Note: 2.4G main carrier was recorded in the plot.



Transmitter unwanted emissions in the spurious domain above 1 GHz			
Measurement Method	Radiated	Polar:	Horizontal/Vertical
Test Mode:	LE 1M	Test Channel:	CH 39



Freq (MHz)	(RMS) Trace (H) (dBuV)	ERP Factor (H) (dB)	Transducer (H) (dB)	Cable (H) (dB)	Preamp (H) (dB)	(RMS) EMI (H) (dBm)	Limit (dBm)	(RMS) Margin (H) (dB)
2301.00	7.39	-62.62	0.00	7.14	0.00	-48.09	-30.00	-18.09
4960.00	42.54	-60.70	0.00	10.46	43.30	-51.00	-30.00	-21.00
7439.50	41.55	-62.28	0.00	13.23	42.03	-49.53	-30.00	-19.53
12401.50	42.38	-58.88	0.00	16.93	42.03	-41.59	-30.00	-11.59

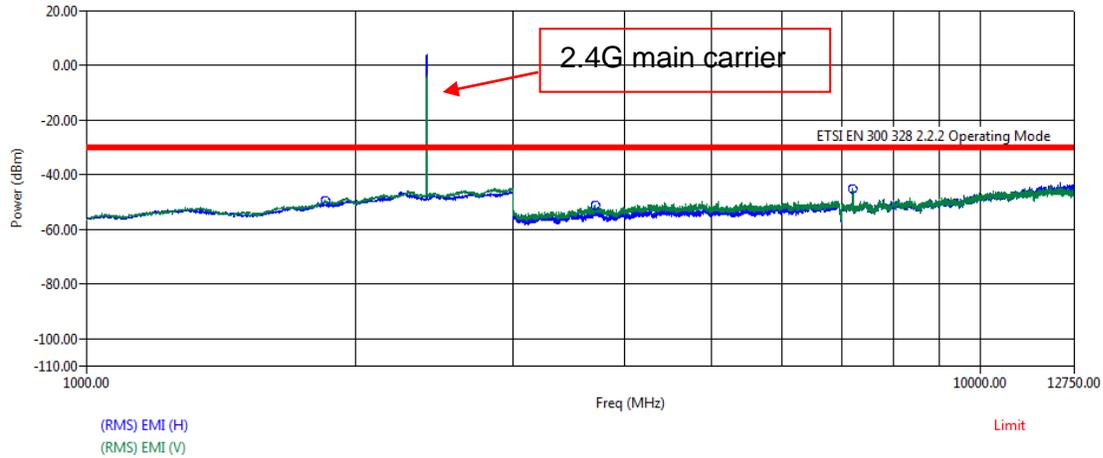
Freq (MHz)	(RMS) Trace (V) (dBuV)	ERP Factor (V) (dB)	Transducer (V) (dB)	Cable (V) (dB)	Preamp (V) (dB)	(RMS) EMI (V) (dBm)	Limit (dBm)	(RMS) Margin (V) (dB)
2301.00	8.04	-61.06	0.00	7.14	0.00	-45.88	-30.00	-15.88
4960.00	43.63	-59.38	0.00	10.46	43.30	-48.60	-30.00	-18.60
7439.50	48.49	-62.18	0.00	13.23	42.03	-42.49	-30.00	-12.49
12401.50	49.76	-59.95	0.00	16.93	42.03	-35.29	-30.00	-5.29

Note: EMI=Trace + Cable(Loss) + ERP Factor + Transducer  
Margin=EMI – Limit

Note: 2.4G main carrier was recorded in the plot.



Transmitter unwanted emissions in the spurious domain above 1 GHz			
Measurement Method	Radiated	Polar:	Horizontal/Vertical
Test Mode:	LE 2M	Test Channel:	CH 0



Freq (MHz)	(RMS) Trace (H) (dBuV)	ERP Factor (H) (dB)	Transducer (H) (dB)	Cable (H) (dB)	Preamp (H) (dB)	(RMS) EMI (H) (dBm)	Limit (dBm)	(RMS) Margin (H) (dB)
1850.50	6.77	-64.45	0.00	6.27	0.00	-51.42	-30.00	-21.42
3712.00	41.06	-61.67	0.00	9.66	43.42	-54.37	-30.00	-24.37
7204.50	42.38	-62.30	0.00	12.77	42.13	-49.29	-30.00	-19.29

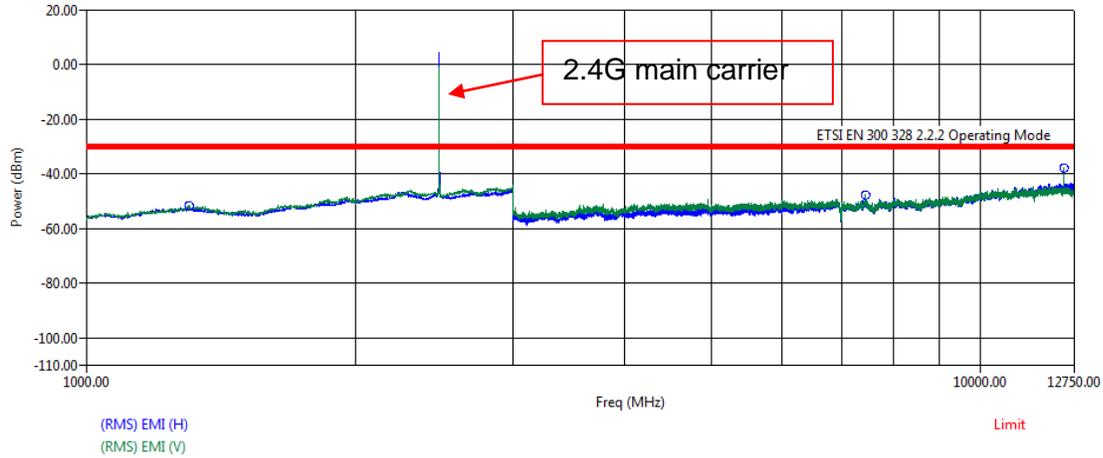
Freq (MHz)	(RMS) Trace (V) (dBuV)	ERP Factor (V) (dB)	Transducer (V) (dB)	Cable (V) (dB)	Preamp (V) (dB)	(RMS) EMI (V) (dBm)	Limit (dBm)	(RMS) Margin (V) (dB)
1850.50	7.83	-63.33	0.00	6.27	0.00	-49.23	-30.00	-19.23
3712.00	43.27	-60.50	0.00	9.66	43.42	-50.98	-30.00	-20.98
7204.50	46.66	-62.41	0.00	12.77	42.13	-45.11	-30.00	-15.11

Note: EMI=Trace + Cable(Loss) + ERP Factor + Transducer  
Margin=EMI – Limit

Note: 2.4G main carrier was recorded in the plot.



Transmitter unwanted emissions in the spurious domain above 1 GHz			
Measurement Method	Radiated	Polar:	Horizontal/Vertical
Test Mode:	LE 2M	Test Channel:	CH 39



Freq (MHz)	(RMS) Trace (H) (dBuV)	ERP Factor (H) (dB)	Transducer (H) (dB)	Cable (H) (dB)	Preamp (H) (dB)	(RMS) EMI (H) (dBm)	Limit (dBm)	(RMS) Margin (H) (dB)
1302.50	6.27	-65.01	0.00	5.23	0.00	-53.52	-30.00	-23.52
7438.50	41.86	-62.29	0.00	13.23	42.03	-49.23	-30.00	-19.23
12398.00	41.87	-58.94	0.00	16.94	42.03	-42.17	-30.00	-12.17

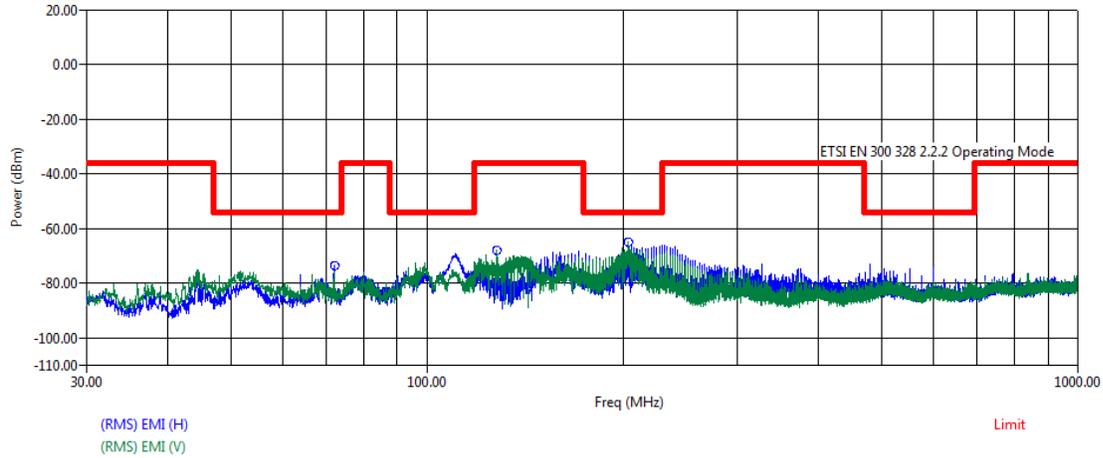
Freq (MHz)	(RMS) Trace (V) (dBuV)	ERP Factor (V) (dB)	Transducer (V) (dB)	Cable (V) (dB)	Preamp (V) (dB)	(RMS) EMI (V) (dBm)	Limit (dBm)	(RMS) Margin (V) (dB)
1302.50	7.81	-64.60	0.00	5.23	0.00	-51.56	-30.00	-21.56
7438.50	43.27	-62.19	0.00	13.23	42.03	-47.73	-30.00	-17.73
12398.00	47.43	-60.01	0.00	16.94	42.03	-37.67	-30.00	-7.67

Note: EMI=Trace + Cable(Loss) + ERP Factor + Transducer  
Margin=EMI – Limit

Note: 2.4G main carrier was recorded in the plot.



Transmitter unwanted emissions in the spurious domain below 1 GHz			
Measurement Method	Radiated	Polar:	Horizontal/Vertical
Test Mode:	LE 1M	Test Channel:	CH 0



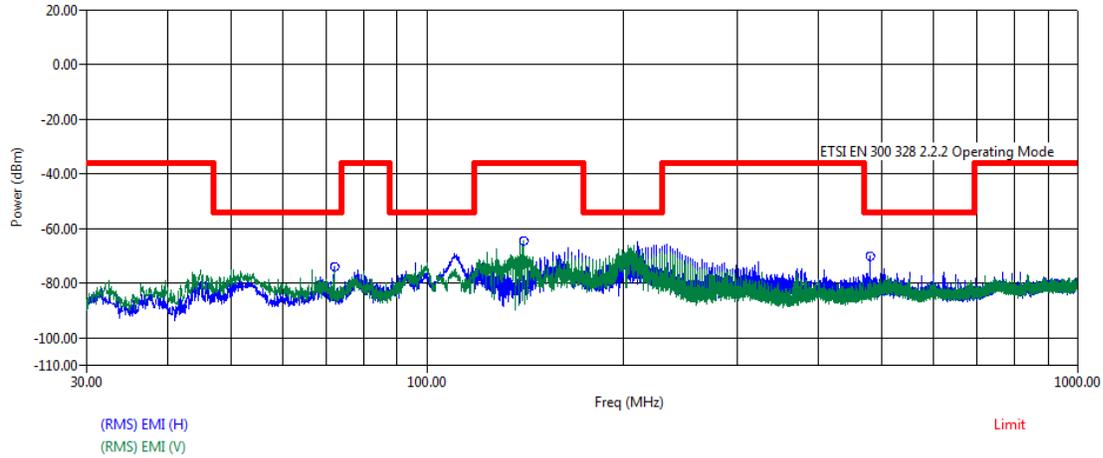
Freq (MHz)	(RMS) Trace (H) (dBuV)	ERP Factor (H) (dB)	Transducer (H) (dB)	Cable (H) (dB)	Preamp (H) (dB)	(RMS) EMI (H) (dBm)	Limit (dBm)	(RMS) Margin (H) (dB)
72.00	56.37	-88.46	0.00	1.07	42.54	-73.56	-54.00	-19.56
127.95	45.60	-88.02	0.00	1.45	42.69	-83.67	-36.00	-47.67
203.45	55.15	-86.36	0.00	1.86	42.51	-71.86	-54.00	-17.86

Freq (MHz)	(RMS) Trace (V) (dBuV)	ERP Factor (V) (dB)	Transducer (V) (dB)	Cable (V) (dB)	Preamp (V) (dB)	(RMS) EMI (V) (dBm)	Limit (dBm)	(RMS) Margin (V) (dB)
72.00	53.89	-88.56	0.00	1.07	42.54	-76.15	-54.00	-22.15
127.95	63.02	-89.66	0.00	1.45	42.69	-67.89	-36.00	-31.89
203.45	61.74	-85.83	0.00	1.86	42.51	-64.74	-54.00	-10.74

Note: EMI=Trace + Cable(Loss) + ERP Factor + Transducer  
Margin=EMI – Limit



Transmitter unwanted emissions in the spurious domain below 1 GHz			
Measurement Method	Radiated	Polar:	Horizontal/Vertical
Test Mode:	LE 1M	Test Channel:	CH 39



Freq (MHz)	(RMS) Trace (H) (dBuV)	ERP Factor (H) (dB)	Transducer (H) (dB)	Cable (H) (dB)	Preamp (H) (dB)	(RMS) EMI (H) (dBm)	Limit (dBm)	(RMS) Margin (H) (dB)
72.00	56.17	-88.46	0.00	1.07	42.54	-73.77	-54.00	-19.77
140.80	53.14	-89.19	0.00	1.61	42.65	-77.10	-36.00	-41.10
480.00	51.95	-81.93	0.00	2.90	42.79	-69.86	-54.00	-15.86

Freq (MHz)	(RMS) Trace (V) (dBuV)	ERP Factor (V) (dB)	Transducer (V) (dB)	Cable (V) (dB)	Preamp (V) (dB)	(RMS) EMI (V) (dBm)	Limit (dBm)	(RMS) Margin (V) (dB)
72.00	54.66	-88.56	0.00	1.07	42.54	-75.38	-54.00	-21.38
140.80	65.94	-89.11	0.00	1.61	42.65	-64.22	-36.00	-28.22
480.00	42.50	-81.67	0.00	2.90	42.79	-79.05	-54.00	-25.05

Note: EMI=Trace + Cable(Loss) + ERP Factor + Transducer  
Margin=EMI – Limit

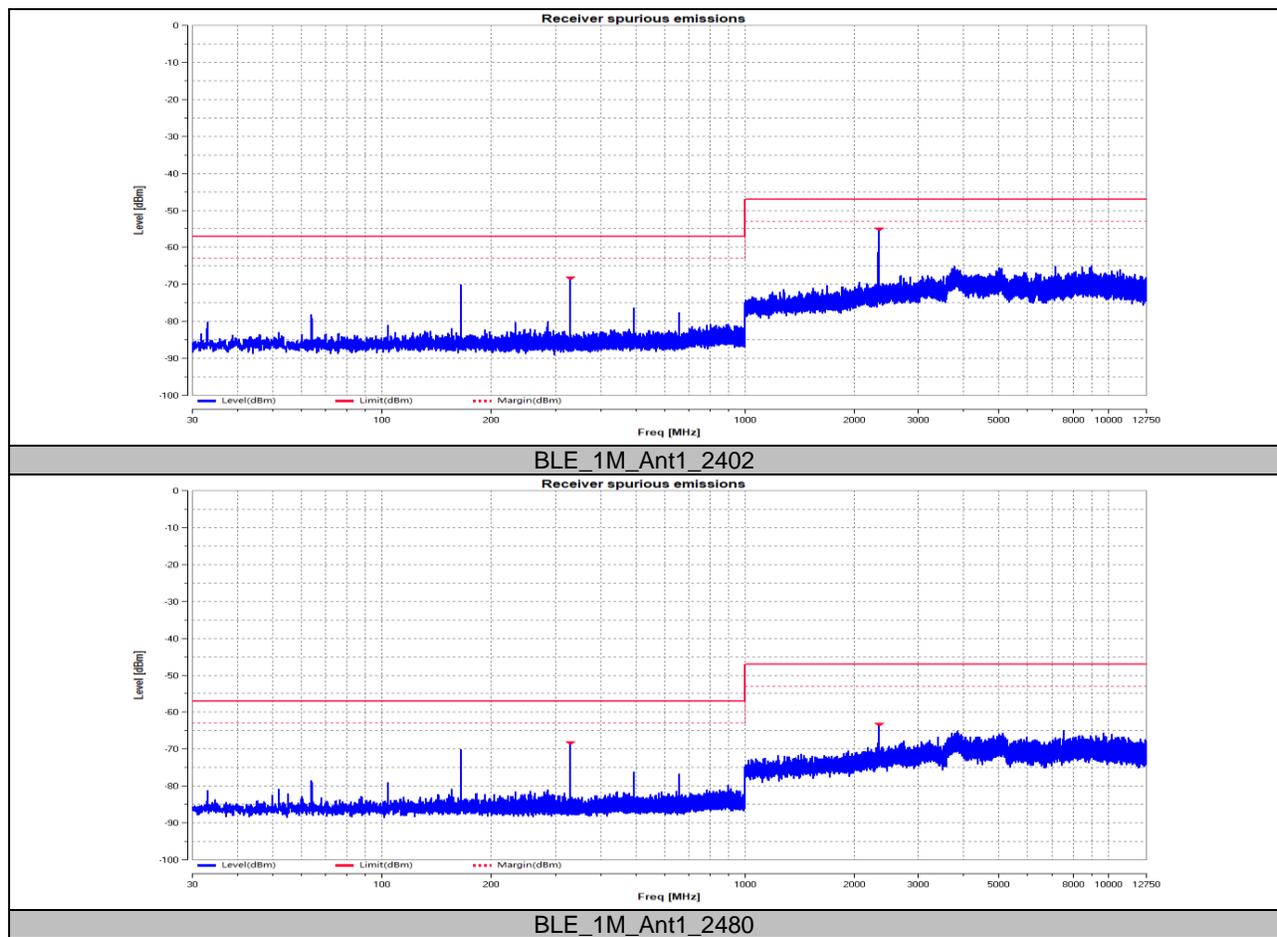
Note All the modes had been tested, but only the worst data was recorded in the report.

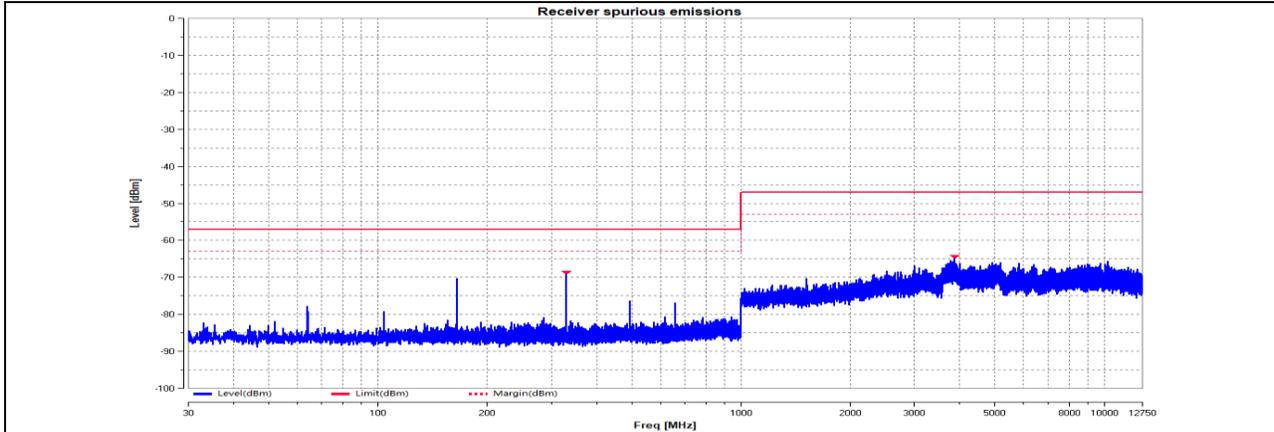
## 9.6. Appendix F: Receiver Spurious Emissions

### 9.6.1. Conducted Test Result-Pre-scan

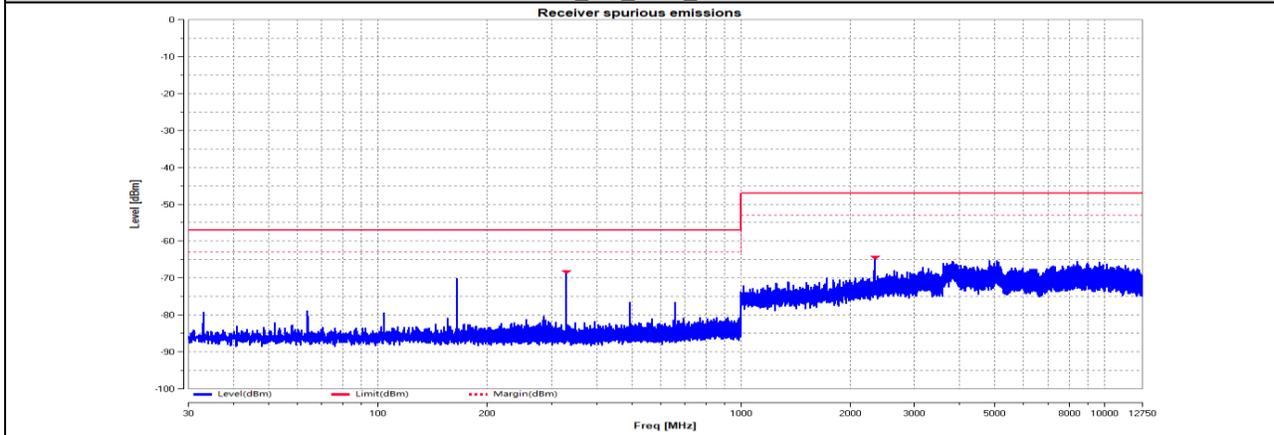
Test Mode	Antenna	Channel	Freq. [MHz]	Level[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	330.55	-68.79	-57.00	PASS
			2336.76	-55.7	-47.00	PASS
		2480	330.55	-68.94	-57.00	PASS
			2335.98	-63.85	-47.00	PASS
BLE_2M	Ant1	2402	330.55	-69.19	-57.00	PASS
			3868.57	-64.96	-47.00	PASS
		2480	330.55	-68.91	-57.00	PASS
			2337.54	-64.89	-47.00	PASS

### 9.6.2. Conducted Test Graphs-Pre-scan





BLE\_2M\_Ant1\_2402

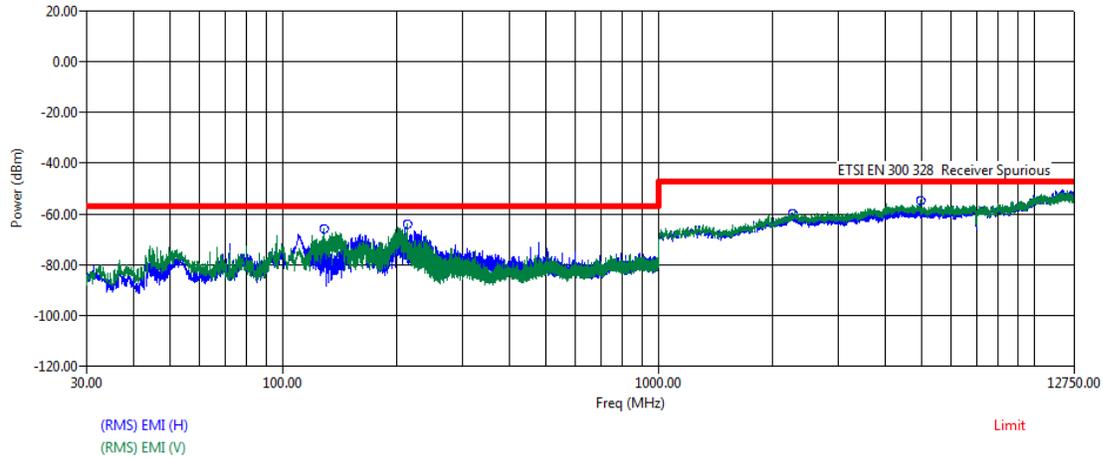


BLE\_2M\_Ant1\_2480



### 9.6.3. Radiated Test Result

Receiver spurious emissions			
Measurement Method	Radiated	Polar:	Horizontal/Vertical
Test Mode:	LE 1M	Test Channel:	CH 0



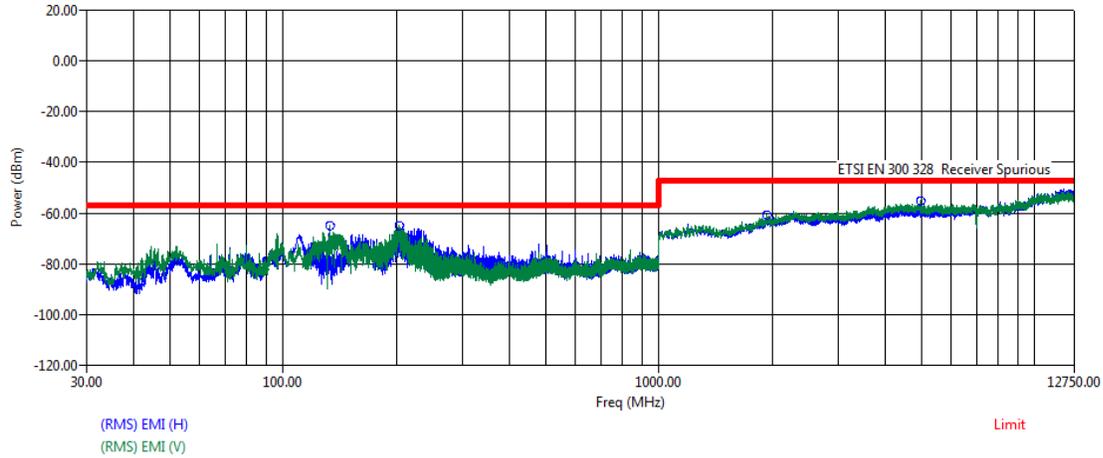
Freq (MHz)	(RMS) Trace (H) (dBuV)	ERP Factor (H) (dB)	Transducer (H) (dB)	Cable (H) (dB)	Preamp (H) (dB)	(RMS) EMI (H) (dBm)	Limit (dBm)	(RMS) Margin (H) (dB)
127.95	57.07	-88.02	0.00	1.45	42.69	-72.19	-57.00	-15.19
213.65	56.17	-86.50	0.00	1.98	42.52	-70.87	-57.00	-13.87
2267.50	43.86	-61.73	0.00	6.43	48.22	-59.66	-47.00	-12.66
4958.50	43.58	-60.68	0.00	9.64	48.30	-55.76	-47.00	-8.76

Freq (MHz)	(RMS) Trace (V) (dBuV)	ERP Factor (V) (dB)	Transducer (V) (dB)	Cable (V) (dB)	Preamp (V) (dB)	(RMS) EMI (V) (dBm)	Limit (dBm)	(RMS) Margin (V) (dB)
127.95	65.13	-89.66	0.00	1.45	42.69	-65.78	-57.00	-8.78
213.65	63.18	-86.67	0.00	1.98	42.52	-64.03	-57.00	-7.03
2267.50	42.98	-61.72	0.00	6.43	48.22	-60.53	-47.00	-13.53
4958.50	43.38	-59.37	0.00	9.64	48.30	-54.65	-47.00	-7.65

Note: EMI=Trace + Cable(Loss) + ERP Factor + Transducer  
Margin=EMI - Limit



Receiver spurious emissions			
Measurement Method	Radiated	Polar:	Horizontal/Vertical
Test Mode:	LE 1M	Test Channel:	CH 39



Freq (MHz)	(RMS) Trace (H) (dBuV)	ERP Factor (H) (dB)	Transducer (H) (dB)	Cable (H) (dB)	Preamp (H) (dB)	(RMS) EMI (H) (dBm)	Limit (dBm)	(RMS) Margin (H) (dB)
133.00	51.07	-88.73	0.00	1.51	42.68	-78.83	-57.00	-21.83
204.05	58.96	-86.39	0.00	1.87	42.51	-68.07	-57.00	-11.07
1936.00	43.10	-64.12	0.00	5.87	48.18	-63.33	-47.00	-16.33
4958.50	41.41	-60.68	0.00	9.64	48.30	-57.94	-47.00	-10.94
Freq (MHz)	(RMS) Trace (V) (dBuV)	ERP Factor (V) (dB)	Transducer (V) (dB)	Cable (V) (dB)	Preamp (V) (dB)	(RMS) EMI (V) (dBm)	Limit (dBm)	(RMS) Margin (V) (dB)
133.00	66.34	-89.92	0.00	1.51	42.68	-64.75	-57.00	-7.75
204.05	61.92	-85.91	0.00	1.87	42.51	-64.63	-57.00	-7.63
1936.00	44.78	-63.17	0.00	5.87	48.18	-60.70	-47.00	-13.70
4958.50	43.11	-59.37	0.00	9.64	48.30	-54.93	-47.00	-7.93

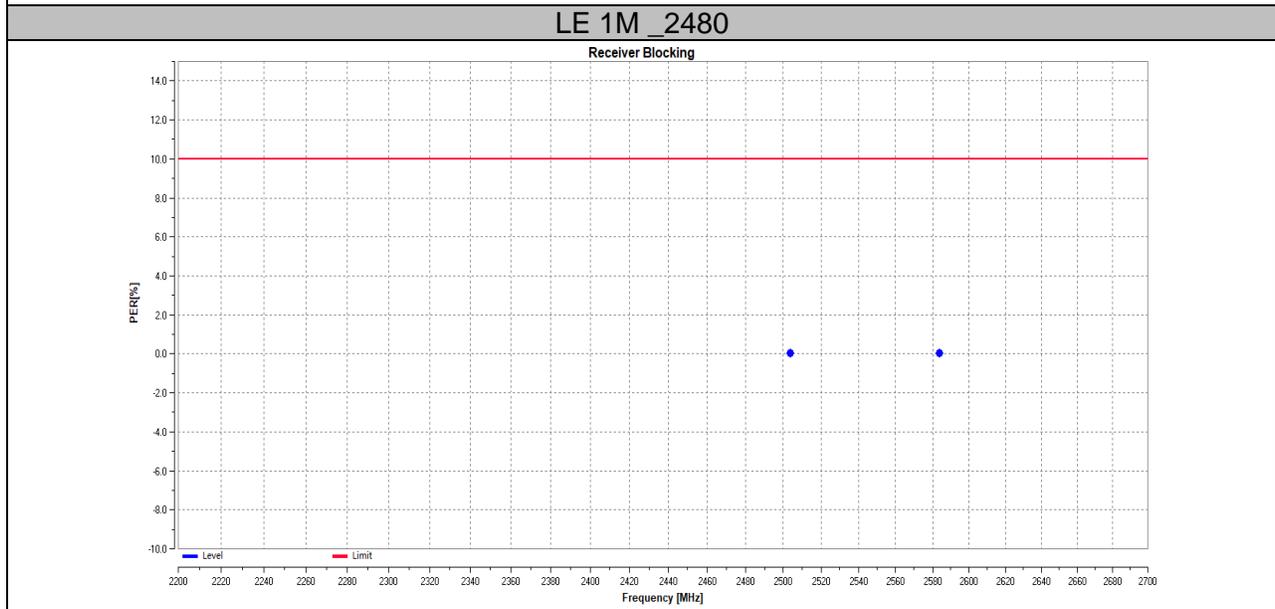
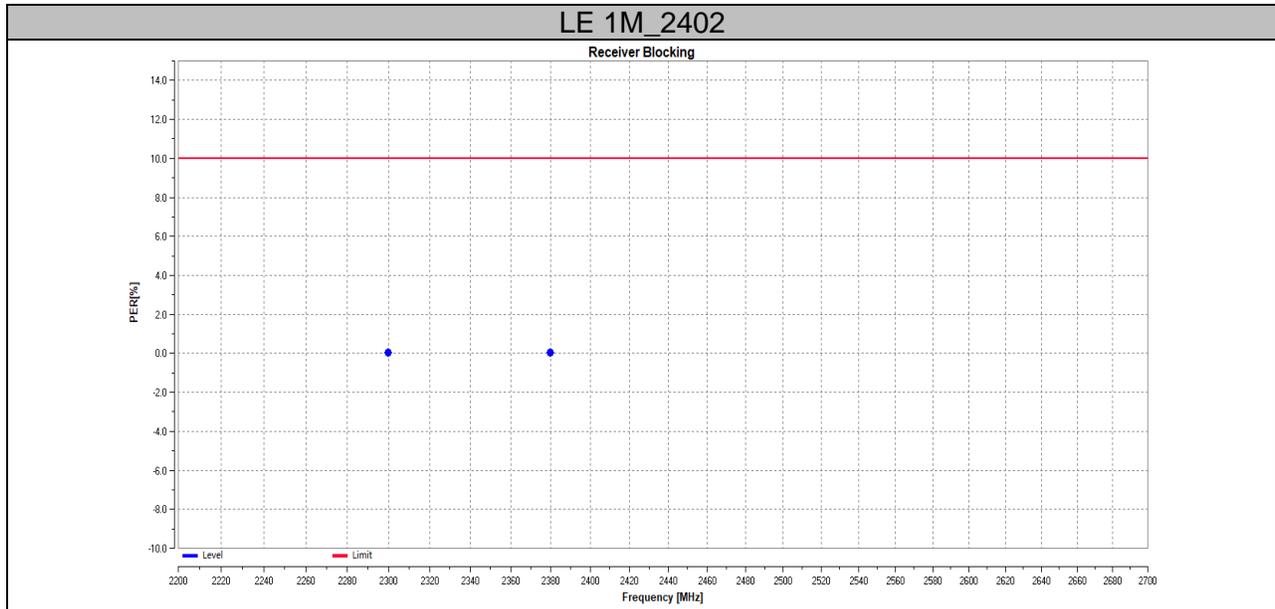
Note: EMI=Trace + Cable(Loss) + ERP Factor + Transducer  
Margin=EMI - Limit

Note All the modes had been tested, but only the worst data was recorded in the report.

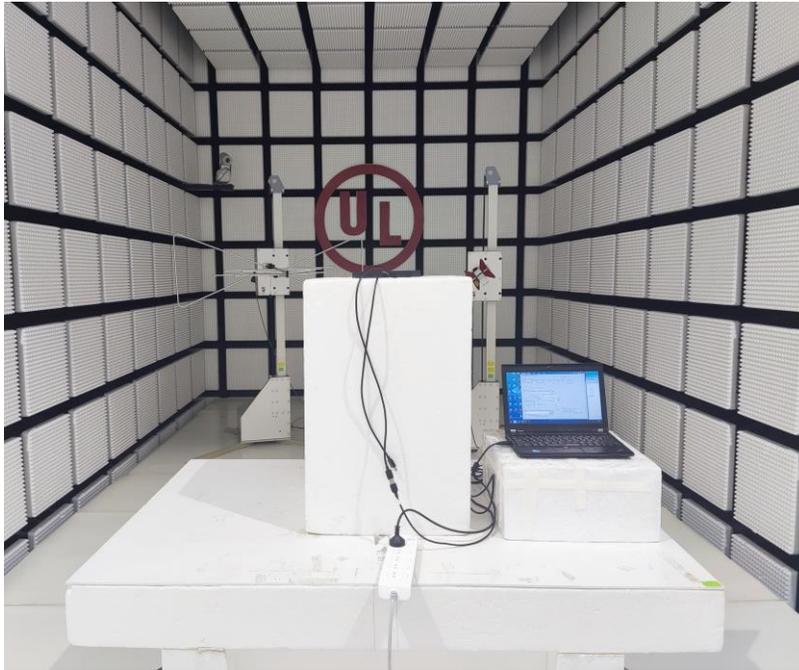
## 9.7. Appendix G: Receiver Blocking

### 9.7.1. Test Result

Channel [MHz]	Freq. [MHz]	PER [%]	Limit [%]	Verdict
2402	2300	0.00	<=10	PASS
	2380	0.00	<= 10	PASS
2480	2504	0.00	<=10	PASS
	2584	0.00	<= 10	PASS



## RADIATED SPURIOUS EMISSIONS TEST PHOTOS



---

**END OF REPORT**