



# CE RADIO TEST REPORT

**Equipment** : CC2340R5 Launchpad™ Development Kit  
**Brand Name** : Texas Instruments  
**Model Name** : LP-EM-CC2340R5  
**Marketing Name** : LP-EM-CC2340R5  
**Applicant** : Texas Instruments Incorporated  
12500 TI BLVD., DALLAS, TEXAS, 75243  
**Manufacturer** : Texas Instruments Incorporated  
12500 TI BLVD., DALLAS, TEXAS, 75243  
**Standard** : ETSI EN 300 328 V2.2.2 (2019-07)

The product was received on Mar. 16, 2023, and testing was performed from Mar. 24, 2023 to Apr. 17, 2023. We, Sporton International Inc. Wensan Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ETSI EN 300 328 V2.2.2 (2019-07), and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval from Sporton International Inc. Wensan Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

**Sporton International Inc. Wensan Laboratory**

No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.)



## Table of Contents

<b>History of this test report.....</b>	<b>3</b>
<b>Summary of Test Result.....</b>	<b>4</b>
<b>1 General Description .....</b>	<b>6</b>
1.1 Product Feature of Equipment Under Test.....	6
1.2 Modification of EUT .....	6
1.3 Testing Facility.....	7
1.4 Applied Standards .....	7
1.5 Test Condition.....	7
<b>2 Test Configuration of Equipment under Test.....</b>	<b>8</b>
2.1 Descriptions of Test Mode .....	8
2.2 Test Mode.....	8
2.3 Connection Diagram of Test System.....	8
2.4 Supported Unit used in test configuration and system .....	8
2.5 EUT Operation Test Setup .....	8
<b>3 Transmitter Parameters .....</b>	<b>9</b>
3.1 Maximum Transmit Power .....	9
3.2 Maximum Equivalent Isotropically Radiated Power (E.I.R.P.) Spectral Density .....	10
3.3 Occupied Channel Bandwidth .....	12
3.4 Transmitter unwanted emissions in the out-of-band domain .....	13
3.5 Transmitter spurious emissions .....	15
<b>4 Receiver Parameters.....</b>	<b>17</b>
4.1 Receiver spurious emissions .....	17
4.2 Receiver Blocking Test.....	19
<b>5 Geo-location Capability .....</b>	<b>23</b>
5.1 Geo-location .....	23
<b>6 List of Measuring Equipment.....</b>	<b>24</b>
<b>7 Uncertainty Evaluation .....</b>	<b>25</b>
<b>Appendix A. Test Result of Conducted Test Items</b>	
<b>Appendix B. Radiated Spurious Emission Test Data</b>	
<b>Appendix C. Photographs of Test Configuration</b>	



## History of this test report

Report No.	Version	Description	Issue Date
ER331602	01	Initial issue of report	Apr. 21, 2023

## Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	4.3.1.2 4.3.2.2	Maximum Transmit Power	PASS	-
3.2	4.3.2.3	Maximum Equivalent Isotropically Radiated Power (E.I.R.P.) Spectral Density	PASS	Only applicable for modulations other than FHSS
3.3	4.3.1.8 4.3.2.7	Occupied Channel Bandwidth	PASS	-
-	4.3.1.4 4.3.1.5	Frequency Hopping Requirements	Not Required	Only applicable for FHSS
3.4	4.3.1.9 4.3.2.8	Transmitter spurious emissions in OOB	PASS	-
3.5	4.3.1.10 4.3.2.9	Transmitter spurious emissions	PASS	6.05 dB under the limit at 12220.000 MHz for Bluetooth Mode
4.1	4.3.1.11 4.3.2.10	Receiver spurious emissions	PASS	1.78 dB under the limit at 4948.670 MHz for Bluetooth Mode
-	4.3.1.7 4.3.2.6	Adaptivity	Not Required	Only applicable for adaptive equipment Output Power >10dBm
4.2	4.3.1.12 4.3.2.11	Receiver Blocking	PASS	-



Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
-	4.3.1.3 4.3.2.4	Duty cycle, Tx-Sequence, Tx-gap	Not Required	Only applicable for non-adaptive equipment Output Power >10dBm
-	4.3.1.6 4.3.2.5	Medium Utilisation (MU) factor	Not Required	

**Note:**

1. Bluetooth belongs to adaptive equipment and EIRP < 10dBm.
2. Not required means after assessing, test items are not necessary to carry out.

**Conformity Assessment Condition:**

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacture who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.
2. The measurement uncertainty please refer to each test result in the section "Uncertainty Evaluation".

**Disclaimer:**

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.

**Reviewed by: Danny Lee**

**Report Producer: Ming Chen**



# 1 General Description

## 1.1 Product Feature of Equipment Under Test

Product Feature
<b>General Specs</b> Bluetooth LE (125 kbps, 500 kbps, 1Mbps, 2Mbps)
<b>Antenna Type</b> Bluetooth LE: Inverted F PCB Antenna

**Remark:** The EUT's information above is declared by manufacturer. Please refer to Disclaimer in report summary.

## 1.2 Modification of EUT

No modifications made to the EUT during the testing.

### 1.3 Testing Facility

Test Site	Sporton International Inc. Wensan Laboratory		
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855		
Test Site No.	Sporton Site No.		
	TH05-HY	05CH06-HY	TH08-HY
Test Engineer	Mina Liu	Jarvis Huang	Louis Chung
Temperature (°C)	24~26	19~26	23.6~26.7
Relative Humidity (%)	51~55	54~60	62.2~68.1

### 1.4 Applied Standards

According to the specifications declared by the manufacturer, the EUT must comply with the requirements of ETSI EN 300 328 V2.2.2 (2019-07).

**Note:** All test items were verified and recorded according to the standards and without any deviation during the test.

### 1.5 Test Condition

Normal Voltage	DC 3.3V
Normal Temperature	25°C
Extreme Temperature	-40°C and 85°C

**Note:** The product operating temperature range per the manufacture is -40 °C to 125 °C.  
Extreme temperature was performed between -40 °C and 85 °C due to test facility limitations.

## 2 Test Configuration of Equipment under Test

### 2.1 Descriptions of Test Mode

- During testing, the interface cables and equipment positions were varied according to ETSI EN 300 328 V2.2.2 (2019-07).
- The complete test system included EUT for RF test.

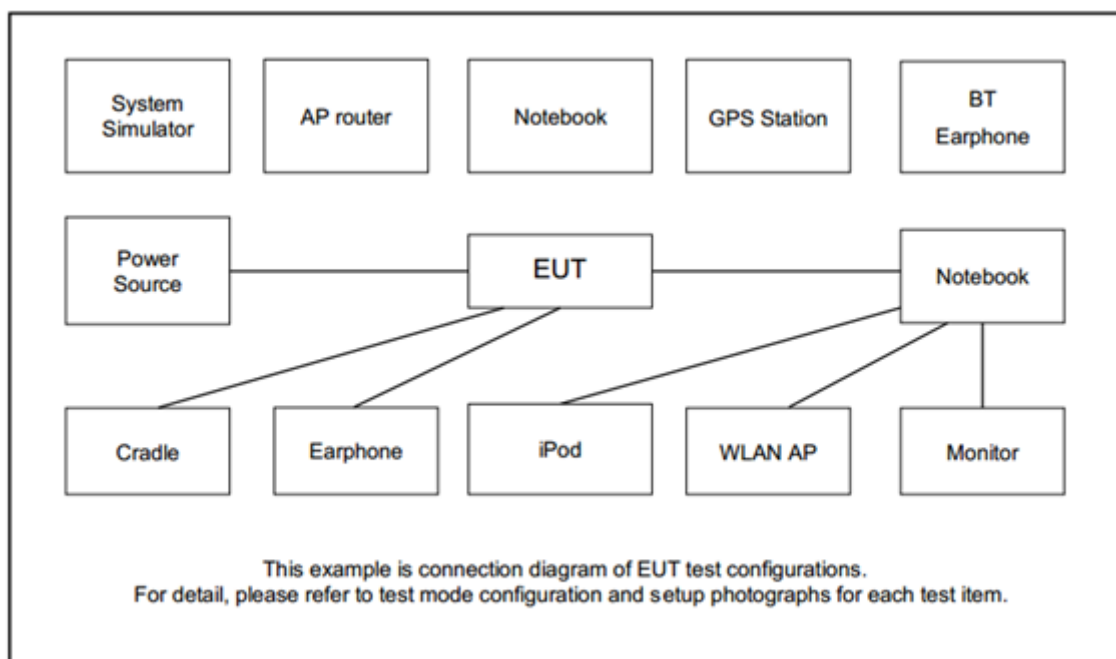
### 2.2 Test Mode

Frequency range of radiation was investigated from 25 MHz to 18 GHz.

For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases were recorded in this report.

**Remark:** The detailed test modes are shown in appendix B.

### 2.3 Connection Diagram of Test System



### 2.4 Supported Unit used in test configuration and system

Item	Equipment	Brand Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Notebook	DELL	Latitude 3400	NA	N/A	AC I/P: Shielded, 1.8m DC O/P: Unshielded, 1.2m

### 2.5 EUT Operation Test Setup

The RF utility, "SmartRF Studio" was installed in the notebook in order to make the EUT provide functions like channel selection and power level for continuous transmitting and receiving signals.



### 3 Transmitter Parameters

#### 3.1 Maximum Transmit Power

##### 3.1.1 Limit of Effective Isotropic Radiated Power

SUBCLAUSE 4.3.1.2.3 and 4.3.2.2.3	
TEST CONDITION	LIMIT
Normal and Extreme Temperature Conditions	20dBm (e.i.r.p)

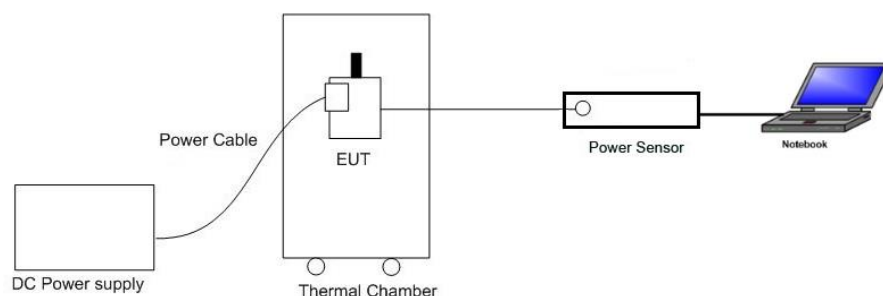
##### 3.1.2 Measuring Instruments

Please refer to the measuring equipment list in the section 6 of this test report.

##### 3.1.3 Test Procedure

1. The measurement procedure follows the clause 5.4.2.2.1 of the ETSI EN 300 328 V2.2.2 (2019-07).
2. Place the EUT in thermal chamber.
3. The EUT is connected to external power supply.
4. Setting thermal chamber temperature and power supply voltage at suitable values.
5. The EIRP = A+G+Y, where A is the power measured, G is the assembly gain of the individual antenna of the EUT in dBi and Y is the additional beamforming gain of the EUT in dB if applicable, here, Y=0.
6. The measurement duration is at least 1 second to ensure a minimum number of bursts (at least 10) are captured.

##### 3.1.4 Test Setup



##### 3.1.5 Test Results

Please refer to Appendix A.

## 3.2 Maximum Equivalent Isotropically Radiated Power (E.I.R.P.) Spectral Density

### 3.2.1 Limit of Maximum Power Spectral Density

SUBCLAUSE 4.3.2.3.3	
TEST CONDITION	LIMIT
Normal and Extreme Temperature Conditions	10dBm / MHz

**Remark:** Maximum spectral power density is not applicable to FHSS system device.

### 3.2.2 Measuring Instruments

Please refer to the measuring equipment list in the section 6 of this test report.

### 3.2.3 Test Procedure

1. The measurement procedure follows the clause 5.4.3.2.1 of the ETSI EN 300 328 V2.2.2 (2019-07).
2. These measurements shall only be performed at normal test conditions.
3. The measurement shall be repeated for the equipment being configured to operate at the lowest, the middle, and the highest frequency of the stated frequency range.
4. The test procedure shall be as follows:

**Step 1:**

Connect the EUT to the spectrum analyzer and use the following settings:

Start Frequency	2400MHz
Stop Frequency	2483.5MHz
Resolution BW	10kHz
Video BW	30kHz
Sweep Points	8350
Detector	RMS
Trace Mode	Max Hold
Sweep time	10 sec

**Step 2:**

Add up the values for amplitude (power) for all the samples in the file.

**Step 3:**

Normalize the individual values for amplitude so that the sum is equal to the RF Output Power (e.i.r.p.) measured.

**Step 4:**

Starting from the first sample in the file (lowest frequency), add up the power of the following samples representing a 1 MHz segment and record the results for power and position (i.e. sample #1 to #100). This is the Power Spectral Density (e.i.r.p.) for the first 1 MHz segment which shall be recorded.

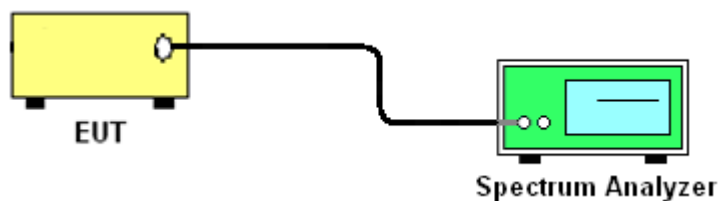
**Step 5:**

Shift the start point of the samples added up in step 4 by 1 sample and repeat the procedure in step 4 (i.e. sample #2 to #101).

**Step 6:**

Repeat step 5 until the end of the data set and record the radiated Power Spectral Density values for each of the 1 MHz segments.

From all the recorded results, the highest value is the maximum Power Spectral Density for the EUT. This value shall be recorded in the test report.

**3.2.4 Test Setup****3.2.5 Test Results**

Please refer to Appendix A.

### 3.3 Occupied Channel Bandwidth

#### 3.3.1 Limit of Occupied Channel Bandwidth

Occupied Channel Bandwidth fall completely within 2.4 GHz – 2.4835 GHz

#### 3.3.2 Measuring Instruments

Please refer to the measuring equipment list in the section 6 of this test report.

#### 3.3.3 Test Procedure

1. The measurement procedure follows the clause 5.4.7.2.1 of the ETSI EN 300 328 V2.2.2 (2019-07).
2. The measurement shall be performed only on the lowest and the highest frequency within the stated frequency range.
3. The test procedure shall be as follows:

##### Step 1:

Connect the EUT to the spectrum analyzer and use the following settings:

Center Frequency	Channel under test
Resolution BW	1 % of the span
Video BW	3 × RBW
Frequency Span	2 × Nominal Channel Bandwidth
Detector	RMS
Trace Mode	Max Hold
Sweep Time	1 s

##### Step 2:

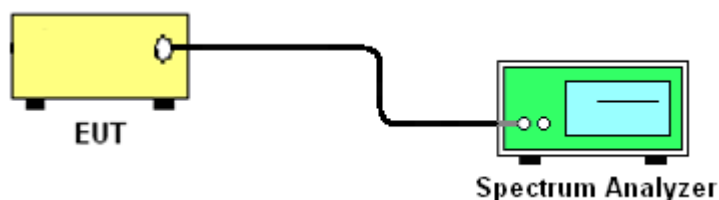
Wait until the trace is completed.

Find the peak value of the trace and place the analyzer marker on this peak.

##### Step 3:

Use the 99 % bandwidth function of the spectrum analyzer to measure the Occupied Channel Bandwidth of the EUT.

#### 3.3.4 Test Setup

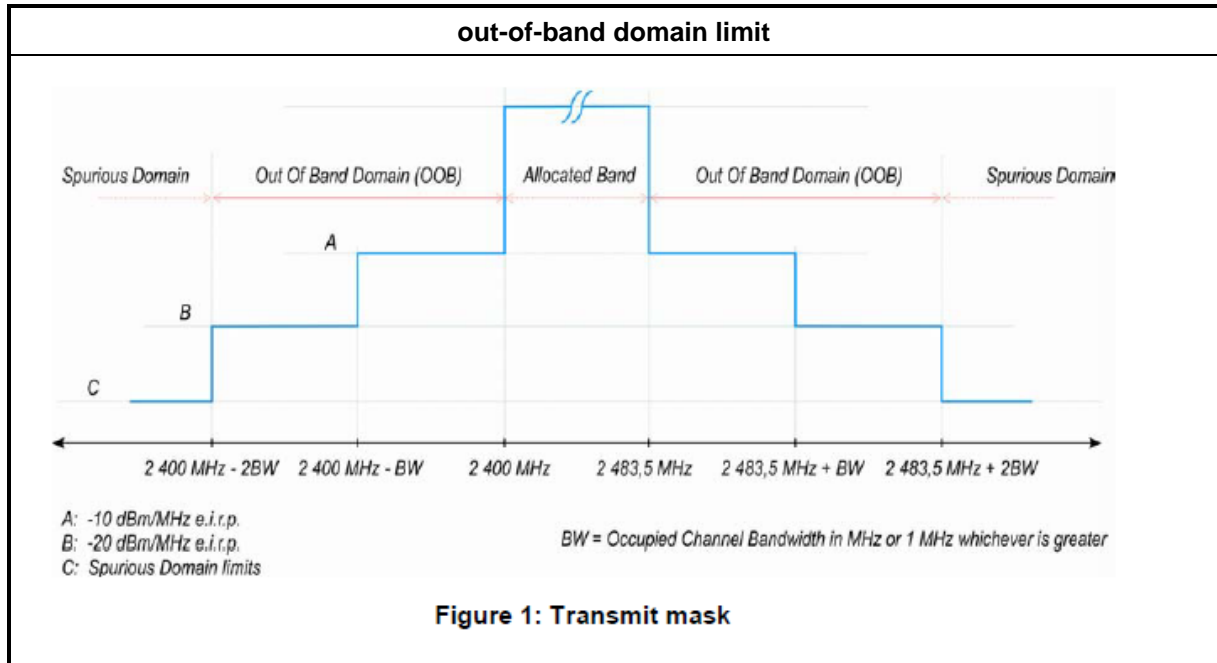


#### 3.3.5 Test Results

Please refer to Appendix A.

### 3.4 Transmitter unwanted emissions in the out-of-band domain

#### 3.4.1 Transmitter unwanted emissions in the out-of-band domain limit



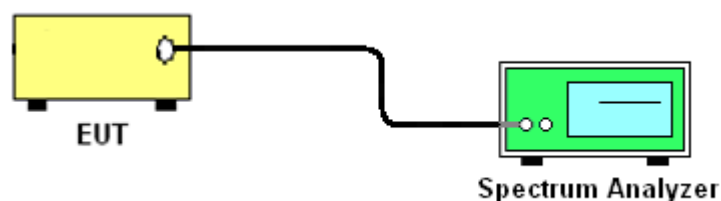
#### 3.4.2 Measuring Instruments

Please refer to the measuring equipment list in the section 6 of this test report.

#### 3.4.3 Test Procedures

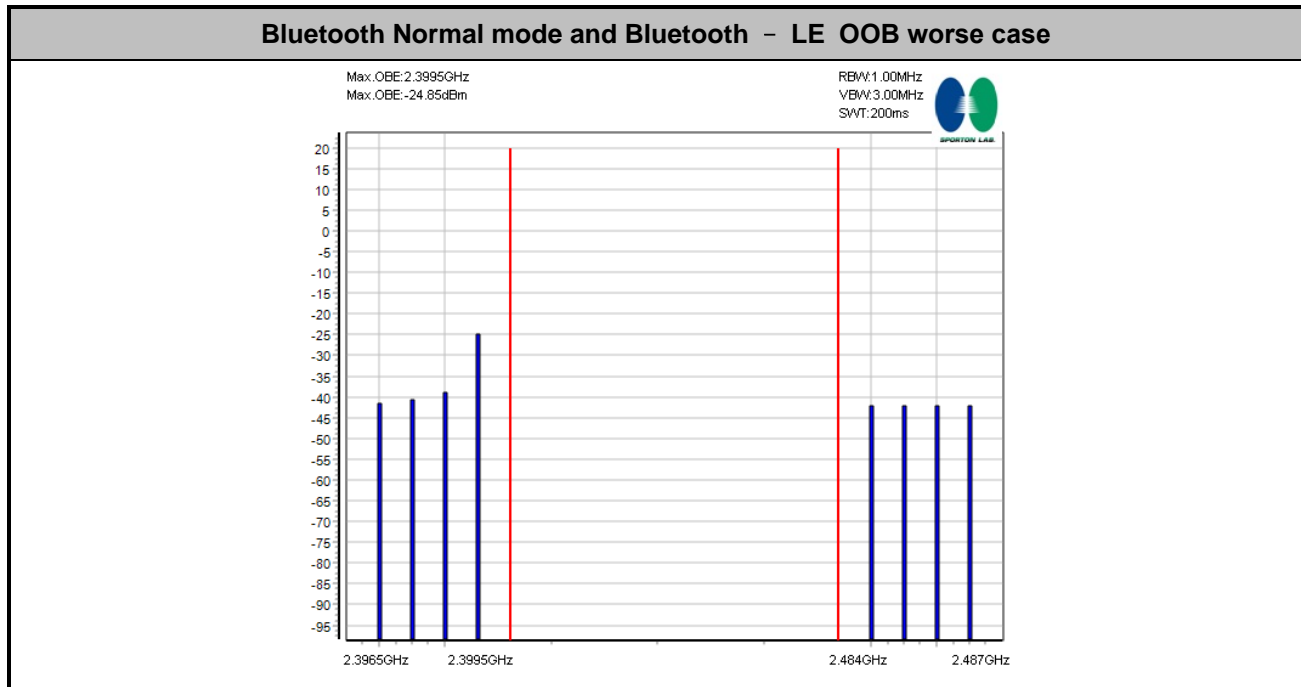
1. The measurement procedure follows the clause 5.4.8.2.1 of the ETSI EN 300 328 V2.2.2 (2019-07).
2. These measurements shall only be performed at normal test conditions.
3. For conducted measurements on devices with multiple transmit chains using the results for each of the transmit chains for the corresponding 1 MHz segments shall be added and compared with the transmit mask limit.

#### 3.4.4 Test Setup



### 3.4.5 Test Results

Please refer to Appendix A.



### 3.5 Transmitter spurious emissions

#### 3.5.1 Limit of Transmitter spurious emissions

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.

SUBCLAUSE 4.3.1.10.3 and 4.3.2.9.3		
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

#### 3.5.2 Measuring Instruments

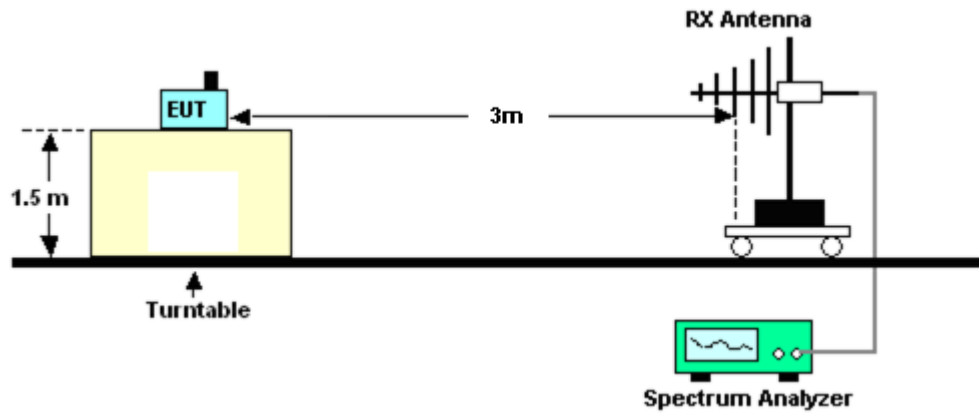
Please refer to the measuring equipment list in the section 6 of this test report.

#### 3.5.3 Test Procedures

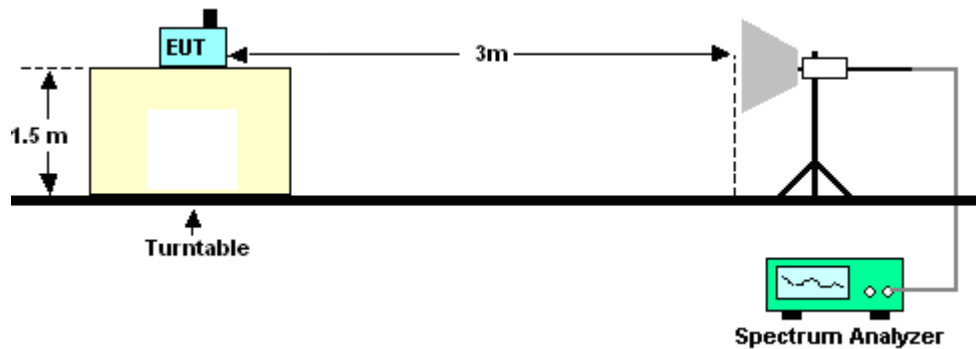
1. The measurement procedure follows the clause 5.4.9.2.2 of the ETSI EN 300 328 V2.2.2 (2019-07).
2. The EUT is placed on a turntable with 1.5m height.
3. The test distance between the receiving antenna and the EUT is 3 meter below 1GHz frequency range, and 3 meter which is in far field test condition for measured frequency above 1GHz, while the receiving (test) antenna is kept at 1.5 meter height.
4. Set EUT in continuous transmitting with maximum output power.
5. The table is rotated from 0 to 360 degree to search the highest radiated emission.
6. Repeating step 3 and 4 for each polarization and channel to find the worst emission level.
7. The results obtained are compared to the limits in order to prove compliance with the requirement.

### 3.5.4 Test Setup

<Below 1GHz>



<Above 1GHz>



### 3.5.5 Test Results

Please refer to Appendix B.



## 4 Receiver Parameters

### 4.1 Receiver spurious emissions

#### 4.1.1 Limit of Receiver spurious emissions

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.

SUBCLAUSE 4.3.1.11.3 and 4.3.2.10.3		
FREQUENCY RANGE	MAXIMUM POWER	BANDWIDTH
30 MHz to 1 GHz	-57 dBm	100kHz
1 GHz to 12,75 GHz	-47 dBm	1MHz

#### 4.1.2 Measuring Instruments

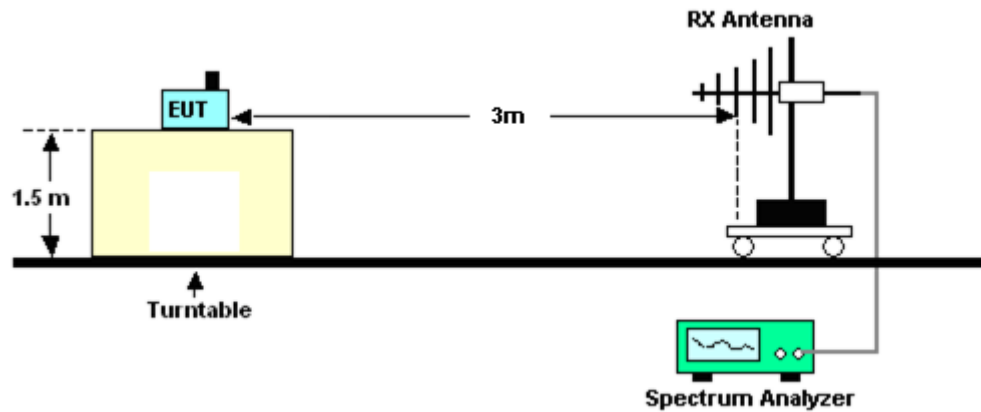
Please refer to the measuring equipment list in the section 6 of this test report.

#### 4.1.3 Test Procedures

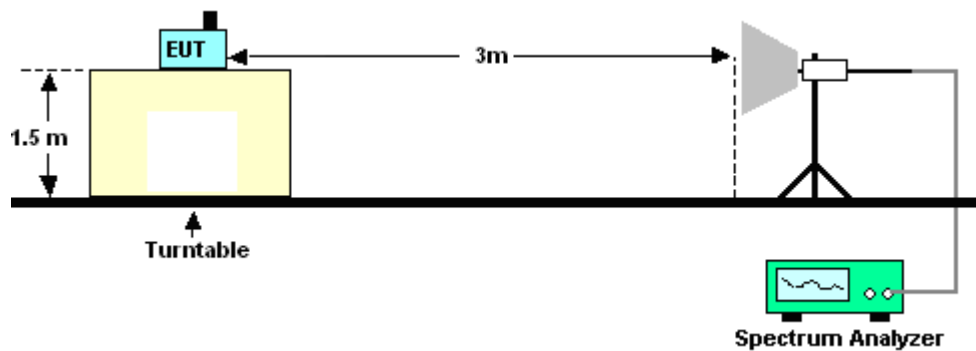
1. The measurement procedure follows the clause 5.4.10.2.2 of the ETSI EN 300 328 V2.2.2 (2019-07).
2. The EUT is placed on a turntable with 1.5m height.
3. The test distance between the receiving antenna and the EUT is 3 meter below 1GHz frequency range, and 3 meter which is in far field test condition for measured frequency above 1GHz, while the receiving (test) antenna is kept at 1.5 meter height.
4. Set EUT in receiving mode.
5. The table is rotated from 0 to 360 degree to search the highest radiated emission.
6. Repeating step 3 and 4 for each polarization and channel to find the worst emission level.
7. The results obtained are compared to the limits in order to prove compliance with the requirement.

#### 4.1.4 Test Setup

<Below 1GHz>



<Above 1GHz>



#### 4.1.5 Test Results

Please refer to Appendix B.

## 4.2 Receiver Blocking Test

### 4.2.1 Limit of Receiver Blocking Test

The minimum performance criterion shall be a PER less than or equal to 10%.

#### Receiver category 1

1. Adaptive equipment with maximum RF output power > 10dBm e.i.r.p.

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 dBm + 10 × log <sub>10</sub> (OCBW)) or -68 dBm whichever is less (see note 2)	2 380 2 504	-34	CW
(-139 dBm + 10 × log <sub>10</sub> (OCBW)) or -74 dBm whichever is less (see note 3)	2 300 2 330 2 360 2 524 2 584 2 674		
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 <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.			
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 <sub>min</sub> + 20 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.			
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**

1. Non-adaptive equipment with MU 1% ~ 10%
2. Adaptive equipment with Maximum RF output power < 10dBm e.i.r.p.

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
$(-139 \text{ dBm} + 10 \times \log_{10}(\text{OCBW}) + 10 \text{ dB})$ or $(-74 \text{ dBm} + 10 \text{ dB})$ 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 <math>P_{\min} + 26 \text{ dB}</math> where <math>P_{\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: 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**

1. Non-adaptive equipment with MU < 1%
2. Adaptive equipment with Maximum RF output power < 0dBm e.i.r.p.

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
$(-139 \text{ dBm} + 10 \times \log_{10}(\text{OCBW}) + 20 \text{ dB})$ or $(-74 \text{ dBm} + 20 \text{ dB})$ 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 <math>P_{\min} + 30 \text{ dB}</math> where <math>P_{\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: 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>			

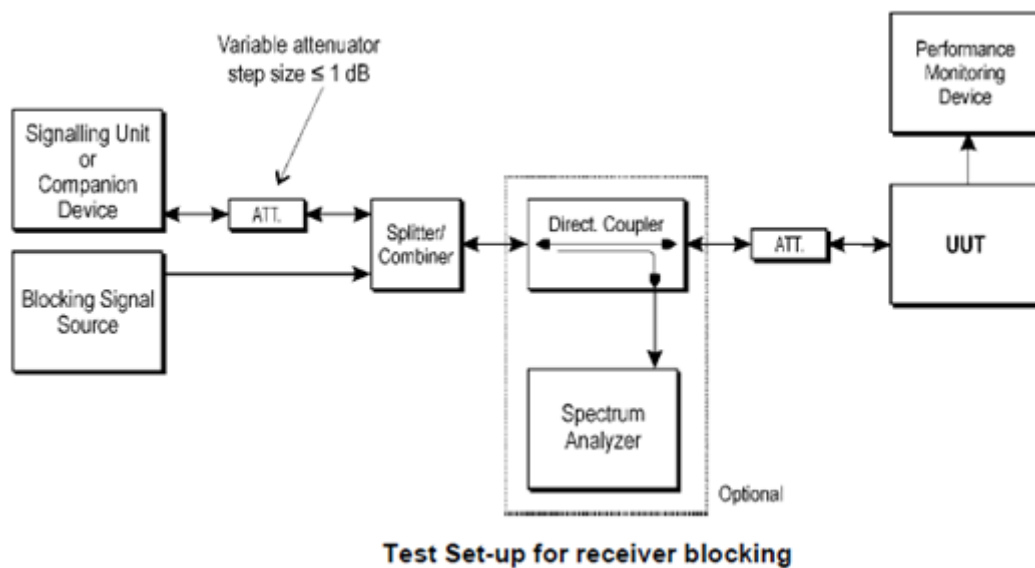
## 4.2.2 Measuring Instruments

Please refer to the measuring equipment list in the section 6 of this test report.

## 4.2.3 Test Procedures

1. The measurement procedure follows the clause 5.4.11.2.1 of the ETSI EN 300 328 V2.2.2 (2019-07).
2. For systems using multiple receive chains only one chain (antenna port) need to be tested. All other receiver inputs shall be terminated.
3. For non-FHSS equipment, having more than one operating channel, the operating channels on which the testing has to be performed shall be selected as follows:  
For testing blocking frequencies less than 2400 MHz, the equipment shall operate on the lowest operating channel.  
For testing blocking frequencies greater than 2500 MHz, the equipment shall operate on the highest operating channel.
4. Both the wanted and blocking signals are adjusted by the in-band antenna gain.

## 4.2.4 Test Setup



#### 4.2.5 Test Results of Receiver Blocking

Mode	Receiver category
BLE	2

Bluetooth BLE Channel 00				
Wanted signal From companion	Wanted signal to be tested (dBm)	Blocking signal Frequency(MHz)	Blocking signal Power(dBm)	PER (%)
$(-139 \text{ dBm} + 10 \times \log_{10}(\text{OCBW}) + 10)$ or $(-74 \text{ dBm} + 10)$ whichever is less	$-69 \text{ dBm}$ $(-139 \text{ dBm} + 10 \times \log_{10}(\text{OCBW of } 1\text{MHz}) + 10 = -69\text{dBm} < -64\text{dBm})$	2380	-34	0.04
		2300	-34	0.01

Bluetooth BLE Channel 39				
Wanted signal From companion	Wanted signal to be tested (dBm)	Blocking signal Frequency(MHz)	Blocking signal Power(dBm)	PER (%)
$(-139 \text{ dBm} + 10 \times \log_{10}(\text{OCBW}) + 10)$ or $(-74 \text{ dBm} + 10)$ whichever is less	$-69 \text{ dBm}$ $(-139 \text{ dBm} + 10 \times \log_{10}(\text{OCBW of } 1\text{MHz}) + 10 = -69\text{dBm} < -64\text{dBm})$	2504	-34	0.13
		2584	-34	0.04

## **5 Geo-location Capability**

### **5.1 Geo-location**

#### **5.1.1 Definition and Requirement**

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.

The geographical location determined by the equipment shall not be accessible to the user.

#### **5.1.2 Description**

Manufacturer shall implement the requirement for marketing units when this function is supported.



## 6 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Power Sensor	DARE	RPR3006W	17I00015SNO 37 (NO:167)	10MHz~6GHz	Dec. 07, 2022	Mar. 24, 2023~ Apr. 17, 2023	Dec. 06, 2023	Conducted (TH05-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101905	10Hz - 40GHz	Aug. 03, 2022	Mar. 24, 2023~ Apr. 17, 2023	Aug. 02, 2023	Conducted (TH05-HY)
Temperature Chamber	ESPEC	SU-241	92003713	-40℃ ~90℃	May 19, 2022	Mar. 24, 2023~ Apr. 17, 2023	May 18, 2023	Conducted (TH05-HY)
Bilog Antenna	TESEQ	CBL 6111D	55605	30MHz~1GHz	Oct. 22, 2022	Apr. 14, 2023	Oct. 21, 2023	Radiation (05CH06-HY)
Horn Antenna	ESCO	3117	00211469	1GHz~18GHz	Oct. 12, 2022	Apr. 14, 2023	Oct. 11, 2023	Radiation (05CH06-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101408	10Hz~44GHz	Aug. 16, 2022	Apr. 14, 2023	Aug. 15, 2023	Radiation (05CH06-HY)
Preamplifier	Keysight	83017A	MY53270078	1GHz~26.5GHz	Oct. 24, 2022	Apr. 14, 2023	Oct. 23, 2023	Radiation (05CH06-HY)
Amplifier	SONOMA	310N	187231	9kHz~1GHz	Jan. 10, 2023	Apr. 14, 2023	Jan. 09, 2024	Radiation (05CH06-HY)
Preamplifier	E-INSTRUMENT TECH LTD.	ERA-100M-18 G-56-01-A70	EC1900250	1GHz-18GHz	Nov. 03, 2022	Apr. 14, 2023	Nov. 02, 2023	Radiation (05CH06-HY)
USB Data Logger	TECPEL	TR-32	HE17XD1148	N/A	Nov. 02, 2022	Apr. 14, 2023	Nov. 01, 2023	Radiation (05CH06-HY)
Antenna Mast	ChainTek	MD-200	1308055	1m~4m	N/A	Apr. 14, 2023	N/A	Radiation (05CH06-HY)
Turn Table	EMEC	TT 2000	N/A	0-360 degree	N/A	Apr. 14, 2023	N/A	Radiation (05CH06-HY)
Test Software	Audix E3	6.2009-8-24	RK-001179	N/A	N/A	Apr. 14, 2023	N/A	Radiation (05CH06-HY)
Signal generation	Anritsu	MG3694C	163401	0.1Hz~40GHz	Feb. 08, 2023	Mar. 31, 2023	Feb. 07, 2024	RX Blocking (TH08-HY)
USB Power Sensor	DARE	RPR3006W	17I00015SNO 35 (NO:109)	10MHz~6GHz	Jan. 11, 2023	Mar. 31, 2023	Jan. 10, 2024	RX Blocking (TH08-HY)

**Note:** Test equipment calibration is traceable to the procedure of ISO17025.





## 7 Uncertainty Evaluation

Test Item		Uncertainty
Occupied Channel Bandwidth		$1.6 \times 10^{-6}$ MHz
RF output power, conducted		$\pm 0.84$ dB
Power density, conducted		$\pm 1.10$ dB
Radiated emissions	30MHz ~ 1GHz	$\pm 3.42$ dB
	1GHz ~ 18GHz	$\pm 3.89$ dB
Temperature		$\pm 0.58$ °C
Humidity		$\pm 3.46$ %

**Appendix A. Test Result of Conducted Test Items**

Test Engineer	Mina Liu	Temperature	24-26	°C
Test Date	2023/3/24~2023/4/17	Relative Humidity	51-55	%

**TEST RESULTS DATA**  
**EIRP Power**

Conducted Power (dBm)												
Mod.	Data Rate	NTx	CH.	Freq. (MHz)	Temperature Normal		Extreme Temperature Low		Extreme Temperature High		Gain (dBi)	
					25 °C		-40 °C		85 °C			
					Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2
BLE	1Mbps	1	0	2402	5.20	-	6.10	-	3.80	-	3.30	-
BLE	1Mbps	1	19	2440	5.20	-	6.10	-	4.00	-	3.30	-
BLE	1Mbps	1	39	2480	5.30	-	6.00	-	3.80	-	3.30	-
BLE	2Mbps	1	0	2402	5.30	-	6.10	-	3.90	-	3.30	-
BLE	2Mbps	1	19	2440	5.00	-	6.10	-	3.90	-	3.30	-
BLE	2Mbps	1	39	2480	5.20	-	6.00	-	3.80	-	3.30	-

EIRP Power (dBm)												
Mod.	Data Rate	NTx	CH.	Freq. (MHz)	Temperature Normal		Extreme Temperature Low		Extreme Temperature High		Limit (dBm)	Pass/Fail
					25 °C		-40 °C		85 °C			
					Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2		
BLE	1Mbps	1	0	2402	8.50	-	9.40	-	7.10	-	20	Pass
BLE	1Mbps	1	19	2440	8.50	-	9.40	-	7.30	-	20	Pass
BLE	1Mbps	1	39	2480	8.60	-	9.30	-	7.10	-	20	Pass
BLE	2Mbps	1	0	2402	8.60	-	9.40	-	7.20	-	20	Pass
BLE	2Mbps	1	19	2440	8.30	-	9.40	-	7.20	-	20	Pass
BLE	2Mbps	1	39	2480	8.50	-	9.30	-	7.10	-	20	Pass

**TEST RESULTS DATA**  
**EIRP Power Density**

Power Density								
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	EIRP Power Density (dBm/MHz)		Limit (dBm /MHz)	Pass/Fail
					Ant 1	Ant 2		
BLE	1Mbps	1	0	2402	8.42	-	10	Pass
BLE	1Mbps	1	19	2440	8.41	-	10	Pass
BLE	1Mbps	1	39	2480	8.52	-	10	Pass
BLE	2Mbps	1	0	2402	7.44	-	10	Pass
BLE	2Mbps	1	19	2440	7.18	-	10	Pass
BLE	2Mbps	1	39	2480	7.29	-	10	Pass

**TEST RESULTS DATA**  
**99% Occupied Bandwidth**

Occupied Bandwidth												
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Occupied BW (MHz)		Freq. Low (MHz)		Freq. High (MHz)		Limit (Within operating Band)	Pass/Fail
					Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2		
BLE	1Mbps	1	0	2402	1.08	-	2401.44	-	2402.51	-		Pass
BLE	1Mbps	1	39	2480	1.08	-	2479.44	-	2480.52	-		Pass
BLE	2Mbps	1	0	2402	2.07	-	2400.95	-	2403.02	-		Pass
BLE	2Mbps	1	39	2480	2.09	-	2478.95	-	2481.04	-		Pass

**TEST RESULTS DATA**  
**OOB Emission Level**

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	OOB Emission Worst Level (dBm/MHz)		Limit (dBm /MHz)	Pass/Fail
					Ant 1	Ant 2		
BLE	1Mbps	1	0	2402	-37.85	-	-10,-20	Pass
BLE	1Mbps	1	39	2480	-40.16	-	-10,-20	Pass
BLE	2Mbps	1	0	2402	-24.85	-	-10,-20	Pass
BLE	2Mbps	1	39	2480	-39.96	-	-10,-20	Pass

**TEST RESULTS DATA**  
**EIRP Power**

Conducted Power (dBm)												
Mod.	Data Rate (bps)	NTx	CH.	Freq. (MHz)	Temperature Normal		Extreme Temperature Low		Extreme Temperature High		Gain (dBi)	
					25 °C		-40 °C		85 °C			
					Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2
BLE	125k	1	0	2402	5.20	-	6.00	-	3.70	-	3.30	-
BLE	125k	1	19	2440	5.10	-	5.90	-	3.80	-	3.30	-
BLE	125k	1	39	2480	5.20	-	5.90	-	3.70	-	3.30	-
BLE	500k	1	0	2402	5.10	-	5.90	-	3.80	-	3.30	-
BLE	500k	1	19	2440	5.10	-	5.90	-	3.70	-	3.30	-
BLE	500k	1	39	2480	5.20	-	5.90	-	3.70	-	3.30	-

EIRP Power (dBm)												
Mod.	Data Rate (bps)	NTx	CH.	Freq. (MHz)	Temperature Normal		Extreme Temperature Low		Extreme Temperature High		Limit (dBm)	Pass/Fail
					25 °C		-40 °C		85 °C			
					Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2		
BLE	125k	1	0	2402	8.50	-	9.30	-	7.00	-	20	Pass
BLE	125k	1	19	2440	8.40	-	9.20	-	7.10	-	20	Pass
BLE	125k	1	39	2480	8.50	-	9.20	-	7.00	-	20	Pass
BLE	500k	1	0	2402	8.40	-	9.20	-	7.10	-	20	Pass
BLE	500k	1	19	2440	8.40	-	9.20	-	7.00	-	20	Pass
BLE	500k	1	39	2480	8.50	-	9.20	-	7.00	-	20	Pass

**TEST RESULTS DATA**  
**EIRP Power Density**

Power Density								
Mod.	Data Rate (bps)	NTX	CH.	Freq. (MHz)	EIRP Power Density (dBm/MHz)		Limit (dBm /MHz)	Pass/Fail
					Ant 1	Ant 2		
BLE	125k	1	0	2402	8.43	-	10	Pass
BLE	125k	1	19	2440	8.43	-	10	Pass
BLE	125k	1	39	2480	8.43	-	10	Pass
BLE	500k	1	0	2402	8.32	-	10	Pass
BLE	500k	1	19	2440	8.32	-	10	Pass
BLE	500k	1	39	2480	8.42	-	10	Pass



**TEST RESULTS DATA**  
**99% Occupied Bandwidth**

Occupied Bandwidth												
Mod.	Data Rate (bps)	NTX	CH.	Freq. (MHz)	99% Occupied BW (MHz)		Freq. Low (MHz)		Freq. High (MHz)		Limit (Within operating Band)	Pass/Fail
					Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2		
BLE	125k	1	0	2402	1.05	-	2401.49	-	2402.54	-		Pass
BLE	125k	1	39	2480	1.06	-	2479.49	-	2480.55	-		Pass
BLE	500k	1	0	2402	1.08	-	2401.48	-	2402.55	-		Pass
BLE	500k	1	39	2480	1.08	-	2479.48	-	2480.56	-		Pass

**TEST RESULTS DATA**  
**OOB Emission Level**

Mod.	Data Rate (bps)	NTX	CH.	Freq. (MHz)	OOB Emission Worst Level (dBm/MHz)		Limit (dBm /MHz)	Pass/Fail
					Ant 1	Ant 2		
BLE	125k	1	0	2402	-38.63	-	-10,-20	Pass
BLE	125k	1	39	2480	-41.39	-	-10,-20	Pass
BLE	500k	1	0	2402	-38.64	-	-10,-20	Pass
BLE	500k	1	39	2480	-41.34	-	-10,-20	Pass



## Appendix B. Radiated Spurious Emission Test Data

### B1. Radiated Spurious Emission Test Modes

Antenna	Mode	TX/RX	Test Function	Condition	Modulation	Channel	Frequency	Axis
1	Mode 1	Tx	Bluetooth - LE	1Mbps	GFSK	CH00	2402	Z Plane
1	Mode 2	Tx	Bluetooth - LE	1Mbps	GFSK	CH39	2480	Z Plane
1	Mode 3	Tx	Bluetooth - LE	2Mbps	GFSK	CH00	2402	Z Plane
1	Mode 4	Tx	Bluetooth - LE	2Mbps	GFSK	CH39	2480	Z Plane
1	Mode 5	Rx	Bluetooth - LE	2Mbps	GFSK	CH39	2480	Z Plane

### B2. Summary of each worse mode

Mode	Freq. (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Polarization	Result
1	12740.00	-36.35	-30.00	-6.35	H	Pass
2	12530.00	-36.68	-30.00	-6.68	H	Pass
3	12570.00	-36.13	-30.00	-6.13	V	Pass
4	12220.00	-36.05	-30.00	-6.05	V	Pass
5	4948.67	-48.78	-47.00	-1.78	H	Pass



Mode	1																																																																																																	
	Bluetooth-LE GFSK_CH00																																																																																																	
Ant	1																																																																																																	
Pol.	Horizontal	Vertical																																																																																																
Tx	<div><div><div>Level(dBm)</div><div>Date: 2023-04-14</div><div>Site : 05CH06-HY Condition: 300328_TX HORIZONTAL Power : From system Project : ER 331602 Mode : 1 Plane : Z</div><table><tr><th>Result</th><th>Freq</th><th>Level</th><th>Margin</th><th>Limit</th><th>Read</th><th></th><th></th></tr><tr><th></th><th>MHz</th><th>dBm</th><th>dB</th><th>dBm</th><th>dBm</th><th>Factor</th><th>Pol/Phase</th></tr><tr><td>1</td><td>214.00</td><td>-75.67</td><td>-21.67</td><td>-54.00</td><td>-65.46</td><td>-10.21</td><td>HORIZONTAL</td></tr><tr><td>2</td><td>1990.00</td><td>-46.21</td><td>-16.21</td><td>-30.00</td><td>-60.82</td><td>14.61</td><td>HORIZONTAL</td></tr><tr><td>3</td><td>2798.00</td><td>-47.12</td><td>-17.12</td><td>-30.00</td><td>-63.59</td><td>16.47</td><td>HORIZONTAL</td></tr><tr><td>4 @</td><td>12740.00</td><td>-36.35</td><td>-6.35</td><td>-30.00</td><td>-67.15</td><td>30.80</td><td>HORIZONTAL</td></tr></table></div></div> <div><div><div>Level(dBm)</div><div>Date: 2023-04-14</div><div>Site : 05CH06-HY Condition: 300328_TX VERTICAL Power : From system Project : ER 331602 Mode : 1 Plane : Z</div><table><tr><th>Result</th><th>Freq</th><th>Level</th><th>Margin</th><th>Limit</th><th>Read</th><th></th><th></th></tr><tr><th></th><th>MHz</th><th>dBm</th><th>dB</th><th>dBm</th><th>dBm</th><th>Factor</th><th>Pol/Phase</th></tr><tr><td>1</td><td>666.00</td><td>-71.43</td><td>-17.43</td><td>-54.00</td><td>-71.26</td><td>-0.17</td><td>VERTICAL</td></tr><tr><td>2</td><td>2000.00</td><td>-42.70</td><td>-12.70</td><td>-30.00</td><td>-57.24</td><td>14.54</td><td>VERTICAL</td></tr><tr><td>3</td><td>2856.00</td><td>-46.97</td><td>-16.97</td><td>-30.00</td><td>-63.87</td><td>16.90</td><td>VERTICAL</td></tr><tr><td>4 @</td><td>11510.00</td><td>-36.51</td><td>-6.51</td><td>-30.00</td><td>-67.27</td><td>30.76</td><td>VERTICAL</td></tr></table></div></div>	Result	Freq	Level	Margin	Limit	Read				MHz	dBm	dB	dBm	dBm	Factor	Pol/Phase	1	214.00	-75.67	-21.67	-54.00	-65.46	-10.21	HORIZONTAL	2	1990.00	-46.21	-16.21	-30.00	-60.82	14.61	HORIZONTAL	3	2798.00	-47.12	-17.12	-30.00	-63.59	16.47	HORIZONTAL	4 @	12740.00	-36.35	-6.35	-30.00	-67.15	30.80	HORIZONTAL	Result	Freq	Level	Margin	Limit	Read				MHz	dBm	dB	dBm	dBm	Factor	Pol/Phase	1	666.00	-71.43	-17.43	-54.00	-71.26	-0.17	VERTICAL	2	2000.00	-42.70	-12.70	-30.00	-57.24	14.54	VERTICAL	3	2856.00	-46.97	-16.97	-30.00	-63.87	16.90	VERTICAL	4 @	11510.00	-36.51	-6.51	-30.00	-67.27	30.76	VERTICAL	
	Result	Freq	Level	Margin	Limit	Read																																																																																												
	MHz	dBm	dB	dBm	dBm	Factor	Pol/Phase																																																																																											
1	214.00	-75.67	-21.67	-54.00	-65.46	-10.21	HORIZONTAL																																																																																											
2	1990.00	-46.21	-16.21	-30.00	-60.82	14.61	HORIZONTAL																																																																																											
3	2798.00	-47.12	-17.12	-30.00	-63.59	16.47	HORIZONTAL																																																																																											
4 @	12740.00	-36.35	-6.35	-30.00	-67.15	30.80	HORIZONTAL																																																																																											
Result	Freq	Level	Margin	Limit	Read																																																																																													
	MHz	dBm	dB	dBm	dBm	Factor	Pol/Phase																																																																																											
1	666.00	-71.43	-17.43	-54.00	-71.26	-0.17	VERTICAL																																																																																											
2	2000.00	-42.70	-12.70	-30.00	-57.24	14.54	VERTICAL																																																																																											
3	2856.00	-46.97	-16.97	-30.00	-63.87	16.90	VERTICAL																																																																																											
4 @	11510.00	-36.51	-6.51	-30.00	-67.27	30.76	VERTICAL																																																																																											



Mode	2																																																																																																	
	Bluetooth-LE GFSK_CH39																																																																																																	
Ant	1																																																																																																	
Pol.	Horizontal	Vertical																																																																																																
Tx	<div><p>Level(dBm) <span>Date: 2023-04-14</span></p><p>Site : 05CH06-HY Condition: 300328_TX HORIZONTAL Power : From system Project : ER 331602 Mode : 2 Plane : Z</p><table><tr><th>Result</th><th>Freq</th><th>Level</th><th>Margin</th><th>Limit</th><th>Read</th><th>Factor</th><th>Pol/Phase</th></tr><tr><th></th><th>MHz</th><th>dBm</th><th>dB</th><th>dBm</th><th>dBm</th><th>dB</th><th></th></tr><tr><td>1</td><td>666.00</td><td>-73.04</td><td>-19.04</td><td>-54.00</td><td>-72.74</td><td>-0.30</td><td>HORIZONTAL</td></tr><tr><td>2</td><td>1994.00</td><td>-46.48</td><td>-16.48</td><td>-30.00</td><td>-61.08</td><td>14.60</td><td>HORIZONTAL</td></tr><tr><td>3</td><td>2996.00</td><td>-46.27</td><td>-16.27</td><td>-30.00</td><td>-64.16</td><td>17.89</td><td>HORIZONTAL</td></tr><tr><td>4 @</td><td>12530.00</td><td>-36.68</td><td>-6.68</td><td>-30.00</td><td>-67.00</td><td>30.32</td><td>HORIZONTAL</td></tr></table></div>	Result	Freq	Level	Margin	Limit	Read	Factor	Pol/Phase		MHz	dBm	dB	dBm	dBm	dB		1	666.00	-73.04	-19.04	-54.00	-72.74	-0.30	HORIZONTAL	2	1994.00	-46.48	-16.48	-30.00	-61.08	14.60	HORIZONTAL	3	2996.00	-46.27	-16.27	-30.00	-64.16	17.89	HORIZONTAL	4 @	12530.00	-36.68	-6.68	-30.00	-67.00	30.32	HORIZONTAL	<div><p>Level(dBm) <span>Date: 2023-04-14</span></p><p>Site : 05CH06-HY Condition: 300328_TX VERTICAL Power : From system Project : ER 331602 Mode : 2 Plane : Z</p><table><tr><th>Result</th><th>Freq</th><th>Level</th><th>Margin</th><th>Limit</th><th>Read</th><th>Factor</th><th>Pol/Phase</th></tr><tr><th></th><th>MHz</th><th>dBm</th><th>dB</th><th>dBm</th><th>dBm</th><th>dB</th><th></th></tr><tr><td>1</td><td>663.00</td><td>-71.13</td><td>-17.13</td><td>-54.00</td><td>-70.88</td><td>-0.25</td><td>VERTICAL</td></tr><tr><td>2</td><td>1990.00</td><td>-40.37</td><td>-10.37</td><td>-30.00</td><td>-54.87</td><td>14.50</td><td>VERTICAL</td></tr><tr><td>3</td><td>2810.00</td><td>-47.29</td><td>-17.29</td><td>-30.00</td><td>-64.13</td><td>16.84</td><td>VERTICAL</td></tr><tr><td>4 @</td><td>11650.00</td><td>-36.90</td><td>-6.90</td><td>-30.00</td><td>-67.31</td><td>30.41</td><td>VERTICAL</td></tr></table></div>	Result	Freq	Level	Margin	Limit	Read	Factor	Pol/Phase		MHz	dBm	dB	dBm	dBm	dB		1	663.00	-71.13	-17.13	-54.00	-70.88	-0.25	VERTICAL	2	1990.00	-40.37	-10.37	-30.00	-54.87	14.50	VERTICAL	3	2810.00	-47.29	-17.29	-30.00	-64.13	16.84	VERTICAL	4 @	11650.00	-36.90	-6.90	-30.00	-67.31	30.41	VERTICAL
	Result	Freq	Level	Margin	Limit	Read	Factor	Pol/Phase																																																																																										
	MHz	dBm	dB	dBm	dBm	dB																																																																																												
1	666.00	-73.04	-19.04	-54.00	-72.74	-0.30	HORIZONTAL																																																																																											
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3	2996.00	-46.27	-16.27	-30.00	-64.16	17.89	HORIZONTAL																																																																																											
4 @	12530.00	-36.68	-6.68	-30.00	-67.00	30.32	HORIZONTAL																																																																																											
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	MHz	dBm	dB	dBm	dBm	dB																																																																																												
1	663.00	-71.13	-17.13	-54.00	-70.88	-0.25	VERTICAL																																																																																											
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4 @	11650.00	-36.90	-6.90	-30.00	-67.31	30.41	VERTICAL																																																																																											



Mode	3																																																																																																	
	Bluetooth-LE GFSK_CH00																																																																																																	
Ant	1																																																																																																	
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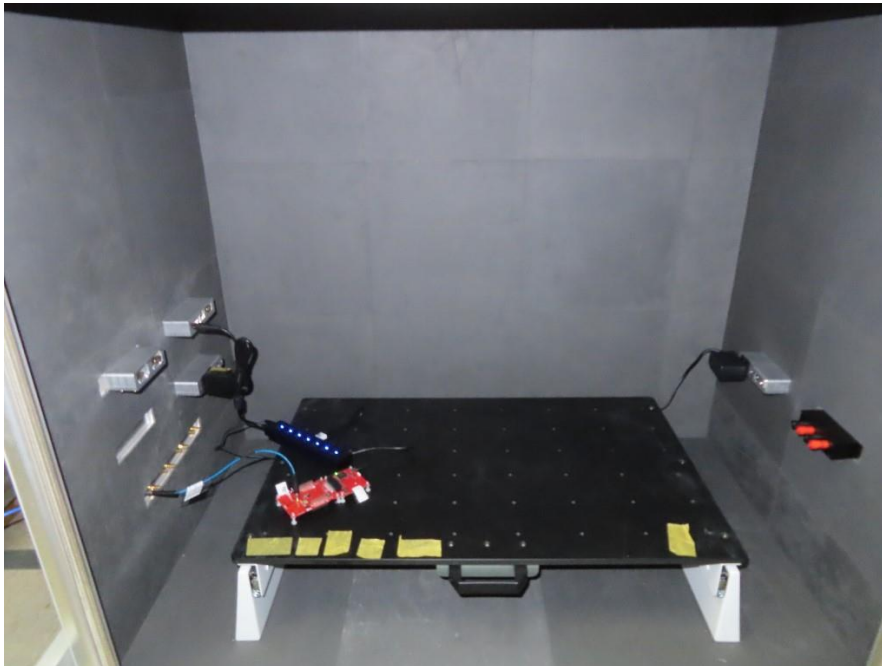


## Appendix C. Photographs of Test Configuration

### <Radiated Emission>

#### Z Plane



**<Receiver Blocking>****Setup Photo****Near Photo (inside shielding room)**

————THE END————