



中认信通

CHINA CERTIFICATION ICT CO., LTD (DONGGUAN)

TEST REPORT

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Address: 1705, 1706, 1709A, Building E, Xinghe WORLD, Minle Community,
Minzhi Street, Longhua District, Shenzhen, Guangdong, China

Product Name: Radar Module

Model Number: HLK-LD2410B, HLK-LD2410B-P, HLK-LD2410B-B

Standard(s): ETSI EN 300 328 V2.2.2 (2019-07)

The above device has been tested and found compliant with the requirement of the relative standards by China Certification ICT Co., Ltd (Dongguan)

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Test Facility

The Test site used by China Certification ICT Co., Ltd (Dongguan) to collect test data is located on the No. 113, Pingkang Road, Dalang Town, Dongguan, Guangdong, China.

Declarations

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
1.0	CR231277022-22B	Original Report	2024/1/23

1. GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

EUT Name:	Radar Module
EUT Model:	HLK-LD2410B
Multiple Models:	HLK-LD2410B-P, HLK-LD2410B-B
Frequency Range:	2402-2480MHz
Max. RF Output Power (EIRP) (dBm):	-3.04dBm
Antenna Gain (dBi)▲:	2.72
Modulation Type:	GFSK
Rated Input Voltage:	5Vdc
Serial Number:	2FJR-1 (for RF Conducted Test) 2FJR-2 (for Radiated Spurious Emissions Test)
EUT Received Date:	2023/12/21
EUT Received Status:	Good
Note: The Multiple models are electrically identical with the test model. Please refer to the declaration letter for more detail, which was provided by manufacturer.	

Operation Frequency Detail:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	40	2442
1	2404	41	2444
...
...
..	...	39	2480
19	2440	/	/
The test frequencies were performed the test as below:			
Test Channel		Frequency (MHz)	
Lowest		2402	
Middle		2440	
Highest		2480	

Accessory Information:

Accessory Description	Manufacturer	Model	Parameters
/	/	/	/

1.2 Description of Test Configuration

1.2.1 EUT Operation Condition:

EUT Operation Mode:	The system was configured for testing in Engineering Mode, which was provided by the manufacturer.		
Equipment Modifications:	No		
EUT Exercise Software:	FCC_assist_1.0.2.2		
The software was provided by manufacturer. The maximum power was configured as below, that was provided by the manufacturer ▲ :			
Test Modes	Power Level Setting		
	Lowest	Middle	Highest
BLE 2Mbps	10	10	10
The extreme temperature test conditions which were declared by the manufacturer and the normal conditions are as below:			
NT: Normal Temperature +25℃			
LT: Low Temperature-40℃			
HT: High Temperature +85℃			

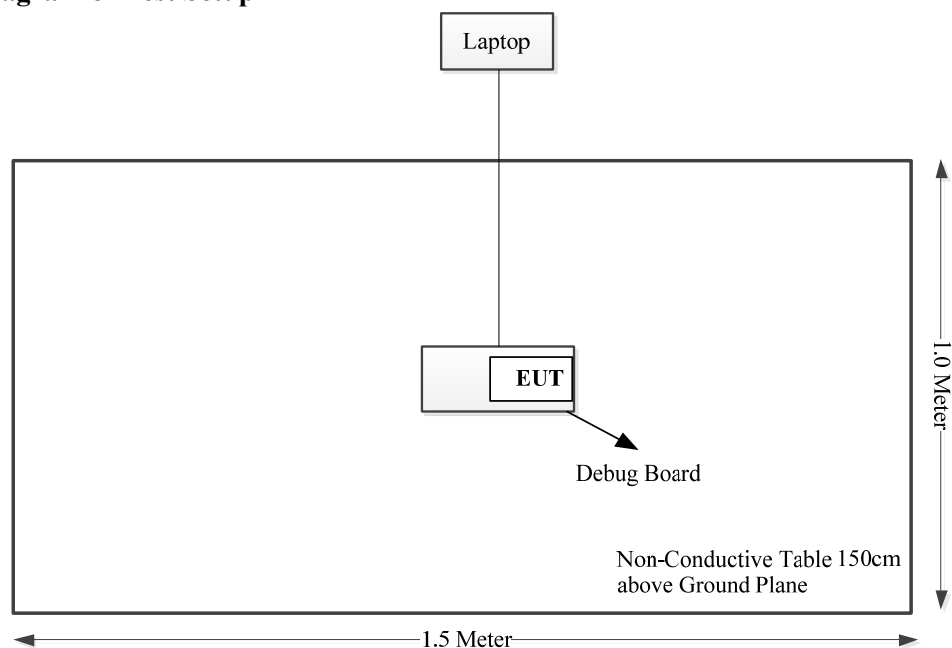
1.2.2 Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Lenovo	Laptop	T460S	60PDTEK8
Unknown	Debug Board	Unknown	Unknown

1.2.3 Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
USB Cable	No	No	0.8	EUT	USB extension cord
USB extension cord	No	No	10	Laptop	USB extension cord

1.2.4 Block Diagram of Test Setup



1.3 Measurement Uncertainty

Note: Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty. The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval.

Parameter	Flab	Maximum allow uncertainty
Occupied Channel Bandwidth	$\pm 5 \%$	$\pm 5 \%$
RF output power, conducted	$\pm 0.61 \text{ dB}$	$\pm 1,5 \text{ dB}$
Power Spectral Density, conducted	$\pm 3 \text{ dB}$	$\pm 3 \text{ dB}$
Unwanted Emissions, conducted	$\pm 2.47 \text{ dB}$	$\pm 3 \text{ dB}$
All emissions, radiated	$\pm 3.62 \text{ dB}$	$\pm 6 \text{ dB}$
Temperature	$\pm 1 ^\circ \text{C}$	$\pm 3 ^\circ \text{C}$
Supply voltages	$\pm 0.4 \%$	$\pm 3 \%$
Time	1%	$\pm 5 \%$

2. SUMMARY OF TEST RESULTS

SN	Rule and Clause	Description of Test	Test Result
1	EN 300 328 Clause 4.3.2.2	RF output power	Compliant
2	EN 300 328 Clause 4.3.2.3	Power Spectral Density	Compliant
3	EN 300 328 Clause 4.3.2.4	Duty cycle, Tx-Sequence, Tx-gap	Not applicable*
4	EN 300 328 Clause 4.3.2.5	Medium Utilization (MU) factor	Not applicable*
5	EN 300 328 Clause 4.3.2.6	Adaptivity	Not applicable**
6	EN 300 328 Clause 4.3.2.7	Occupied Channel Bandwidth	Compliant
7	EN 300 328 Clause 4.3.2.8	Transmitter unwanted emissions in the out-of-band domain	Compliant
8	EN 300 328 Clause 4.3.2.9	Transmitter unwanted emissions in the spurious domain	Compliant
9	EN 300 328 Clause 4.3.2.10	Receiver spurious emissions	Compliant
10	EN 300 328 Clause 4.3.2.11	Receiver Blocking	Compliant
11	EN 300 328 Clause 4.3.2.12	Geo-location capability	Not applicable***

Note:

The applicant declared that the equipment is adaptive equipment.

Not applicable*: The test is not applicable for adaptive equipment.

Not applicable**: The test is not applicable for adaptive equipment output power which is less than 10mW.

Not applicable***: The manufacturer declared the device without Geo-location capability.

3. REQUIREMENTS AND TEST PROCEDURES

3.1 RF Output Power

3.1.1 Definition

The RF output power is defined as the mean equivalent isotropic radiated power (e.i.r.p.) of the equipment during a transmission burst.

3.1.2 Limit

The RF output power for non-FHSS equipment shall be equal to or less than 20 dBm.

For Non-adaptive FHSS equipment, the manufacturer may have declared a reduced RF Output Power (see clause 5.4.1 m)) and associated Duty Cycle (see clause 5.4.1 e)) that will ensure that the equipment meets the requirement for the Medium Utilization (MU) factor further described in clause 4.3.2.5. This is verified by the conformance test referred to in clause 4.3.2.5.4.

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.

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

3.1.3 Test Procedure

The test procedure shall be as follows:

Step 1:

- Use a fast power sensor suitable for 2,4 GHz and capable of minimum 1 MS/s.
 - Use the following settings:
 - Sample speed 1 MS/s or faster.
 - The samples shall represent the RMS power of the signal.
 - Measurement duration: For non-adaptive equipment: equal to the observation period defined in clause 4.3.1.3.2 or clause 4.3.2.4.2. For adaptive equipment, the measurement duration shall be long enough to ensure a minimum number of bursts (at least 10) are captured.
- For adaptive equipment, to increase the measurement accuracy, a higher number of bursts may be used.

Step 2:

- For conducted measurements on devices with one transmit chain:
 - Connect the power sensor to the transmit port, sample the transmit signal and store the raw data. Use these stored samples in all following steps.
- For conducted measurements on devices with multiple transmit chains:
 - Connect one power sensor to each transmit port for a synchronous measurement on all transmit ports.
 - Trigger the power sensors so that they start sampling at the same time. Make sure the time difference between the samples of all sensors is less than 500 ns.
 - For each individual sampling point (time domain), sum the coincident power samples of all ports and store them. Use these summed samples in all following steps.

Step 3:

- Find the start and stop times of each burst in the stored measurement samples.
The start and stop times are defined as the points where the power is at least 30 dB below the highest value of the stored samples in step 2.
In case of insufficient dynamic range, the value of 30 dB may need to be reduced appropriately.

Step 4:

- Between the start and stop times of each individual burst calculate the RMS power over the burst using the formula below. The start and stop points shall be included. Save these P_{burst} values, as well as the start and stop times for each burst.

$$P_{burst} = \frac{1}{k} \sum_{n=1}^k P_{sample}(n)$$

with 'k' being the total number of samples and 'n' the actual sample number

Step 5:

- The highest of all P_{burst} values (value "A" in dBm) will be used for maximum e.i.r.p. calculations.

Step 6:

- Add the (stated) antenna assembly gain "G" in dBi of the individual antenna.
- If applicable, 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 (P) shall be calculated using the formula below:

$$P = A + G + Y$$

- This value, which shall comply with the limit given in clause 4.3.1.2.3 or clause 4.3.2.2.3, shall be recorded in the test report.

3.2 Power Spectral Density

3.2.1 Definition

The Power Spectral Density is the mean equivalent isotropically radiated power (e.i.r.p.) spectral density in a 1 MHz bandwidth during a transmission burst.

3.2.2 Limit

The maximum Power Spectral Density for non-FHSS equipment is 10 dBm per MHz.

3.2.3 Test Procedure

The transmitter shall be connected to a spectrum analyser and the Power Spectral Density as defined in clause 4.3.2.3 shall be measured and recorded.

The test procedure shall be as follows:

Step 1:

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

- Start Frequency: 2 400 MHz
- Stop Frequency: 2 483.5 MHz
- Resolution BW: 10 kHz
- Video BW: 30 kHz
- Sweep Points: > 8 350; for spectrum analysers not supporting this number of sweep points, the frequency band may be segmented

NOTE: For spectrum analysers not supporting this number of sweep points, the frequency band may be segmented.

- Detector: RMS
- Trace Mode: Max Hold
- Sweep time: For non-continuous transmissions: $2 \times \text{Channel Occupancy Time} \times \text{number of sweep points}$
For continuous transmissions: 10 s; the sweep time may be increased further until a value where the sweep time has no impact on the RMS value of the signal.

For non-continuous signals, wait for the trace to stabilize. Save the data (trace data) set to a file.

Step 2:

For conducted measurements on smart antenna systems using either operating mode 2 or operating mode 3 (see clause 5.3.2.2), repeat the measurement for each of the transmit ports. For each sampling point (frequency domain), add up the coincident power values (in mW) for the different transmit chains and use this as the new data set.

Step 3:

Add up the values for power for all the samples in the file using the formula below.

$$P_{Sum} = \frac{1}{k} \sum_{n=1}^k P_{sample}(n)$$

with 'k' being the total number of samples and 'n' the actual sample number

Step 4:

Normalize the individual values for power (in dBm) so that the sum is equal to the RF Output Power (e.i.r.p.) measured in clause 5.3.2 and save the corrected data. The following formulas can be used:

$$C_{Corr} = P_{Sum} - P_{e.i.r.p}$$

$$P_{Samplecorr}(n) = P_{Sample}(n) - C_{Corr}$$

with 'n' being the actual sample number

Step 5:

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

Step 6:

Shift the start point of the samples added up in step 5 by one sample and repeat the procedure in step 5 (i.e. sample #2 to sample #101).

Step 7:

Repeat step 6 until the end of the data set and record the 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 UUT. This value, which shall comply with the limit given in clause 4.3.2.3.3, shall be recorded in the test report.

3.3 Occupied Channel Bandwidth

3.3.1 Definition

The Occupied Channel Bandwidth is the bandwidth that contains 99 % of the power of the signal.

3.3.2 Limit

The Occupied Channel Bandwidth shall fall completely within the band given in clause 1.
In addition, for non-adaptive equipment using wide band modulations other than FHSS and with e.i.r.p greater than 10 dBm, the occupied channel bandwidth shall be less than 20 MHz.

3.3.3 Test Procedure

The measurement procedure shall be as follows:

Step 1:

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

- Centre Frequency: The centre frequency of the channel under test
- Resolution BW: $\sim 1\%$ of the span without going below 1%
- Video BW: $3 \times \text{RBW}$
 - Frequency Span for other types of equipment: $2 \times \text{Nominal Channel Bandwidth}$
- Detector Mode: RMS
- Trace Mode: Max Hold
 - Sweep time: 1 s

Step 2:

Wait for the trace to stabilize.

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

Step 3:

Use the 99 % bandwidth function of the spectrum analyser to measure the Occupied Channel Bandwidth of the UUT. This value shall be recorded.

NOTE: Make sure that the power envelope is sufficiently above the noise floor of the analyser to avoid the noise signals left and right from the power envelope being taken into account by this measurement.

3.4 Transmitter Unwanted Emissions In The Out-Of-Band Domain

3.4.1 Definition

According to ETSI EN 300 328 V2.2.2 (2019-07) §4.3.2.8.2, Transmitter unwanted emissions in the out-of-band domain are emissions when the equipment is in Transmit mode, on frequencies immediately outside the allocated band , but excluding unwanted emissions in the spurious domain.

3.4.2 Limit

The transmitter unwanted emissions in the out-of-band domain shall not exceed the values provided by the mask in figure 3.

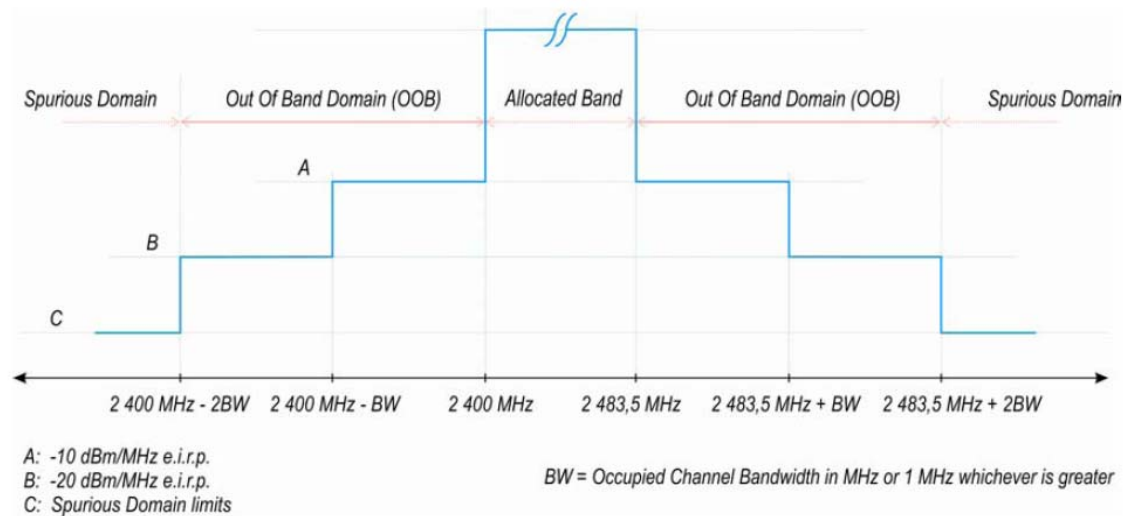


Figure 3: Transmit mask

3.4.3 Test Procedure

According to ETSI EN 300 328 V2.2.2 (2019-07) §5.4.8

3.5 Transmitter Unwanted Emissions In The Spurious Domain

3.5.1 Definition

Transmitter unwanted emissions in the spurious domain are emissions outside the allocated band and outside the Out-of-band Domain as indicated in figure 3 when the equipment is in Transmit mode.

3.5.2 Limit

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

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

3.5.2 Test Procedure

According to ETSI EN 300 328 V2.2.2 (2019-07) §5.4.9

3.6 Receiver Spurious Emissions

3.6.1 Definition

Receiver spurious emissions are emissions at any frequency when the equipment is in receive mode.

3.6.2 Limit

The receiver spurious emissions shall not exceed the values given in the following table.

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

—
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

3.6.3 Test Procedure

According to ETSI EN 300 328 V2.2.2 (2019-07) §5.4.10

3.7 Receiver Blocking

3.7.1 Definition

Receiver blocking is a measure of the ability of the equipment to receive a wanted signal on its operating channel without exceeding a given degradation due to the presence of an unwanted input signal (blocking signal) on frequencies other than those of the operating band and spurious responses.

3.7.2 Limit

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.

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 dBm whichever is less (see note 2)	2 380 2 504	-34	CW		
$(-139 \text{ dBm} + 10 \times \log_{10}(\text{OCBW}))$ or -74 dBm whichever is less (see note 3)	2 300 2 330 2 360 2 524 2 584 2 674				
NOTE 1: OCBW is in Hz.					
NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to $P_{\min} + 26 \text{ dB}$ where P_{\min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.					
NOTE 3: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to $P_{\min} + 20 \text{ dB}$ where P_{\min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.					
NOTE 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.					

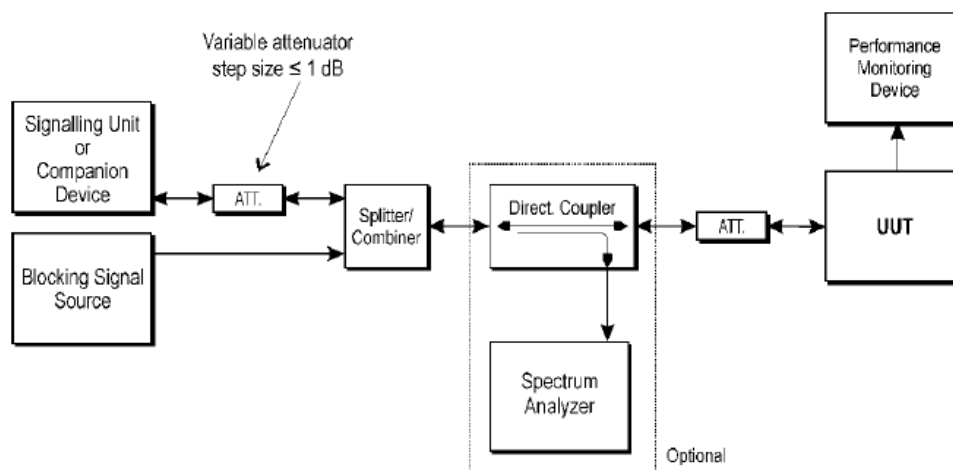
Table 15: Receiver Blocking parameters receiver Category 2 equipment

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
$(-139 \text{ dBm} + 10 \times \log_{10}(\text{OCBW}) + 10 \text{ dB})$ 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 $P_{\min} + 26 \text{ dB}$ where P_{\min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.</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>			

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
$(-139 \text{ dBm} + 10 \times \log_{10}(\text{OCBW}) + 20 \text{ dB})$ 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 $P_{\min} + 30 \text{ dB}$ where P_{\min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.</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>			

3.7.3 Test Setup Block Diagram

**Figure 6: Test Set-up for receiver blocking**

3.7.2 Test Procedure

The measurement procedure refers to ETSI EN 300 328 V2.2.2 (2019-07) §5.4.11

4. TEST DATA AND RESULTS

4.1 RF Output Power

Serial Number:	2FJR-1	Test Date:	2024/1/8
Test Site:	RF	Test Mode:	Transmitting
Tester:	LingLing Li	Test Result:	Pass

Environmental Conditions:

Temperature: (°C)	25.8	Relative Humidity: (%)	55	ATM Pressure: (kPa)	101.4
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Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
BACL	TEMP&HUMI Test Chamber	BTH-150-40	30174	2023/3/31	2024/3/30
Agilent	USB Average Power Sensor	U2001H	MY50000432	2023/3/31	2024/3/30
zhuoxiang	Coaxial Cable	SMA-178	211002	Each time	N/A

** Statement of Traceability: China Certification ICT Co., Ltd (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).*

Test Data:

Test Result: Compliant. Please refer to following tables.

RF Output Power								
Mode	Channel	Conducted Output Power (dBm)			Result (dBm)			Limit (dBm)
		LT	NT	HT	LT	NT	HT	
BLE 2Mbps	Low	-6.44	-6.6	-6.72	-3.72	-3.88	-4.00	≤ 20
	Middle	-6.03	-6.16	-6.26	-3.31	-3.44	-3.54	
	High	-5.76	-5.89	-5.94	-3.04	-3.17	-3.22	

Note: The antenna gain was added into the test result.

4.2 Power Spectral Density

Serial Number:	2FJR-1	Test Date:	2024/1/8
Test Site:	RF	Test Mode:	Transmitting
Tester:	LingLing Li	Test Result:	Pass

Environmental Conditions:

Temperature: (°C)	25.8	Relative Humidity: (%)	55	ATM Pressure: (kPa)	101.4
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Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
zhuoxiang	Coaxial Cable	SMA-178	211002	Each time	N/A
R&S	Spectrum Analyzer	FSU26	100147	2023/3/31	2024/3/30

** Statement of Traceability: China Certification ICT Co., Ltd (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).*

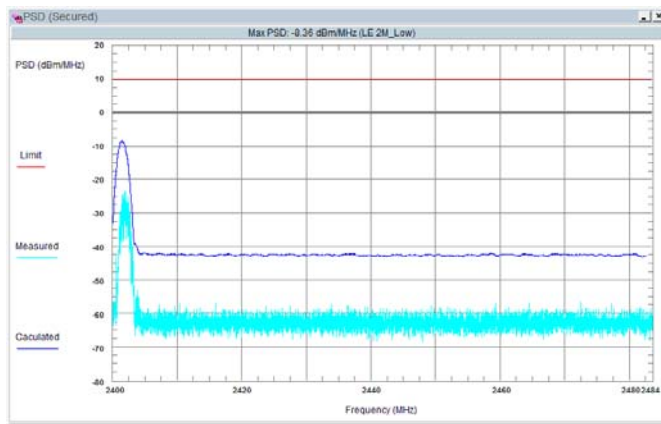
Test Data:

Test Result: *Compliant. Please refer to following tables.*

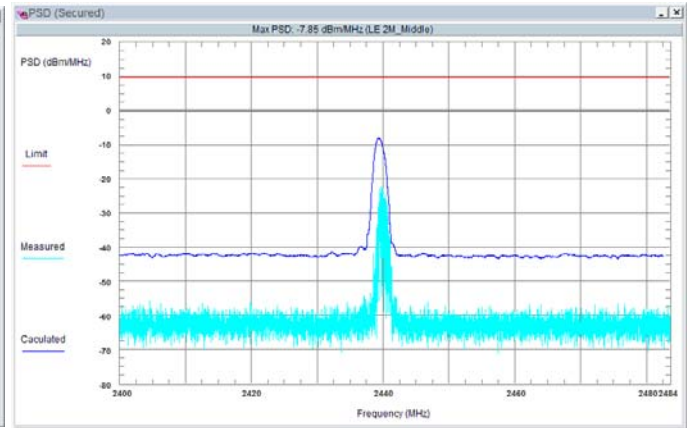
Power Spectral Density				
Mode	Channel	Reading (dBm/MHz)	Result (dBm/MHz)	Limit (dBm/MHz)
BLE 2Mbps	Low	-8.36	-5.64	≤ 10
	Middle	-7.85	-5.13	
	High	-7.64	-4.92	

Note: *The antenna gain was added into the test result.*

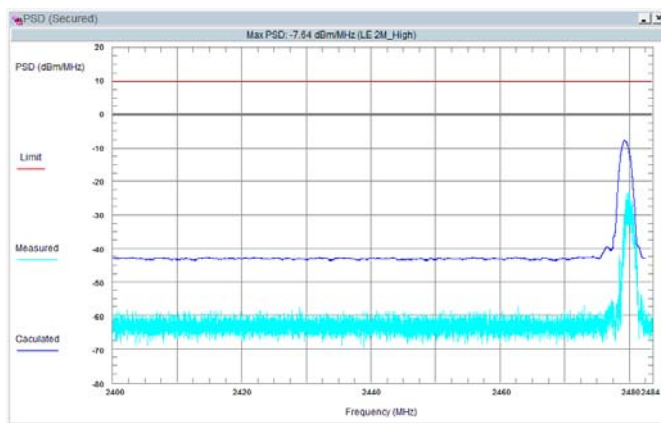
Test plots for Power Spectral Density:
BLE 2Mbps Low Channel



BLE 2Mbps Middle Channel



BLE 2Mbps High Channel



4.3 Occupied Channel Bandwidth

Serial Number:	2FJR-1	Test Date:	2024/1/8
Test Site:	RF	Test Mode:	Transmitting
Tester:	LingLing Li	Test Result:	Pass

Environmental Conditions:

Temperature: (°C)	25.8	Relative Humidity: (%)	55	ATM Pressure: (kPa)	101.4
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Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
zhuoxiang	Coaxial Cable	SMA-178	211002	Each time	N/A
R&S	Spectrum Analyzer	FSU26	100147	2023/03/31	2024/03/30

** Statement of Traceability: China Certification ICT Co., Ltd (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).*

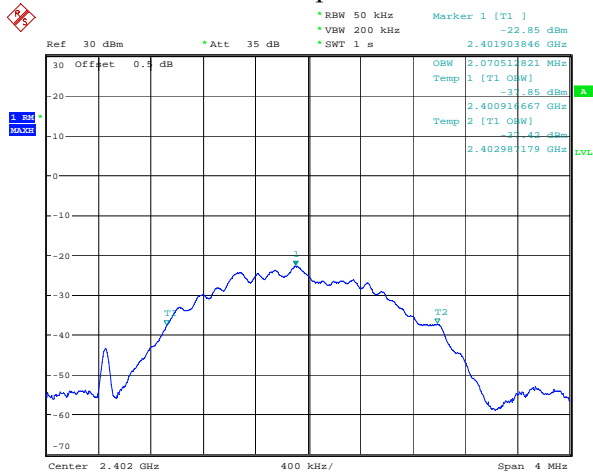
Test Data:

Test Result: Compliant. Please refer to following tables.

Occupied Channel Bandwidth			
Mode	Channel	Frequency (MHz)	Result (MHz)
BLE 2Mbps	Low	2402	2.071
	High	2480	2.071

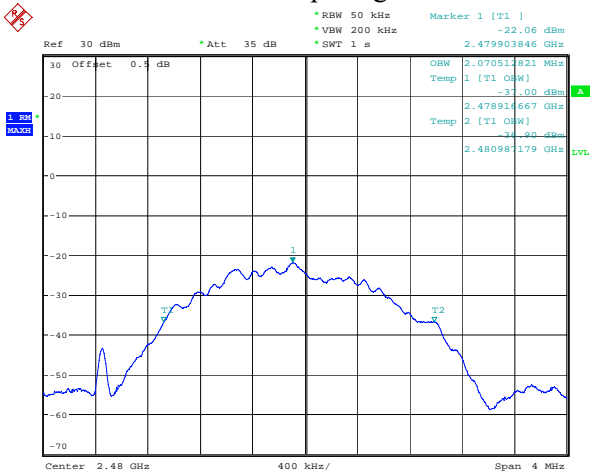
Test plots for Occupied Channel Bandwidth:

BLE 2Mbps Low



Comment: ProjectNo.:CR231277022-RF Tester:LingLing Li
Date: 8.JAN.2024 10:29:12

BLE 2Mbps High



Comment: ProjectNo.:CR231277022-RF Tester:LingLing Li
Date: 8.JAN.2024 10:29:58

4.4 Transmitter Unwanted Emissions in The Out-Of-Band Domain

Serial Number:	2FJR-1	Test Date:	2024/1/8
Test Site:	RF	Test Mode:	Transmitting
Tester:	LingLing Li	Test Result:	Pass

Environmental Conditions:

Temperature: (°C)	25.8	Relative Humidity: (%)	55	ATM Pressure: (kPa)	101.4
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Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
zhuoxiang	Coaxial Cable	SMA-178	211002	Each time	N/A
R&S	Spectrum Analyzer	FSU26	100147	2023/03/31	2024/03/30

* Statement of Traceability: China Certification ICT Co., Ltd (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data:

Test Result: Compliant. Please refer to following tables.

Transmitter Unwanted Emissions in The Out-of-band Domain						
Mode	Channel	Frequency Segment	Reading (dBm/MHz)	Result (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)
BLE 2Mbps	Low	2400MHz-2BW~2400-BW	-45.87	-43.15	-20	23.15
		2400MHz-BW~2400MHz	-43.25	-40.53	-10	30.53
	High	2483.5MHz~2483.5MHz+BW	-46.27	-43.55	-10	33.55
		2483.5MHz+BW~2483.5MHz+2BW	-46.79	-44.07	-20	24.07

Note: The antenna gain was added into the test result.

4.5 Transmitter Unwanted Emissions in The Spurious Domain

Serial Number:	2FJR-2	Test Date:	2024/1/11~2024/1/16
Test Site:	966-1, 966-2	Test Mode:	Transmitting
Tester:	Carl Xue, coco Tian	Test Result:	Pass

Environmental Conditions:

Temperature: (°C)	25.4~25.5	Relative Humidity: (%)	44~53	ATM Pressure: (kPa)	101.4~101.6
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Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Sunol Sciences	Antenna	JB6	A082520-5	2023/12/1	2026/11/30
R&S	EMI Test Receiver	ESR3	102724	2023/3/31	2024/3/30
TIMES MICROWAVE	Coaxial Cable	LMR-600-UltraFlex	C-0470-02	2023/7/16	2024/7/15
TIMES MICROWAVE	Coaxial Cable	LMR-600-UltraFlex	C-0780-01	2023/7/16	2024/7/15
Sonoma	Amplifier	310N	186165	2023/7/16	2024/7/15
EMCO	Adjustable Dipole Antenna	3121C	9109-756	N/A	N/A
MICRO-COAX	Coaxial Cable	UFA210B-0-0720-300300	99G1448	2023/7/16	2024/7/15
Agilent	Signal Generator	E8247C	MY43321352	2023/11/17	2024/11/16
AH	Double Ridge Guide Horn Antenna	SAS-571	1394	2023/2/22	2026/2/21
R&S	Spectrum Analyzer	FSV40	101591	2023/3/31	2024/3/30
MICRO-COAX	Coaxial Cable	UFA210A-1-1200-70U300	217423-008	2023/8/6	2024/8/5
MICRO-COAX	Coaxial Cable	UFA210A-1-2362-300300	235780-001	2023/8/6	2024/8/5
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2023/11/8	2024/11/7
AH	Double Ridge Guide Horn Antenna	SAS-571	1396	2021/10/18	2024/10/17
MICRO-COAX	Coaxial Cable	UFA210B-0-0720-300300	99G1448	2023/7/16	2024/7/15
E-Microwave	Band Rejection Filter	2400-2483.5MHz	OE01902424	2023/8/6	2024/8/5
Mini Circuits	High Pass Filter	VHF-6010+	31119	2023/8/6	2024/8/5

*** Statement of Traceability:** China Certification ICT Co., Ltd (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Test Result: Compliant. Please refer to following tables.

BLE 2Mbps:

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
Low Channel:			2402	MHz				
309.99	H	33.15	-77.42	0.00	0.34	-77.76	-36.00	41.76
72.59	V	37.42	-66.74	-3.71	0.16	-70.61	-54.00	16.61
4804.00	H	33.27	-60.79	10.96	1.44	-51.27	-30.00	21.27
4804.00	V	34.64	-59.23	10.96	1.44	-49.71	-30.00	19.71
7206.00	H	34.88	-54.70	11.08	1.93	-45.55	-30.00	15.55
7206.00	V	35.29	-54.47	11.08	1.93	-45.32	-30.00	15.32
High Channel:			2480	MHz				
300.36	H	32.93	-77.78	0.00	0.34	-78.12	-36.00	42.12
72.84	V	37.20	-67.11	-3.58	0.16	-70.85	-54.00	16.85
4960.00	H	33.47	-59.42	11.15	1.50	-49.77	-30.00	19.77
4960.00	V	33.62	-59.24	11.15	1.50	-49.59	-30.00	19.59
7440.00	H	35.64	-53.94	11.08	1.93	-44.79	-30.00	14.79
7440.00	V	36.17	-53.59	11.08	1.93	-44.44	-30.00	14.44

Note 1: The unit of antenna gain is dBd for frequency below 1GHz and dBi for frequency above 1GHz.

Note 2:

Absolute Level = Substituted Level - Cable loss + Antenna Gain

Margin = Limit- Absolute Level

4.6 Receiver Spurious Emissions

Serial Number:	2FJR-2	Test Date:	2024/1/11~2024/1/16
Test Site:	966-1, 966-2	Test Mode:	Receiving
Tester:	Carl Xue, coco Tian	Test Result:	Pass

Environmental Conditions:

Temperature: (°C)	25.4~25.5	Relative Humidity: (%)	44~53	ATM Pressure: (kPa)	101.4~101.6
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Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Sunol Sciences	Antenna	JB6	A082520-5	2023/12/1	2026/11/30
R&S	EMI Test Receiver	ESR3	102724	2023/3/31	2024/3/30
TIMES MICROWAVE	Coaxial Cable	LMR-600-UltraFlex	C-0470-02	2023/7/16	2024/7/15
TIMES MICROWAVE	Coaxial Cable	LMR-600-UltraFlex	C-0780-01	2023/7/16	2024/7/15
Sonoma	Amplifier	310N	186165	2023/7/16	2024/7/15
EMCO	Adjustable Dipole Antenna	3121C	9109-756	N/A	N/A
MICRO-COAX	Coaxial Cable	UFA210B-0-0720-300300	99G1448	2023/7/16	2024/7/15
Agilent	Signal Generator	E8247C	MY43321352	2023/11/17	2024/11/16
AH	Double Ridge Guide Horn Antenna	SAS-571	1394	2023/2/22	2026/2/21
R&S	Spectrum Analyzer	FSV40	101591	2023/3/31	2024/3/30
MICRO-COAX	Coaxial Cable	UFA210A-1-1200-70U300	217423-008	2023/8/6	2024/8/5
MICRO-COAX	Coaxial Cable	UFA210A-1-2362-300300	235780-001	2023/8/6	2024/8/5
AH	Double Ridge Guide Horn Antenna	SAS-571	1396	2021/10/18	2024/10/17
MICRO-COAX	Coaxial Cable	UFA210B-0-0720-300300	99G1448	2023/7/16	2024/7/15

*** Statement of Traceability:** China Certification ICT Co., Ltd (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Test Result: Compliant. Please refer to following tables.

BLE 2Mbps:

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
Low Channel:			2402	MHz				
300.36	H	33.09	-77.62	0.00	0.34	-77.96	-57.00	20.96
72.38	V	37.59	-66.44	-3.81	0.15	-70.40	-57.00	13.40
1358.60	H	36.84	-66.46	8.10	0.78	-59.14	-47.00	12.14
1422.30	V	41.68	-62.02	8.28	0.73	-54.47	-47.00	7.47
High Channel:			2480	MHz				
152.13	H	33.27	-78.61	0.00	0.23	-78.84	-57.00	21.84
72.59	V	37.21	-66.95	-3.71	0.16	-70.82	-57.00	13.82
1324.50	H	41.08	-61.89	8.01	0.74	-54.62	-47.00	7.62
1258.70	V	39.89	-63.47	7.82	0.68	-56.33	-47.00	9.33

Note 1: The unit of antenna gain is dBd for frequency below 1GHz and dBi for frequency above 1GHz.

Note 2:

Absolute Level = Substituted Level - Cable loss + Antenna Gain

Margin = Limit- Absolute Level

4.7 Receiver Blocking

Serial Number:	2FJR-1	Test Date:	2024/1/8
Test Site:	RF	Test Mode:	Transmitting
Tester:	LingLing Li	Test Result:	Pass

Environmental Conditions:					
Temperature: (°C)	25.8	Relative Humidity: (%)	55	ATM Pressure: (kPa)	101.4

Test Equipment List and Details:

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSU26	100147	2023/3/31	2024/3/30
zhuoxiang	Coaxial Cable	SMA-178	211002	Each time	N/A
R&S	Wideband Radio Communication Tester	CMW500	143458	2023/3/31	2024/3/30
Unknown	Coaxial tee connector	Unknown	2204004	Each time	N/A
Agilent	MXG Vector Signal Generator	N5182B	MY51350144	2023/3/31	2024/3/30
YINSAIGE	Coaxial Cable	SS402	SJ0100002	Each time	N/A

* Statement of Traceability: China Certification ICT Co., Ltd (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data:

Test Result: Compliant. Please refer to following tables.

Receiver Blocking					
Mode	Receiver Category	Channel	Blocking signal frequency (MHz)	PER (%)	Limit (%)
BLE 2Mbps	3	Low	2300	1.1	≤ 10
			2380	1.5	
		High	2504	1.4	
			2584	1.2	

Note: PER was monitored by CMW500.

EXHIBIT A - E.2 Information as required by EN 300 328 V2.2.2, clause 5.4.1

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

a) The type of modulation used by the equipment:

- ☐ FHSS
☒ other forms of modulation

b) In case of FHSS modulation:

In case of non-Adaptive Frequency Hopping equipment:

The number of Hopping Frequencies: _____.

In case of Adaptive Frequency Hopping Equipment:

The maximum number of Hopping Frequencies: _____;

The minimum number of Hopping Frequencies: _____;

The (average) Dwell Time: _____;

c) Adaptive / non-adaptive equipment:

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

d) In case of adaptive equipment:

The Channel Occupancy Time implemented by the equipment: _____ ms

- ☐ The equipment has implemented an LBT based DAA mechanism

In case of equipment using modulation different from FHSS:

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

The CCA time implemented by the equipment: _____ μ s

- ☐ The equipment has implemented an non-LBT based DAA mechanism
☐ The equipment can operate in more than one adaptive mode

e) In case of non-adaptive Equipment:

The maximum RF Output Power (e.i.r.p.): _____ dBm

The maximum (corresponding) Duty Cycle: _____ %

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

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

RF Output Power: -3.04 dBm ;
 Power Spectral Density -4.92 dBm/MHz ;
 Duty cycle, Tx-Sequence, Tx-gap N/A ;
 Accumulated Transmit Time, Minimum Frequency Occupation & Hopping Sequence (only for FHSS equipment) N/A ;
 Hopping Frequency Separation (only for FHSS equipment) N/A ;
 Medium Utilisation N/A ;
 Adaptivity N/A ;
 Receiver Blocking Pass ;
 Nominal Occupied Channel Bandwidth 2MHz ;
 Transmitter unwanted emissions in the OOB domain -43.15 dBm/MHz ;
 Transmitter unwanted emissions in the spurious domain -44.44 dBm ;
 Receiver spurious emissions -54.47 ;

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

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

h) In case of Smart Antenna Systems:

The number of Receive chains;;
 The number of Transmit chains;;

- ☐ symmetrical power distribution
☐ asymmetrical power distribution

In case of beam forming, the maximum beam forming gain;;

Note: Beam forming gain does not include the basic gain of a single antenna.

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

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

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

j) Nominal Channel Bandwidth(s):Nominal Channel Bandwidth 1: 2 MHz

Nominal Channel Bandwidth 2: _____ MHz

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

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

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

l) The normal and the extreme operating conditions that apply to the equipment:**Normal operating conditions (if applicable):**Operating temperature range: +25 ° C

Other (please specify if applicable): _____ ° C

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

Other (please specify if applicable): Minimum: _____ ° C Maximum _____ ° C

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

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

Antenna Type:

- ☒ Integral Antenna (information to be provided in case of conducted measurements)

Antenna Gain: 2.72 dBi

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

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

- ☐ Dedicated Antennas (equipment with antenna connector)
☐ Single power level with corresponding antenna(s)
☐ Multiple power settings and corresponding antenna(s)

Number of different Power Levels: _____;

Power Level 1: _____ dBm

Power Level 2: _____ dBm

Power Level 3: _____ dBm

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

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

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

Power Level 1: ____dBm

Number of antenna assemblies provided for this power level:

Assembly #	Gain (dBi)	e.i.r.p. (dBm)	Part number or model name
1			
2			
3			
4			

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

Power Level 2: ____dBm

Number of antenna assemblies provided for this power level:

Assembly #	Gain (dBi)	e.i.r.p. (dBm)	Part number or model name
1			
2			
3			
4			

Note4: Add more rows in case more antenna assemblies are supported for this power level.

Power Level 2: ____dBm

Number of antenna assemblies provided for this power level:

Assembly #	Gain (dBi)	e.i.r.p. (dBm)	Part number or model name
1			
2			
3			
4			

Note5: Add more rows in case more antenna assemblies are supported for this power level.

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

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

Supply Voltage ☐ AC mains State AC voltage _____ V
☒ DC State DC voltage 5 V

In case of DC, indicate the type of power source

- ☐ Internal Power Supply
☐ External Power Supply or AC/DC adapter
☐ Battery
☒ Other: DC 5V from Host.

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

The measurements shall be performed during continuously transmitting.

p) The equipment type (e.g., Bluetooth®, IEEE 802.11™, IEEE 802.15.4™, proprietary, etc.):

Bluetooth®.

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

(to be provided as separate attachment)

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

(to be provided as separate attachment)

s) Geo-location capability supported by the equipment:

☐ Yes

☐ The geographical location determined by the equipment as defined in clause 4.3.1.13.2 or clause 4.3.2.12.2 is not accessible to the user.

☒ No

EXHIBIT B - EUT PHOTOGRAPHS

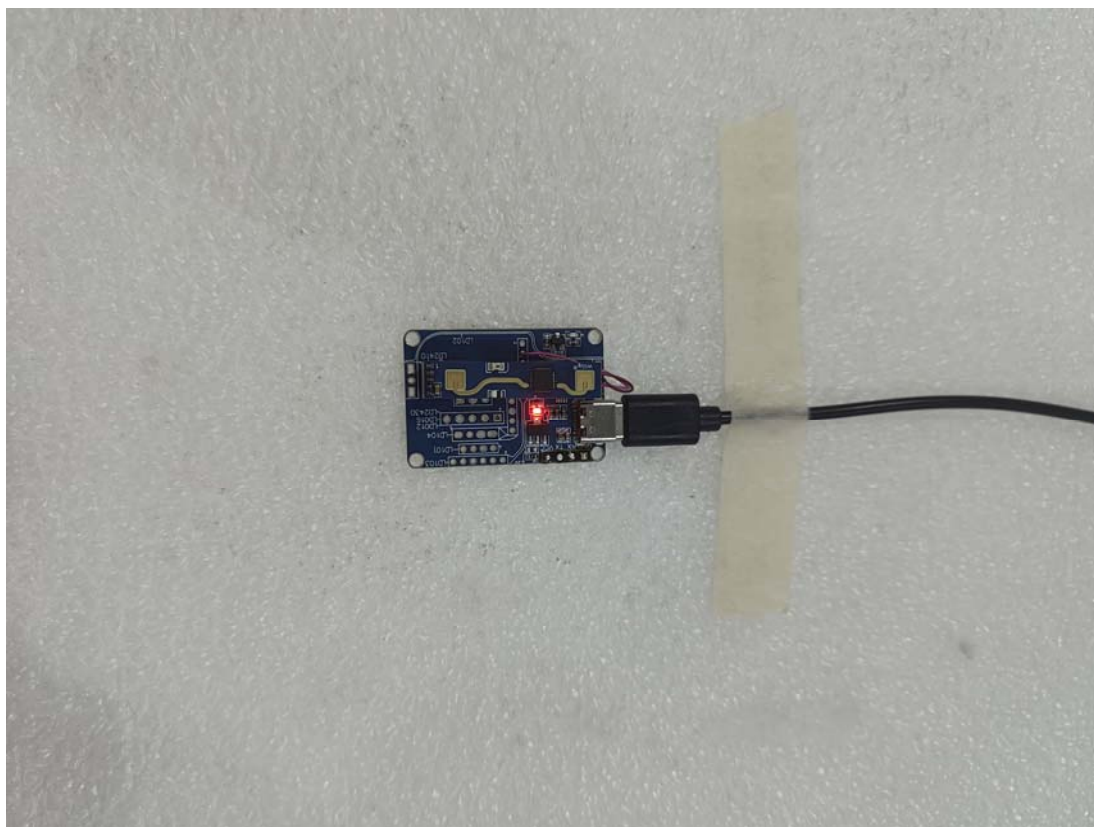
For photos in this section, please refer to report No.: CR231277022-02 EXHIBIT A.

EXHIBIT C - TEST SETUP PHOTOGRAPHS

Radiated Emission Below 1GHz View



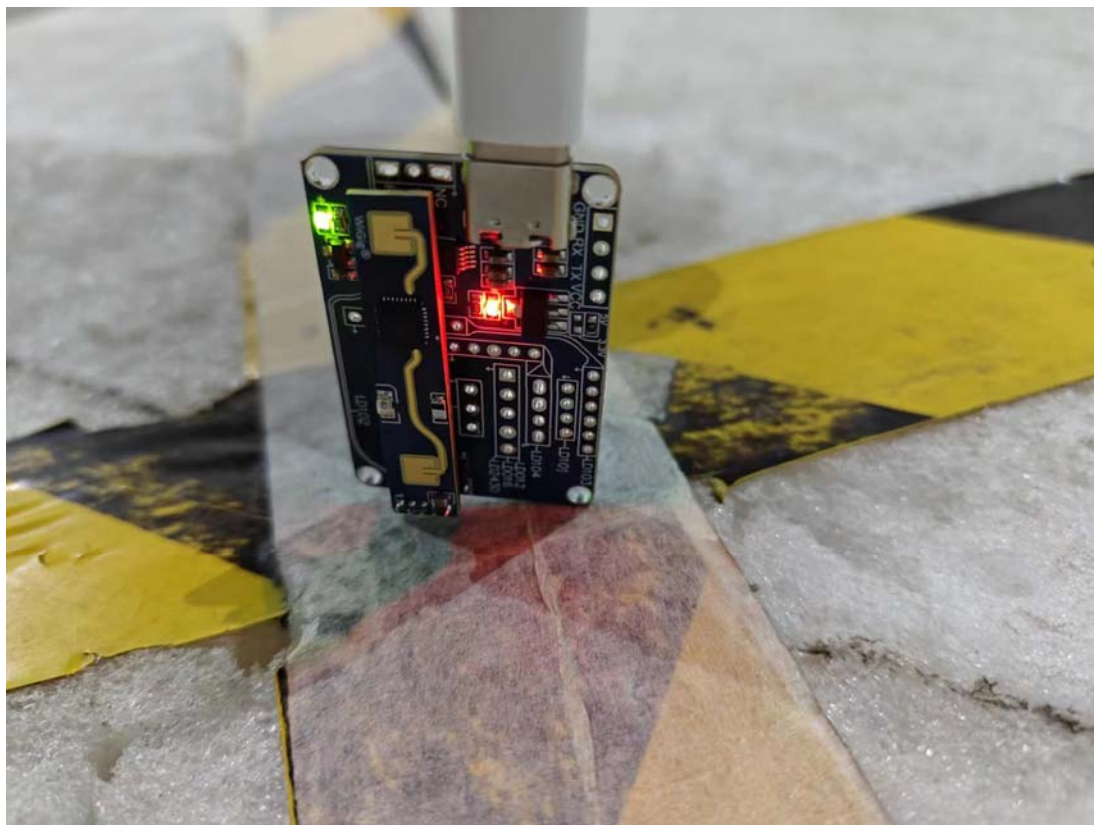
Radiated Emission Below 1GHz View



Radiated Emission Above 1GHz View



Radiated Emission Above 1GHz View



***** END OF REPORT *****