

RF - TEST REPORT

Report Number : 4840320329801C Date of Issue: February 17, 2022

Model : LLS Bxy/zG, LLS BLxy/zG, LLS Bxy/zC, LLS BLxy/zC, (x=250-600, An integer multiple of 10; y=Null,i,B; z=Y,B,G)

Product Type : Robotic lawnmower, powered by battery

Applicant : SUMEC Hardware & Tools Co., Ltd.

Address : No.1 Xinghuo Road Jiangbei New Area 210061 Nanjing, Jiangsu
PEOPLE'S REPUBLIC OF CHINA

Manufacturer : SUMEC Hardware & Tools Co., Ltd.

Address : No.1 Xinghuo Road Jiangbei New Area 210061 Nanjing, Jiangsu
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Factory : SUMEC Manufacturing Venture Co., Ltd.

Address : 1# Gaoke Eighth Road, Nanjing High-Tech Zone, Pukou District,
Nanjing, Jiangsu Jiangsu PEOPLE'S REPUBLIC OF CHINA

Test Result : **Positive** **Negative**

Total pages including Appendices : **38**



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1 Report Version

Revision	Release Date	History/Memo.
1.0	February 17, 2022	Initial Release

2 General Information

2.1 Notes

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Prepared by
Project Engineer

2022-02-17
Date

Zhilan Xue
Name



Signature

Approved by
Review Engineer

2022-02-17
Date

Jun Bao
Name



Signature

2.2 Testing Laboratory

Site 1

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. – EMC-Lab

Company Address: 10# Huaxia Road (M), Dongting, Wuxi, 214100 P. R. China

Telephone: +86 510 8820 3737

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2.3 Details of Applicant

Client: **SUMEC Hardware & Tools Co., Ltd.**
Address: **No.1 Xinghuo Road Jiangbei New Area 210061 Nanjing,
Jiangsu PEOPLE'S REPUBLIC OF CHINA**

Product Description: **Robotic lawnmower, powered by battery**

Submitted Model No.: **LLS Bxy/zG, LLS BLxy/zG, LLS Bxy/zC, LLS BLxy/zC, (x=250-600, An integer multiple of 10; y=Null,i,B;z=Y,B,G)**

2.4 Application Details

Date of receipt of order: September 28, 2021
Date of receipt of test item: September 29, 2021
Date of test: September 29, 2021 – November 11, 2021

2.5 Applied Standard

APPLIED PRODUCT STANDARD **ETSI EN 300 328 V2.2.2 (2019-07)**
EN 50663:2017

2.6 Test Summary

Table1. Summary of results

Conformance requirement according to ETSI EN 300 328 V2.2.2 (2019-07)		Result	Test Site
Essential parameter	Corresponding technical requirements		
Transmitter requirements	4.3.1.2/4.3.2.2 RF output power	PASS	Site 1
	4.3.2.3 Power Spectral Density	PASS	Site 1
	4.3.1.3/4.3.2.4 Duty Cycle, Tx-sequence, Tx-gap**	N/A	N/A
	4.3.1.4 Dwell time, Minimum Frequency Occupation and Hopping Sequence*	N/A	N/A
	4.3.1.5 Hopping Frequency Separation*	N/A	N/A
	4.3.1.6/4.3.2.5 Medium Utilisation (MU) factor**	N/A	N/A
	4.3.1.7/4.3.2.6 Adaptivity ****	N/A	N/A
	4.3.1.8/4.3.2.7 Occupied Channel Bandwidth	PASS	Site 1
	4.3.1.9/4.3.2.8 Transmitter unwanted emissions in the out-of-band domain	PASS	Site 1
	4.3.1.10/4.3.2.9 Transmitter unwanted emissions in the spurious domain	PASS	Site 1
Receiver requirements	4.3.1.11/4.3.2.10 Receiver spurious emissions	PASS	Site 1
	4.3.1.12/4.3.2.11 Receiver Blocking	PASS	Site 1 Site 2
	4.3.1.13/4.3.2.12 Geo-location capability***	N/A	N/A

NOTE1: Measurement taken is within the measurement uncertainty of measurement system.

NOTE2: "*" This requirement applies to all types of equipment using FHSS other than wide band modulations.

NOTE3: "****" This requirement does not apply to adaptive equipment unless operating in a non-adaptive mode.

NOTE4: "*****" This requirement only applies to equipment with geo-location capability.

NOTE5: "*****" These requirements do not apply for equipment with a maximum declared RF Output power of less than 10 dBm e.i.r.p.

3 Equipment Specification

3.1 General Description

The EUT is a Robotic Lawnmower with Inductive loop system(RMI), and it's powered by battery. It has BLE function which operated at 2.4GHz.

All models have the same BLE module, only LLS BL300B/YG was performed for all tests.

3.2 EUT Identity

NOTE: Unless otherwise noted in the report, the functional boards installed in the units shall be selected from the below list, but not means all the functional boards listed below shall be installed in one unit.

3.2.1 Technical data

Description:	Robotic lawnmower,powered by battery
Models:	LLS Bxy/zG, LLS BLxy/zG, LLS Bxy/zC, LLS BLxy/zC, (x=250-600,An integer multiple of 10; y=Null,i,B;z=Y,B,G)
Hardware version	RM-MB-V8.1.0
Software version	MCU0 : RM V6.01_2021
Input Rated Voltage	DC 20V

Remark 1: The above EUT's information is declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

3.3 Product Description –manufacturer description

3.3.1 Type of Tested Equipment

<input checked="" type="checkbox"/> BLE	<input type="checkbox"/> IEEE 802.11	Other supply full details: _____
<input checked="" type="checkbox"/> Stand-alone	<input type="checkbox"/> Plug-in radio	<input type="checkbox"/> Combined equipment <input type="checkbox"/> Other

3.3.2 Extreme operating condition as declared by manufacturer

Power source description	
<input type="checkbox"/> AC mains voltage	<input checked="" type="checkbox"/> DC voltage Nominal
Type of DC	
<input type="checkbox"/> Internal Power Supply	<input type="checkbox"/> External AC/DC Adapter <input checked="" type="checkbox"/> Battery <input type="checkbox"/> Other

EXTREME TEMPERATURE RANGE [manufacturer declared]			
Environment class /Operating Temperature	TL = Minimum Temperature [°C]	TN = Normal Temperature [°C]	TH = Maximum Temperature [°C]
<input type="checkbox"/> Outdoor and indoor usage	-20	25	55
<input type="checkbox"/> Outdoor usage only	-25	25	60
<input checked="" type="checkbox"/> Other [declared by manufacturer in UM]	0	25	45

3.3.3 Type of adaptivity used

<input type="checkbox"/> Non-adaptive	<input checked="" type="checkbox"/> Adaptive	<input checked="" type="checkbox"/> LBT	<input type="checkbox"/> Non LBT
	<input type="checkbox"/> The system can operate in more than one adaptive mode	<input type="checkbox"/> System can operate both adaptive & non adaptive mode	
	<input type="checkbox"/> Frame Based Equipment	<input checked="" type="checkbox"/> Load Based Equipment	
		CCA time implemented [uS]	>20
		q as referred by 4.3.2.5.2.2.2	4-32

3.3.4 Antenna Assemblies Profiles

Antenna Type	<input checked="" type="checkbox"/> Integrated	<input type="checkbox"/> External
Temporary RF connector	<input checked="" type="checkbox"/> Provided	<input type="checkbox"/> Not- provided
<input checked="" type="checkbox"/> SISO - Single antenna equipment	Antenna gain [dBi] =	3
<input type="checkbox"/> MIMO - Multiple antenna without beam forming	Number of transmit antennas=	1
<input type="checkbox"/> MIMO/B - Multiple antenna with beam forming	Beam forming gain [dB] Y =
Number of receive chains	1	<input type="checkbox"/> Symmetrical power distribution
Number of transceive chains	1	<input type="checkbox"/> Asymmetrical power distribution
<input type="checkbox"/> Tx power control (TPC) (antenna connector with multiple power setting)	Nr. of different power level

3.4 Operating Frequency Range and Modulation

Transmitter / Receiver Frequency Range			
<input checked="" type="checkbox"/>	Range 1 : from :	2402 MHz	To 2480 MHz
<input type="checkbox"/>	Range 2 : from :		
<input type="checkbox"/>	Other - (include frequency ranges supported):		

Modulation type	
<input type="checkbox"/>	GFSK
<input type="checkbox"/>	$\pi/4$ -DQPSK
<input type="checkbox"/>	8-DPSK
<input checked="" type="checkbox"/>	BLE(GFSK)
<input type="checkbox"/>	IEEE 802.11™ [i.3] modulations using a single or multiple transmitters with or without transmit CSD.
<input type="checkbox"/>	HT20: 20 MHz channels with one to four spatial streams (MCS 0 to MCS 76).
<input type="checkbox"/>	HT40: 40 MHz channels with one to four spatial streams (MCS 0 to MCS 76).

3.5 Additional information

The transmitter can operate only:

- Modulated**
- Un-modulated**

ITU Class of emissions 1. 22

Duty Cycle: The transmitter is intended for

- Continuous duty**
- Intermittent duty**
- Continuous operation possible for testing purposes**

About the EUT:

- The equipment submitted are representative production models.**
- If not, the equipment submitted are pre-production models.**
- If preproduction equipment are submitted, the final production equipment will be identical in all respects with the equipment tested.**
- If not, supply full details: _____**

4 General Test Conditions / Configurations

4.1 Test Sample

- The report applies to single model number.
- The report applies to for models. The practical measurements are performed using the model number of LLS B350/YG.

4.2 Test Modes

Test Mode	Test Modes Description
Bluetooth LE	TX and RX

4.3 Frequencies under Test

Test Mode	RF Channel		
	Lowest/Bottom (B)	Middle (M)	Highest/Top (T)
Bluetooth LE	Ch No. 0 / 2402 MHz	Ch No. 19 / 2442 MHz	Ch No. 39 / 2480 MHz

4.4 Test Setups

NOTE: See Appendix H for practical Test Setup Photos.

4.4.1 General Test Setup Configurations

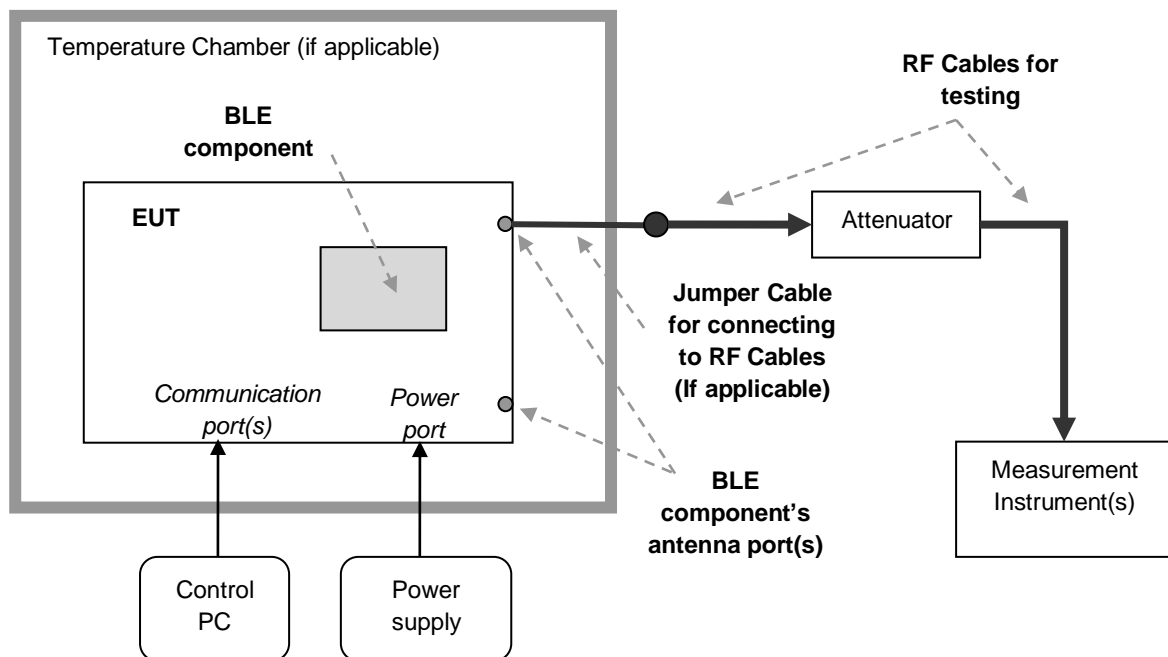
Configuration	Description
Test Antenna Ports	Until declared, all Transmitter tests are performed at all antenna ports of the EUT; all Receiver tests are performed at all antenna ports.
Multiple RF Sources	Other non-BLE RF source(s) (if applicable) of the EUT are disabled or shutdown during measurements for BLE RF source, which is considered in the present report.

4.4.2 Test Setup for Conducted Measurements

The EUT (BLE unit) is placed in a Temperature Chamber (if applicable), and is powered by a Power Supplier. An external Control PC associated with special software(s) is used to configure the EUT (BLE unit) with the purpose of fulfilling the test requirements by EN standard.

The antenna port(s) of the EUT (BLE unit) are connected to the Measurement Instrument(s) through an appropriate Attenuator. For the antenna port(s) which are not tested, appropriate 50 Ohm terminations are used.

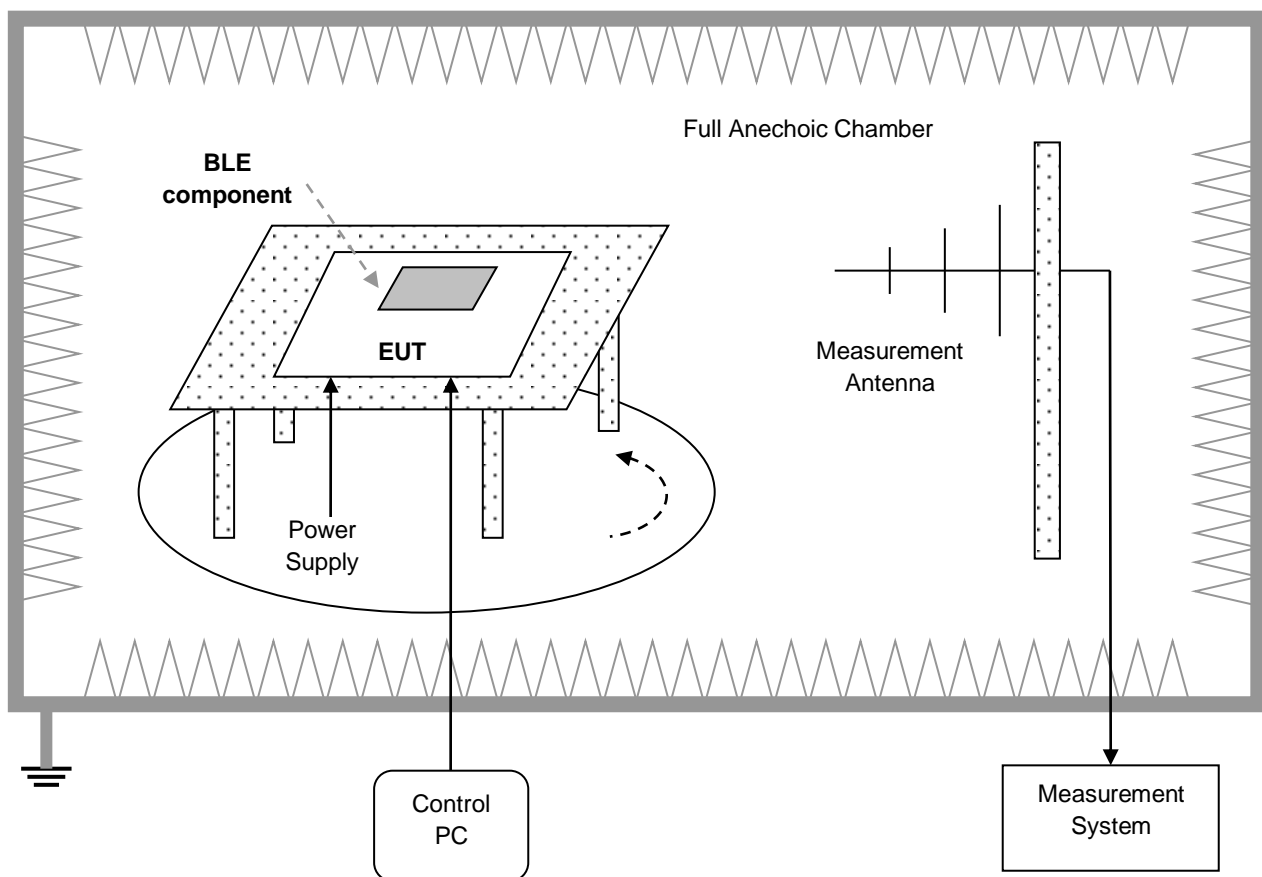
In addition, different setting options (e.g. Option 1) for Measurement Instrument(s) for conducted measurement methods can be used for some test items according to the EN standard. The selected option is specified in test conditions for each test case.



4.4.3 Test Setup for Radiated Measurements

The EUT (BLE unit) is placed in a Fully Anechoic Chamber simulating the free-space conditions. The whole device is positioned on a non-conducting support and is powered by a Power Supply. An external Control PC associated with special software(s) is used to configure the EUT (BLE unit) with the purpose of fulfilling the test requirements by EN standards.

An appropriate Measurement Antenna (according to different test frequency ranges) with the distance of 3 m to the whole device is used to obtain maximum response from the whole device, which is rotated when measurement running. The measurement is performed with the Measurement Antenna in both horizontal and vertical polarization planes.



4.5 Test Conditions

Test Case	Test Conditions	
	Configuration	Description
Equivalent Isotropic Radiated Power (EIRP)	Measurement Method	Conducted
	Power Level	Highest
	Test Conditions	NTNV, LTNV, HTNV
	Smart Antenna Systems	Ant 1
	Test Modes	Bluetooth LE
	Test Frequency	L, M, H
Maximum EIRP Spectral Density	Measurement Method	Conducted, Option 1
	Power Level	Highest
	Test Conditions	NTNV
	Smart Antenna Systems	Ant 1
	Test Modes	Bluetooth LE
	TX ON time (>10µs)	Fulfilled
	Test Frequency	L, M, H
Occupied Channel Bandwidth	Measurement Method	Conducted, Option 1
	Test Conditions	NTNV
	Smart Antenna Systems	Ant 1
	Test Modes	Bluetooth LE
	Transmitter Mode	Operating
	Test Frequency	L, H
Transmitter unwanted emissions in the out-of-band domain	Measurement Method	Conducted, Option 1
	Test Conditions	NTNV
	Smart Antenna Systems	Ant 1

Test Case	Test Conditions	
	Configuration	Description
	Test Modes	Bluetooth LE
	Test Frequency	L, H
Transmitter unwanted emissions in the spurious domain	Measurement Method	Radiated
	Test Conditions	NTNV
	Smart Antenna Systems	Ant 1
	Test Modes	Bluetooth LE
	Transmitter Mode	Operating
	Test Frequency	L, H
Receiver Spurious Emissions	Measurement Method	Radiated
	Test Conditions	NTNV
	Smart Antenna Systems	Ant 1
	Test Modes	Bluetooth LE
	Receiver Mode	Continues Receiving
	Test Frequency	L, H
Receiver Blocking	Measurement Method	Conducted, Option 1
	Power Level	Highest
	Test Conditions	NTNV
	Smart Antenna Systems	Ant 1
	Test Modes	Bluetooth LE
	Transmitter Mode	Operating
	Test Frequency	L, H

5 Test Results

No.	Test Item	Test Result
1	4.3.2.2 RF output power	Appendix A
2	4.3.2.3 Power Spectral Density	Appendix B
3	4.3.2.4 Duty Cycle, Tx-sequence, Tx-gap	N/A
4	4.3.2.5 Medium Utilisation (MU) factor	N/A
5	4.3.2.7 Occupied Channel Bandwidth	Appendix C
6	4.3.2.8 Transmitter unwanted emissions in the out-of-band domain	Appendix D
7	4.3.2.9 Transmitter unwanted emissions in the spurious domain_Radiated	Appendix E
8	4.3.2.9 Transmitter unwanted emissions in the spurious domain_Conducted	N/A
9	4.3.2.10 Receiver spurious emissions_Radiated	Appendix F
10	4.3.2.10 Receiver spurious emissions_Conducted	N/A
11	4.3.2.11 Receiver Blocking	Appendix G

6 Test Requirements

6.1 RF output power

The equivalent isotropic radiated power (as EIRP) shall be equal to or less than -10 dBW (= 20 dBm). This limit shall apply for any combination of power level and intended antenna assembly.

6.2 Maximum EIRP Spectral Density

For wide band modulations other than FHSS (e.g. DSSS, OFDM, etc.), the maximum e.i.r.p. spectral density (as PD) is limited to 10 mW per MHz (= 10 dBm/MHz).

6.3 Occupied Channel Bandwidth

The Occupied Channel Bandwidth shall fall completely within the band given in table 1.

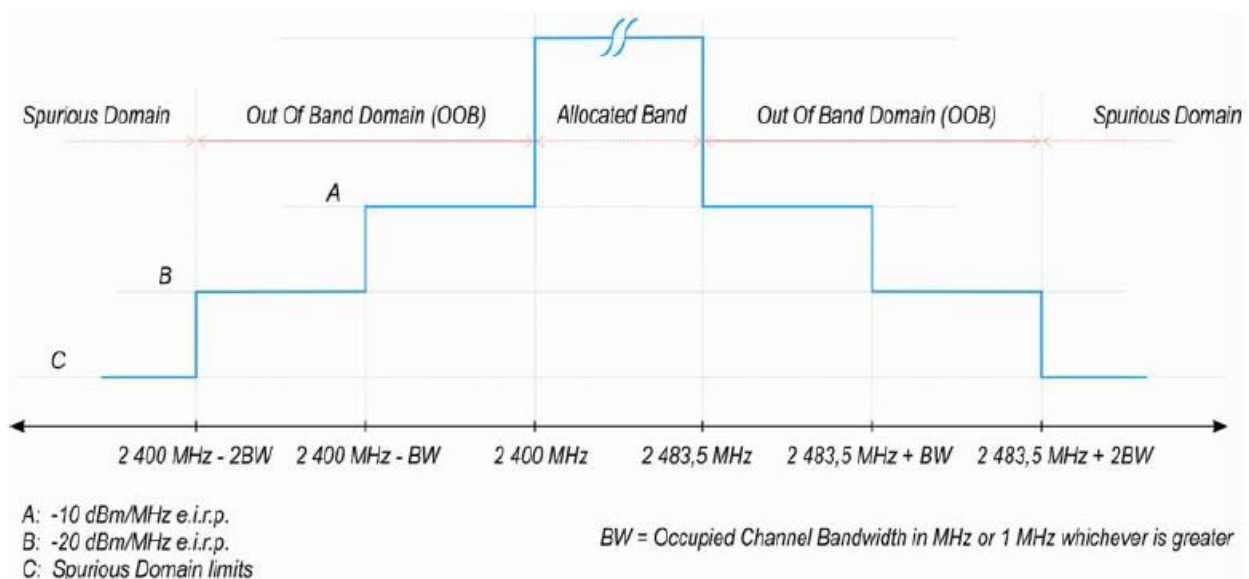
In addition, for non-adaptive equipment using wide band modulations other than FHSS and with e.i.r.p. greater than 10 dBm, the occupied channel bandwidth shall be less than 20 MHz.

Table 1: Service frequency bands

	Service frequency bands
Transmit	2 400 MHz to 2 483,5 MHz
Receive	2 400 MHz to 2 483,5 MHz

6.4 Transmitter unwanted emissions in the out-of-band domain

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



NOTE: Within the 2 400 MHz to 2 483.5 MHz band, the Out-of-band emissions are fulfilled by compliance with the Occupied Channel Bandwidth requirement in clause 4.3.2.7.

6.5 Transmitter Spurious Emissions

The spurious emissions of the transmitter shall not exceed the values in following tables in the indicated bands.

Frequency Range	Limit When Operating	Limit When in Standby
30MHz to 47MHz	-36dBm	-57 dBm
47MHz-74MHz	-54dBm	-57 dBm
74MHz-87.5MHz	-36dBm	-57 dBm
87.5MHz-118MHz	-54dBm	-57 dBm
118MHz-174MHz	-36dBm	-57 dBm
174MHz-230MHz	-54dBm	-57 dBm
230MHz-470MHz	-36dBm	-57 dBm
470MHz-694MHz	-54dBm	-57 dBm
694MHz-1GHz	-36dBm	-57 dBm
Above 1GHz to 12.75GHz	-30dBm	-47 dBm

NOTE: The above limit values apply to narrowband emissions, e.g. as caused by local oscillator leakage. The measurement bandwidth for such emissions may be as small as necessary to achieve a reliable measurement result.

6.6 Receiver Spurious Emissions

The spurious emissions of the receiver shall not exceed the values in following tables in the indicated bands.

Frequency Range	Limit
30 MHz to 1 GHz	-57 dBm
1 GHz to 12.75 GHz	-47 dBm

Note: The above limit values apply to narrowband emissions, e.g. as caused by local oscillator leakage. The measurement bandwidth for such emissions may be as small as necessary to achieve a reliable measurement result.

6.7 Receiver Blocking

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 contains the Receiver Blocking parameters for Receiver Category 1 equipment.

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		
<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: 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.</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>			

Table 15 contains the Receiver Blocking parameters for Receiver Category 2 equipment.

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 $P_{\text{min}} + 26 \text{ dB}$ 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 contains the Receiver Blocking parameters for Receiver Category 3 equipment.

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 $P_{\text{min}} + 30 \text{ dB}$ 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>			



6.8 Estimation of Exposure of Human to Electromagnetic Fields

The product [Robotic lawnmower, powered by battery], Model No. [LLS B350/YG], has an operation frequency of [2402-2480MHz], and the maximum transmitted power is 0.3dBm (1.072mW).

According with EN 50663:2017 clause 6, Equipment complying with the requirements for the general public is deemed to comply with the requirements for workers without further testing if it can be demonstrated using routes B, C or D that the available antenna power and/or the average total radiated power is less than or equal to the values of Pmax. The peak output power of [LLS B350/YG] is 1.072mW; it is less than the limit 20mW which list in the table 1, so the equipment complies with EMF basic restrictions in EN 50663:2017.

7 Main Test Instruments

	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
1	RF TEST SYSTEM	R&S	TS8997	487/391835	2021.12.10
2	SIGNAL ANALYZER	R&S	FSV40	487/641405	2022.05.06
3	LOGBICON TRI-LOG ANTENNA	SCHWARZBECK	VULB 9168	487/621027	2021.12.28
4	HORN ANTENNA 1-18GHZ	ETS	3115	487/621838	2021.12.02

Conducted RF tests –C

- RF output power
- Power Spectral Density
- Adaptivity & Receiver Blocking
- Occupied Channel Bandwidth
- Transmitter unwanted emissions OOB

Radiated RF tests -F

- Radiated unwanted emissions spurious TX
- Radiated unwanted emissions spurious RX

8 System Measurement Uncertainty

For the test methods, according to the harmonized standard and conformance testing standard, the measurement uncertainty figures shall be calculated in accordance with TR 100 028 and shall correspond to an expansion factor (coverage factor) $k = 1.96$ (which provides a confidence level of 95 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)).

System Measurement Uncertainty	
Test Items	Extended Uncertainty
Uncertainty for Radiated Spurious Emission 30MHz-1000MHz	$\pm 3.49\text{dB}$ (Horizontal), $\pm 3.50\text{dB}$ (Vertical)
Uncertainty for Conducted RF test	Power level test involved: 2.04dB Frequency test involved: 1.1×10^{-7}

9 Appendix A: RF output power

NOTE 1: In this Appendix, EIRP [dBm] = A [dBm] + 10*log (1/X) [dB] + G [dBi]. Where, A = Average Power, X = Duty Cycle and G = Antenna Gain. The Jumper Cable Loss (JCL) (if applicable) and Test Path Loss (TPL) were calculated into A.

NOTE 2: For measurements on smart antenna systems (devices with multiple transmit chains), the test is performed at each chain, and then combined into a final result. The result is the calculated linear sum of each chain (as Ant sum).

(1) Common Parameter

Test Mode	Power Level Setting defined by Manufacturer	X [%]	G [dBi]
Bluetooth LE	0dB	100	3

(2) Test Result

Temperature (°C)	Mode	Antenna Gain (dBi)	Channel No.	Frequency (MHz)	AV Power (dBm)	E.I.R.P (dBm)	Limit (dBm)
25	Bluetooth LE	0	0	2402	--	-0.5	20.00
		0	19	2440	--	-0.5	20.00
		0	39	2480	--	-0.8	20.00
-20	Bluetooth LE	0	0	2402	--	-0.4	20.00
		0	19	2440	--	-0.4	20.00
		0	39	2480	--	-0.7	20.00
45	Bluetooth LE	0	0	2402	--	-0.6	20.00
		0	19	2440	--	-0.6	20.00
		0	39	2480	--	-0.9	20.00

10 Appendix B: Maximum EIRP Spectral Density

NOTE 1: In this Appendix, $PD [dBm/MHz] = D [dBm/MHz] + 10 \cdot \log(1/X) [dB] + G [dBi]$. Where, D = Spectral Power Density, X = Duty Cycle and G = Antenna Gain. The Jumper Cable Loss (JCL) (if applicable) and Test Path Loss (TPL) were calculated into D.

NOTE 2: For measurements on smart antenna systems (devices with multiple transmit chains), the test is performed at each chain, and then combined into a final result. The result is the calculated linear sum of each chain (as Ant sum).

(1) Common Parameter

Test Mode	Power Level Setting defined by Manufacturer	X [%]	G [dBi]
Bluetooth LE	0dB	100	3

(2) Test Result

Test Mode	RF Ch.	Ant.	PD [dBm/MHz]	Limit [dBm/MHz]	Verdict
Tx	L	Ant 1	-0.545	< 10	PASS
	M	Ant 1	-0.580	< 10	PASS
	H	Ant 1	-0.848	< 10	PASS

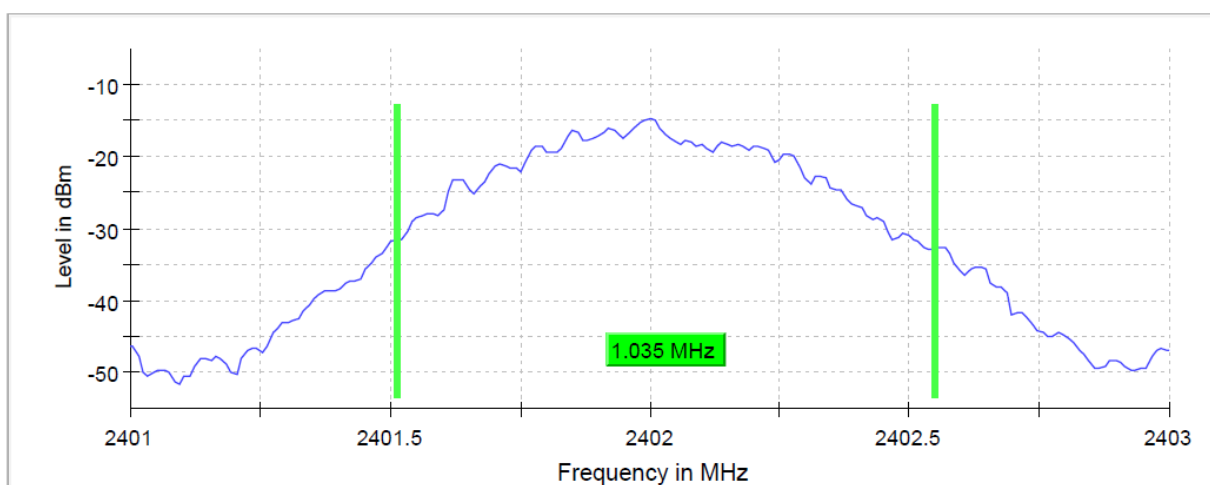
11 Appendix C: Occupied Channel Bandwidth

Channel	Frequency	Occupied Channel Bandwidth (MHz)	Band Edge (MHz)	Limit
0	2402	0.985	2401.502488	FL>2400MHz and FH<2483.5MHz
39	2480	1.005	2480.487562	

Occupied bandwidth test plots:

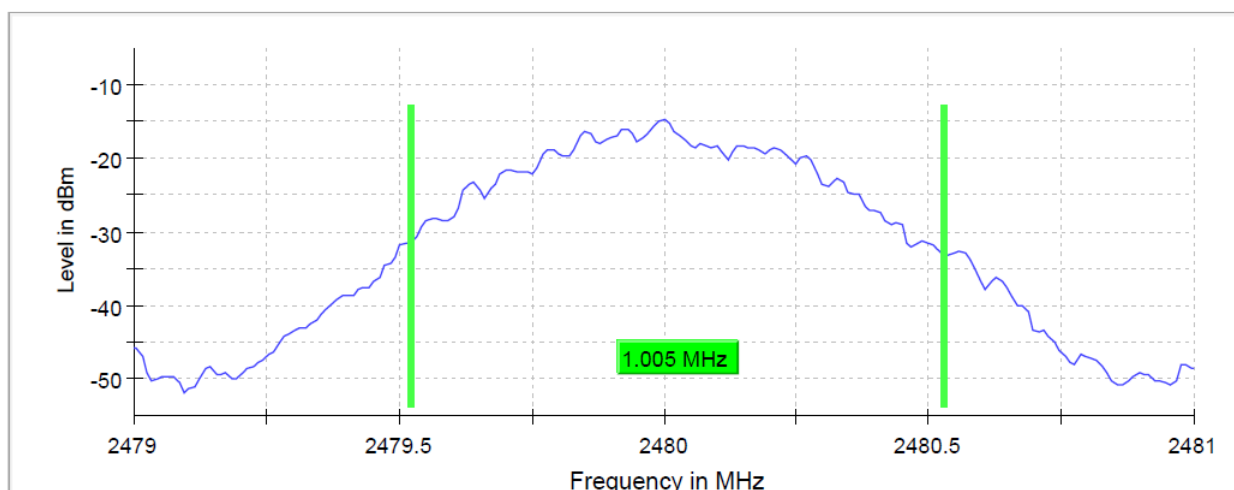
2402MHz

99 % Bandwidth



2480MHz

99 % Bandwidth



12 Appendix D: Transmitter unwanted emissions in the out-of-band domain

Test condition:	Test frequency (MHz)	Test segment (MHz)	Max. Reading (dBm/MHz)	Limit (dBm/MHz)
NTNV	2402	2400-BW to 2400	-42.7	-10
		2400-2BW to 2400-BW	-45.0	-20
	2480	2483.5 to 2483.5+BW	-46.8	-10
		2483.5+BW to 2483.5+2BW	-49.4	-20

13 Appendix E: Transmitter Spurious Emissions –Radiated Mode

NOTE 1: The whole testing range is from “30 MHz to 12.75 GHz” is divided into 2 parts according to the test site settings, which are:

- Part 1: Test range of “30 MHz to 1GHz”,
- Part 2: Test range of “1 GHz to 12.75 GHz”.

NOTE 2: In this Appendix, X = Duty Cycle and G = Antenna Gain. The test path transducer was directly calculated into results for each test range.

(1) Common Parameter

Test Mode	Power Level Setting defined by Manufacturer	X [%]	G [dBi]
Bluetooth LE	0 dB	100	3

(2) Test Result

Note: The test results for testing range of “30 MHz to 12.75 GHz” showed as below is **the WORST case for all Test Modes and Channels**. The detected values which are noise floor or below the limit 20dB will not be recorded.

For new module:

Operating Condition: Tx 2402MHz, lowest Channel

Invested Frequency Range(MHz)	Frequency (MHz)	Maximum Emission Observed(dBm)	Antenna Polarization	Detector	Limit (dBm)	Margin (dB)
30-1000	105.70	-63.51	Horizontal	Peak	-54.00	9.51
30-1000	103.30	-63.97	Vertical	Peak	-54.00	9.97
1000-12750	4803.99	-56.80	Horizontal	Peak	-30.00	26.8
1000-12750	1187.08	-55.37	Vertical	Peak	-30.00	25.37

Operating Condition: Tx 2480MHz, highest Channel

Invested Frequency Range(MHz)	Frequency (MHz)	Maximum Emission Observed(dBm)	Antenna Polarization	Detector	Limit (dBm)	Margin (dB)
30-1000	103.50	-64.79	Horizontal	Peak	-54.00	10.79
30-1000	103.30	-64.84	Vertical	Peak	-54.00	10.84
1000-12750	10946.40	-56.18	Horizontal	Peak	-30.00	26.18
1000-12750	12546.83	-55.01	Vertical	Peak	-30.00	25.01

14 Appendix F: Receiver Spurious Emissions-Radiated Mode

NOTE 1: The whole testing range is from "30 MHz to 12.75 GHz" is divided into 2 parts according to the test site settings, which are:

- Part 1: Test range of "30 MHz to 1 GHz",
- Part 2: Test range of "1 GHz to 12.75 GHz".

NOTE 2: In this Appendix, X = Duty Cycle and G = Antenna Gain. The test path transducer was directly calculated into results for each test range.

(1) Common Parameter

Test Mode	Power Level Setting defined by Manufacturer	X [%]	G [dBi]
Bluetooth LE	0 dB	100	3

(2) Test Result

NOTE: Only test results and plots under the WORST case are reported.

Invested Frequency Range(MHz)	Frequency (MHz)	Maximum Emission Observed(dBm)	Antenna Polarization	DETECTOR	Limit (dBm)	Margin (dB)
30-1000	--	<-80.0	Horizontal	PK	-57.00	>20
30-1000	--	<-80.0	Vertical	PK	-57.00	>20
1000-12750	--	<-75.0	Horizontal	PK	-47.00	>20
1000-12750	--	<-75.0	Vertical	PK	-47.00	>20

Remark: The detected values which are noise floor or below the limit 20dB will not be recorded.

15 Appendix G: Receiver Blocking

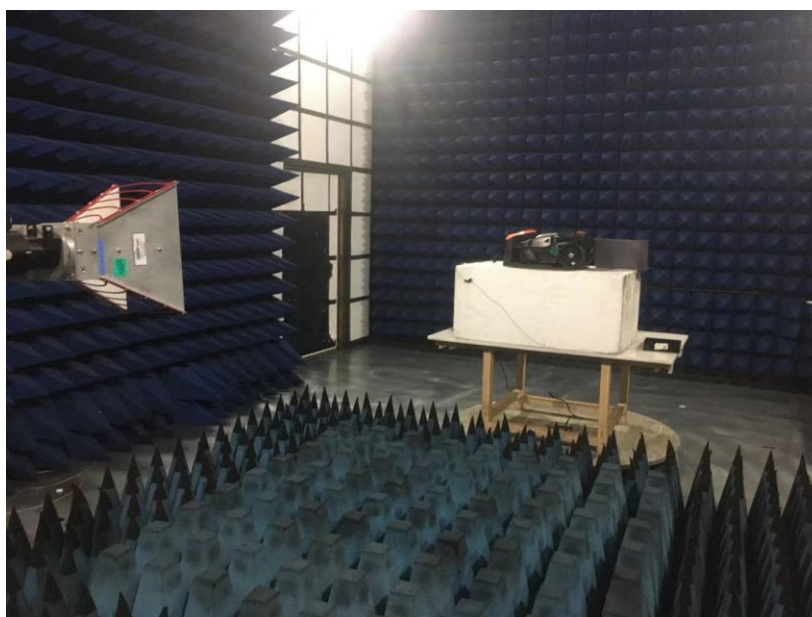
Test result:

Receiver Category

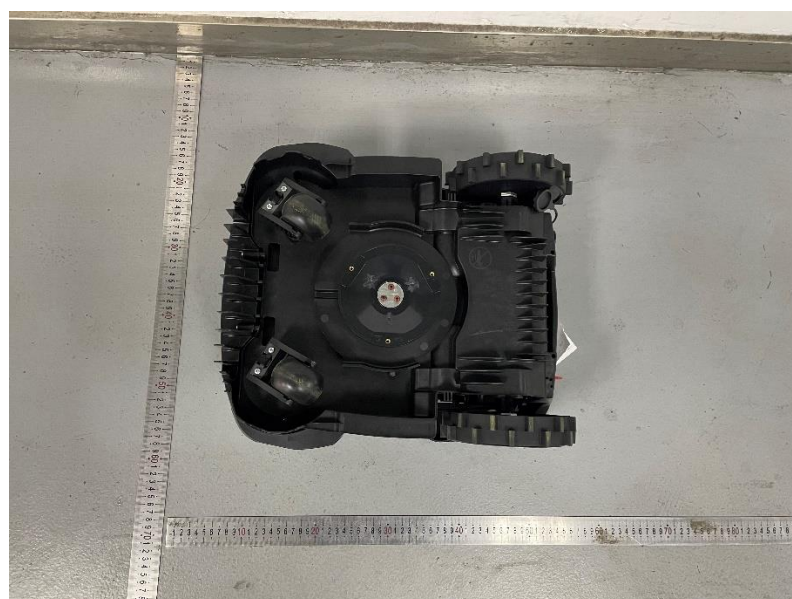
Test Condition	Test Mode	Test Channel	Ant	Wanted signal Level[dBm]	Freq [MHz]	CW Level [dBm]	PER [%]	Limit [%]	Verdict
NTNV	Rx	2402	Ant1	-69	2380	-34	2.00	<=10	PASS
NTNV	Rx	2402	Ant1	-69	2300	-34	1.80	<=10	PASS
NTNV	Rx	2480	Ant1	-69	2504	-34	1.90	<=10	PASS
NTNV	Rx	2480	Ant1	-69	2584	-34	1.70	<=10	PASS

16 Appendix H: Test Setup Photos

Radiated Emission (30MHz-1GHz)/ (1GHz-12.75GHz)



17 Appendix I: Photographs of EUT





BLE
mode

