

RF - TEST REPORT

Report Number	:	68.940.21.0064.01	Date of Issue:	October 8, 2021
Model	:	NL59-E-YYYYLW-3PK-EU; NL59-E-YYYYLW-3PK; NL59-K-YYYYLW-4PK-EU; NL59-K-YYYYLW-4PK; NL59-K-YYYYLW-5PK-EU; NL59-K-YYYYLW-5PK; NL59-K-YYYYLW-6PK-EU; NL59-K-YYYYLW-6PK; NL59-K-YYYYLW-7PK-EU; NL59-K-YYYYLW-7PK; NL59-K-YYYYLW-8PK-EU; NL59-K-YYYYLW-8PK; NL59-K-YYYYLW-9PK-EU; NL59-K-YYYYLW-9PK; NL59-K-YYYYLW-10PK-EU; NL59-K-YYYYLW-10PK; NL59-K-YYYYLW-11PK-EU; NL59-K-YYYYLW-11PK; NL59-K-YYYYLW-12PK-EU; NL59-K-YYYYLW-12PK; NL59-K-YYYYLW-13PK-EU; NL59-K-YYYYLW-13PK; NL59-K-YYYYLW-14PK-EU; NL59-K-YYYYLW-14PK; NL59-K-YYYYLW-15PK-EU; NL59-K-YYYYLW-15PK; NL59-K-YYYYLW-16PK-EU; NL59-K-YYYYLW-16PK; NL59-K-YYYYLW-17PK-EU; NL59-K-YYYYLW-17PK; NL59-K-YYYYLW-18PK-EU; NL59-K-YYYYLW-18PK ['YYYY' can be 0000-9999, stands for different sales area]		
Product Type	:	Fixed general purpose luminaires		
Applicant	:	NANOGRID LIMITED		
Address	:	Room 1301, 13/F, Excel Centre, 483A Castle Peak Road, Lai Chi Kok, Kowloon, HONG KONG		
Production Facility	:	SEVECO GLOBAL LTD.		
Address	:	2 Jianxiang St. Hanxishui Chashan Town, 523377 Dongguan, Guangdong, PEOPLE'S REPUBLIC OF CHINA		
Test Result	:	☒ Positive ☐ Negative		
Total pages including Appendices	:	45		

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1 Report Version

Revision	Release Date	History/Memo.
1.0	October 8, 2021	Initial Release

2 General Information

2.1 Notes

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Prepared By
Project Engineer

2021-10-08

Date

Henry Chen

Name



Signature

Approved By
Project Manager

2021-10-08

Date

Dawi Xu

Name



Signature

2.2 Testing Laboratory

Site 1

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
Building 12&13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2,
Nanshan District, Shenzhen City, 518052, P. R. China,

Telephone: 86 755 8828 6998

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2.3 Details of Applicant

Client: NANOGRID LIMITED

Address: Room 1301, 13/F, Excel Centre, 483A Castle Peak Road,
Lai Chi Kok, Kowloon, HONG KONG

Product Description: Fixed general purpose luminaires

Submitted Model No.: NL59-E-YYYYLW-3PK-EU; NL59-E-YYYYLW-3PK;
NL59-K-YYYYLW-4PK-EU; NL59-K-YYYYLW-4PK;
NL59-K-YYYYLW-5PK-EU; NL59-K-YYYYLW-5PK;
NL59-K-YYYYLW-6PK-EU; NL59-K-YYYYLW-6PK;
NL59-K-YYYYLW-7PK-EU; NL59-K-YYYYLW-7PK;
NL59-K-YYYYLW-8PK-EU; NL59-K-YYYYLW-8PK;
NL59-K-YYYYLW-9PK-EU; NL59-K-YYYYLW-9PK;
NL59-K-YYYYLW-10PK-EU; NL59-K-YYYYLW-10PK;
NL59-K-YYYYLW-11PK-EU; NL59-K-YYYYLW-11PK;
NL59-K-YYYYLW-12PK-EU; NL59-K-YYYYLW-12PK;
NL59-K-YYYYLW-13PK-EU; NL59-K-YYYYLW-13PK;
NL59-K-YYYYLW-14PK-EU; NL59-K-YYYYLW-14PK;
NL59-K-YYYYLW-15PK-EU; NL59-K-YYYYLW-15PK;
NL59-K-YYYYLW-16PK-EU; NL59-K-YYYYLW-16PK;
NL59-K-YYYYLW-17PK-EU; NL59-K-YYYYLW-17PK;
NL59-K-YYYYLW-18PK-EU; NL59-K-YYYYLW-18PK
['YYYY' can be 0000-9999, stands for different sales area]

2.4 Application Details

Date of receipt of order: July 19, 2021

Date of receipt of test item: July 19, 2021

Date of test: July 19, 2021 to July 26, 2021

2.5 Applied Standard

Test Standards	
ETSI EN 300 328 V2.2.2 (2019-07)	Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz band; Harmonised Standard for access to radio spectrum
EN 62479:2010	Assessment of the compliance of low power electronic and electrical equipment with the basic restrictions related to human exposure to electromagnetic fields (10 MHz to 300 GHz)
EN 50663:2017	Generic standard for assessment of low power electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (10 MHz - 300 GHz)

2.6 Test Summary

Summary of results (Requirement for non-FHSS equipment)

Conformance requirement according to ETSI EN 300 328 V2.2.2 (2019-07)		Result	Test Site
Essential parameter	Corresponding technical requirements		
Transmitter requirements	4.3.2.2 RF output power	PASS	Site 1
	4.3.2.3 Power Spectral Density	PASS	Site 1
	4.3.2.4 Duty Cycle, Tx-sequence, Tx-gap*	N/A	---
	4.3.2.5 Medium Utilisation (MU) factor*	N/A	---
	4.3.2.6 Adaptivity*	N/A	---
	4.3.2.7 Occupied Channel Bandwidth	PASS	Site 1
	4.3.2.8 Transmitter unwanted emissions in the out-of-band domain	PASS	Site 1
	4.3.2.9 Transmitter unwanted emissions in the spurious domain	PASS	Site 1
Receiver requirements	4.3.2.10 Receiver spurious emissions	PASS	Site 1
	4.3.2.11 Receiver Blocking	PASS	Site 1
	4.3.2.12 Geo-location capability**	N/A	---

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

NOTE2: "*" These requirements do not apply for equipment with a maximum declared RF Output power of less than 10 dBm e.i.r.p.

NOTE3: "**" This requirement only applies to non-FHSS equipment with geo-location capability.

3 Equipment Specification

3.1 General Description

EUT is a Fixed general purpose luminaires which support 2.4G proprietary protocol, Thread and 2.4GWiFi. Only Thread included in this report.

The products covered in this report named 'Nanoleaf Lines' are Class II luminaires for indoor use only, equipped with non replaceable light source.

The products contain three parts, LED driver, LED controller and LED panel.

The back surfaces of LED controller, LED panel and interconnection connector are with adhere tape for mounting.

The plastic cove of LED panel and enclosure is secured via. ultrasonic wave or glue.

LED driver and LED controller for all models are same.

All models have similar electrical and mechanical structures except that quantities of LED panel is different.

Model list:

Model No.	LED Quantities (pcs)	Rated Power (W)	LED Panel			
			Model No.	Rated Voltage (VDC)	Rated Power (W)	Quantities (pcs)
NL59-E-YYYYLW-3PK-EU	(24White+24RGB) x 3	10	NL59-L	42	2,2	3
NL59-E-YYYYLW-3PK						
NL59-K-YYYYLW-4PK-EU	(24White+24RGB) x 4	12,5	NL59-L	42	2,2	4
NL59-K-YYYYLW-4PK						
NL59-K-YYYYLW-5PK-EU	(24White+24RGB) x 5	15	NL59-L	42	2,2	5
NL59-K-YYYYLW-5PK						
NL59-K-YYYYLW-6PK-EU	(24White+24RGB) x 6	17,5	NL59-L	42	2,2	6
NL59-K-YYYYLW-6PK						
NL59-K-YYYYLW-7PK-EU	(24White+24RGB) x 7	20	NL59-L	42	2,2	7
NL59-K-YYYYLW-7PK						
NL59-K-YYYYLW-8PK-EU	(24White+24RGB) x 8	22,5	NL59-L	42	2,2	8
NL59-K-YYYYLW-8PK						
NL59-K-YYYYLW-9PK-EU	(24White+24RGB) x 9	25	NL59-L	42	2,2	9
NL59-K-YYYYLW-9PK						
NL59-K-YYYYLW-10PK-EU	(24White+24RGB) x 10	27,5	NL59-L	42	2,2	10
NL59-K-YYYYLW-10PK						
NL59-K-YYYYLW-11PK-EU	(24White+24RGB) x 11	30	NL59-L	42	2,2	11
NL59-K-YYYYLW-11PK						
NL59-K-YYYYLW-12PK-EU	(24White+24RGB) x 12	32,5	NL59-L	42	2,2	12
NL59-K-YYYYLW-12PK						
NL59-K-YYYYLW-13PK-EU	(24White+24RGB) x 13	35	NL59-L	42	2,2	13
NL59-K-YYYYLW-13PK						
NL59-K-YYYYLW-14PK-EU	(24White+24RGB) x 14	37,5	NL59-L	42	2,2	14
NL59-K-YYYYLW-14PK						
NL59-K-YYYYLW-15PK-EU	(24White+24RGB) x 15	40	NL59-L	42	2,2	15
NL59-K-YYYYLW-15PK						
NL59-K-YYYYLW-16PK-EU	(24White+24RGB) x 16	42,5	NL59-L	42	2,2	16
NL59-K-YYYYLW-16PK						
NL59-K-YYYYLW-17PK-EU	(24White+24RGB) x 17	45	NL59-L	42	2,2	17
NL59-K-YYYYLW-17PK						
NL59-K-YYYYLW-18PK-EU	(24White+24RGB) x 18	47,5	NL59-L	42	2,2	18
NL59-K-YYYYLW-18PK						

Remark: 'YYYY' can be 0000-9999, stands for different sales area

Unless otherwise specified, RF full tests were applied on NL59-K-0002LW-18PK and other models are deemed to fulfill the relevant RF requirements without further testing.

3.2 Technical Data

EUT Description	
Product Name	Fixed general purpose luminaires
Model Number	NL59-E-YYYYLW-3PK-EU; NL59-E-YYYYLW-3PK; NL59-K-YYYYLW-4PK-EU; NL59-K-YYYYLW-4PK; NL59-K-YYYYLW-5PK-EU; NL59-K-YYYYLW-5PK; NL59-K-YYYYLW-6PK-EU; NL59-K-YYYYLW-6PK; NL59-K-YYYYLW-7PK-EU; NL59-K-YYYYLW-7PK; NL59-K-YYYYLW-8PK-EU; NL59-K-YYYYLW-8PK; NL59-K-YYYYLW-9PK-EU; NL59-K-YYYYLW-9PK; NL59-K-YYYYLW-10PK-EU; NL59-K-YYYYLW-10PK; NL59-K-YYYYLW-11PK-EU; NL59-K-YYYYLW-11PK; NL59-K-YYYYLW-12PK-EU; NL59-K-YYYYLW-12PK; NL59-K-YYYYLW-13PK-EU; NL59-K-YYYYLW-13PK; NL59-K-YYYYLW-14PK-EU; NL59-K-YYYYLW-14PK; NL59-K-YYYYLW-15PK-EU; NL59-K-YYYYLW-15PK; NL59-K-YYYYLW-16PK-EU; NL59-K-YYYYLW-16PK; NL59-K-YYYYLW-17PK-EU; NL59-K-YYYYLW-17PK; NL59-K-YYYYLW-18PK-EU; NL59-K-YYYYLW-18PK ['YYYY' can be 0000-9999, stands for different sales area]
Ratings	100-240VAC; 50/60Hz; Protection Class: II Other ratings see " Model list " for details.
TX & RX Frequency	2402-2480MHz for 2.4G proprietary protocol 2405-2480MHz for Thread 2412-2472MHz for WiFi
S/N	NIL
EUT Accessory	
NIL	NIL

NOTE 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 Cables Used during Test

Cable	Length	Shielded/unshielded	With / without ferrite
/	/	/	/

3.4 Associated Equipment Used during Test

Description	Manufacturer	Model NO.	S/N
/	/	/	/

3.5 Test software information

Test Software Version	QA tool	
Frequency	Modulation	Setting TX Power
2405-2480MHz	QPSK	70

4 Product Information

4.1 Type of Equipment

☐ Bluetooth	☐ IEEE 802.11	☐ IEEE 802.15.4	☐ Other: _____
☐ FHSS equipment	☒ non-FHSS equipment	☐ Other	
☒ Stand-alone	☐ Plug-in radio	☐ Combined equipment	☐ Other: _____

4.2 The Operational Environment

Extreme Temperature Range over which equipment is to be type tested		
[]	Outdoor and indoor usage	-20°C to +55°C
[]	Indoor usage only	0°C to +35°C
[✓]	Other	[-10°C to 40°C declared by manufacturer]

Power source description		
[✓]	AC mains voltage	AC 230V
[]	DC voltage Nominal	
Type of DC		
Internal Power Supply []	External AC/DC Adapter [✓]	Battery []
		Other []

4.3 Transmit Operating Mode

Transmit Operating Mode			
[✓]	Single antenna equipment		
[]	Multiple antenna without beam forming		
[]	Multiple antenna with beam forming	Beam forming gain Y =	[dB]

4.4 Operating Frequency Range

Transmitter / Receiver Frequency Range			
[✓]	Range 1 : from :	2405 MHz	To 2480 MHz
[]	Range 2 : from :		
[]	Other - (include frequency ranges supported):		

4.5 Modulation Type

Modulation type	
☐	GFSK
☐	$\pi/4$ -DQPSK
☐	8-DPSK
☐	BLE(GFSK)
☐	IEEE 802.11™ modulations using a single or multiple transmitters with or without transmit CSD.
☐	IEEE 802.11™ HT20: 20 MHz channels with one to four spatial streams (MCS 0 through MCS 76)
☐	IEEE 802.11™ HT40: 40 MHz channels with one to four spatial streams (MCS 0 through MCS 76)
☒	Other: __QPSK__

4.6 Equipment Type Tested Path

Transmitter operate modulation:	
☒	BLE
☐	IEEE 802.11
☐	IEEE 802.15.4
☐	Other: _____

4.7 Type of Antenna

Type of antenna		
Type of Transmitter's antenna	☐	Integrated Antenna(s)
	☒	Antenna connector for dedicated antenna(s)
Antenna gain:	2.15dBi	
Temporary RF connector provided	☒	
No temporary RF connector provided	☐	

4.8 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

Receiver categories

- [☐] Receiver category 1
[☒] Receiver category 2
[☐] Receiver category 3

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: _____

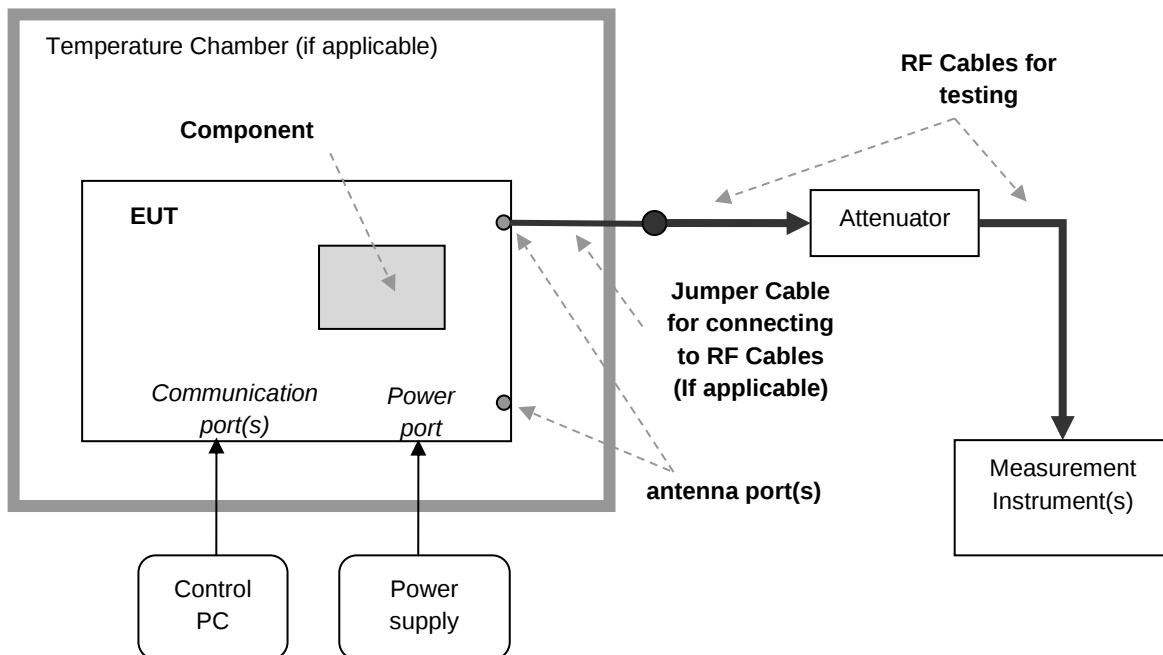
5 General Test Configurations

5.1 Test Setup for Conducted Measurements

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

The antenna port(s) of the EUT 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.

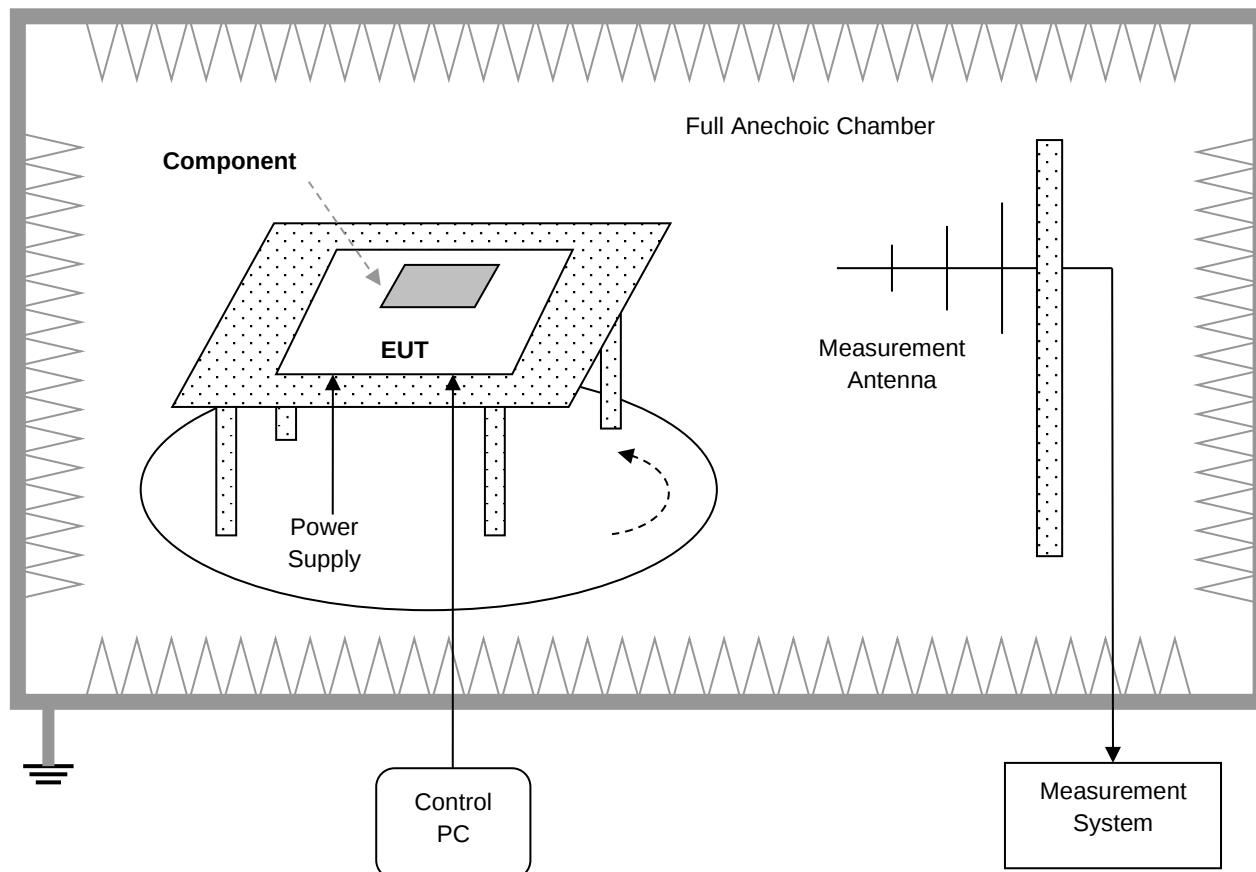
In addition, different setting options for Measurement Instrument(s) for conducted measurement methods can be used for some test items according to the EN standard. The selected option is specified in test conditions for each test case.



5.2 Test Setup for Radiated Measurements

The EUT 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 Supplier. An external Control PC associated with special software(s) is used to configure the EUT 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, the EUT shall be rotated through 360° in a plane until a higher maximum signal is received. The measurement is performed with the Measurement Antenna in both horizontal and vertical polarization planes.



6 Measurements Result

6.1 Maximum Transmit Power

6.1.1 Test Condition

Test Mode:	Transmitting
Ambient temperature:	24.2°C
Relative humidity:	50.1%
Ambient Pressure	101.0Kpa

6.1.2 Limit

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

6.1.3 Test Result

Test Condition: Continuous transmitting				
Antenna gain: 2.15dBi				
Test method:		[]	Radiated	[☒] Conducted
Rel. Humidity: 50.1 %		Test results (dBm)		
		2402MHz	2445MHz	2480MHz
T _{nom} (+24.2 °C)	V _{nom} (AC 230V)	8.8	8.5	7.5
T _{min} (-10 °C)	V _{nom} (AC 230V)	8.7	8.4	7.4
T _{max} (40 °C)	V _{nom} (AC 230V)	8.7	8.3	7.4
Limit: 20dBm (100mW)				

6.1.4 Result

The equipment met the requirement of this clause.

6.2 Power Spectral Density

6.2.1 Test Condition

Test Mode:	Transmitting
Ambient temperature:	24.2°C
Relative humidity:	50.1%
Ambient Pressure	101.0Kpa

6.2.2 Limit

For equipment using wide band modulations other than FHSS, the maximum Power Spectral Density is limited to 10 dBm per MHz.

6.2.3 Test Result

Test Condition: Continuous transmitting			
Antenna gain: 2.15dBi			
Power Setting: Highest Power [] Radiated [✓] Conducted			
Rel. Humidity: 50.1 %	Power Spectral Density(dBm/MHz)		
	2405 MHz	2445 MHz	2480 MHz
QPSK	6.859	6.424	5.485
Limit: 10dBm/MHz			

6.2.4 Result

The equipment met the requirement of this clause.

6.3 Occupied Channel Bandwidth

6.3.1 Test Condition

Test Mode:	Transmitting
Ambient temperature:	24.2°C
Relative humidity:	50.1%
Ambient Pressure	101.0Kpa

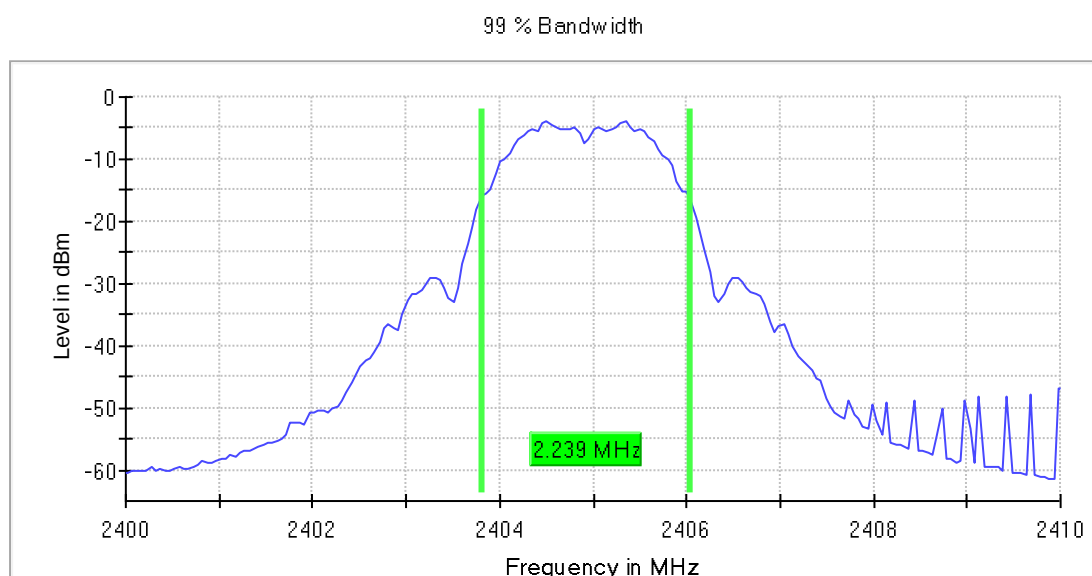
6.3.2 Limit

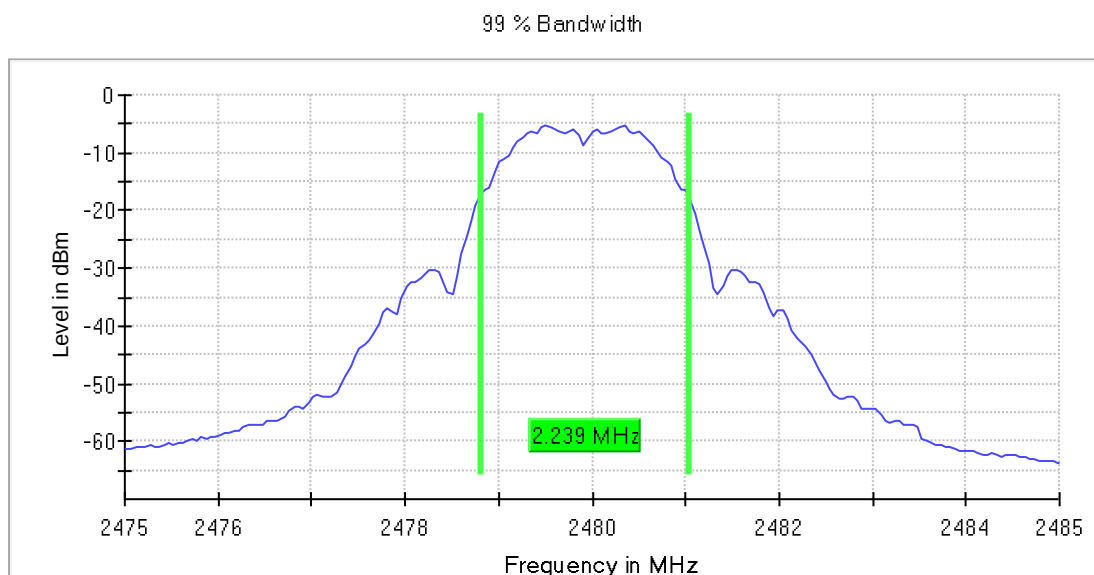
The Occupied Channel Bandwidth (that contains 99 % of the power of the signal) for each hopping frequency shall fall completely within the frequency band (2400-2483.5MHz). For non-adaptive Frequency Hopping equipment with e.i.r.p. greater than 10 dBm, the Occupied Channel Bandwidth for every occupied hopping frequency shall be equal to or less than the Nominal Channel Bandwidth declared by the manufacturer. See clause 5.4.1 j). This declared value shall not be greater than 5 MHz.

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.

6.3.3 Test Result

Frequency	99% Bandwidth (kHz)	Limit [MHz]	Result		Limit [MHz]
			FL(MHz)	FH(MHz)	
2405MHz	2.238806	≤ 5 MHz	2403.805970	---	FL>2400 and FH<2483.5
2480MHz	2.238806	≤ 5 MHz	---	2481.044776	





Thread: 2480MHz

6.3.4 Result

The equipment met the requirement of this clause.

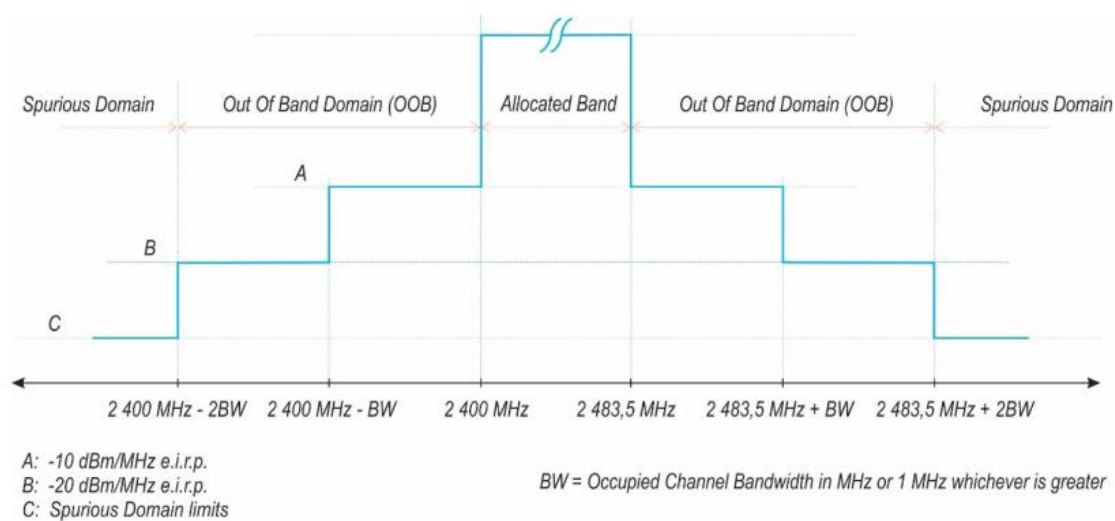
6.4 Transmitter Unwanted Emissions in the out-of-band domain

6.4.1 Test Condition

Test Mode:	Transmitting
Ambient temperature:	24.2°C
Relative humidity:	50.1%
Ambient Pressure	101.0Kpa

6.4.2 Limit

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.



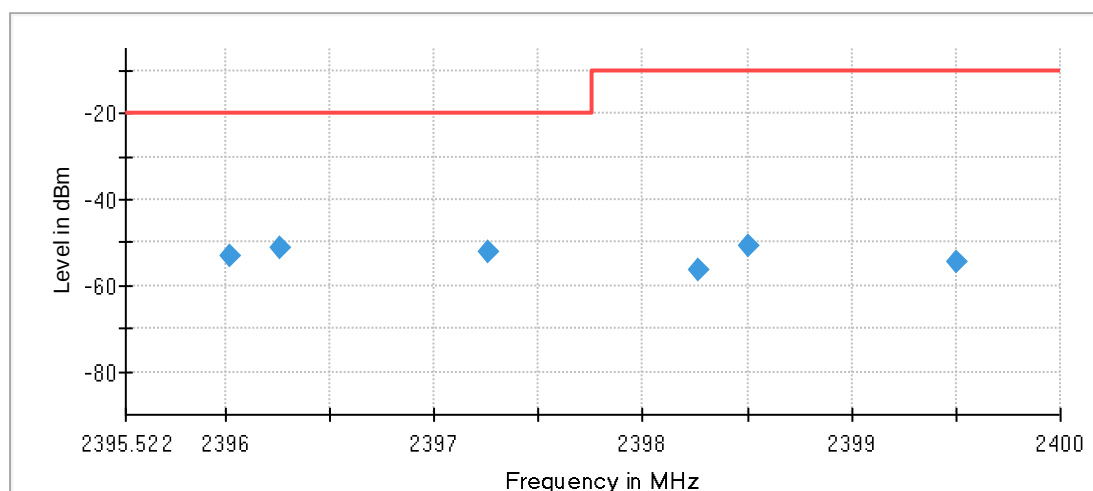
NOTE: Within the band specified in table 1, the Out-of-band emissions are fulfilled by compliance with the Occupied Channel Bandwidth requirement in clause 4.3.2.7.

6.4.3 Test Result

Test condition:	Test frequency (MHz)	Test segment (MHz)	Limit (dBm/MHz)	Result
$T_{nom}V_{nom}$	2405	2400-BW to 2400	-10	Pass
		2400-2BW to 2400-BW	-20	Pass
		2483.5 to 2483.5+BW	-10	Pass
		2483.5+BW to 2483.5+2BW	-20	Pass
$T_{nom}V_{nom}$	2480	2400-BW to 2400	-10	Pass
		2400-2BW to 2400-BW	-20	Pass
		2483.5 to 2483.5+BW	-10	Pass
		2483.5+BW to 2483.5+2BW	-20	Pass

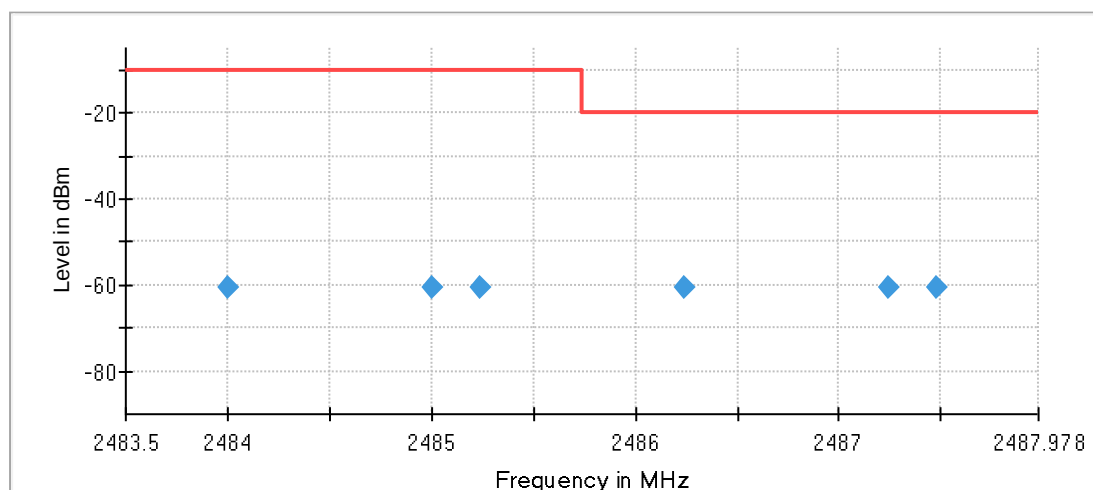
Thread 2405MHz

Out of band low



◆ Level — Limit

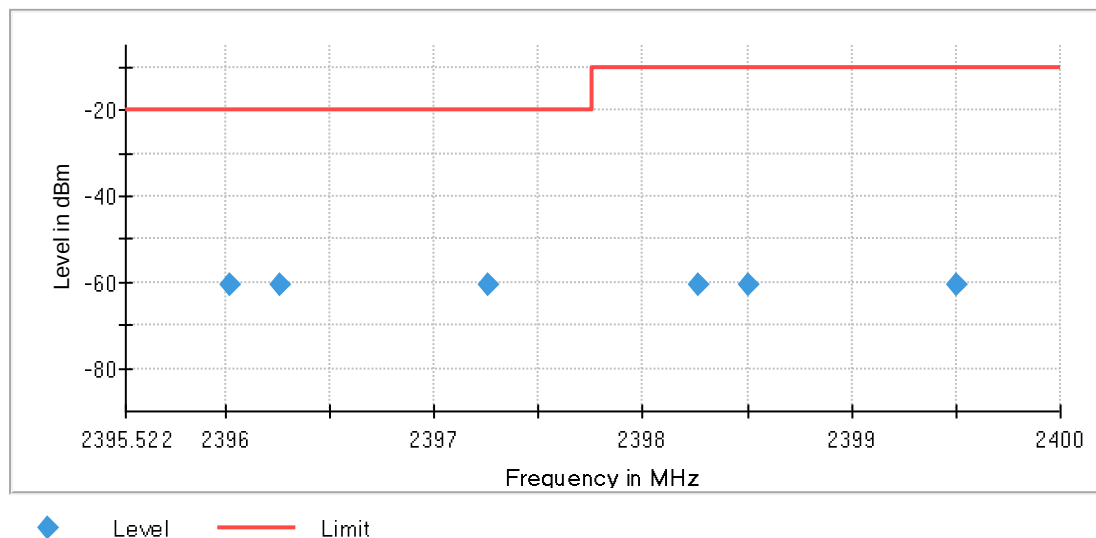
Out of band high



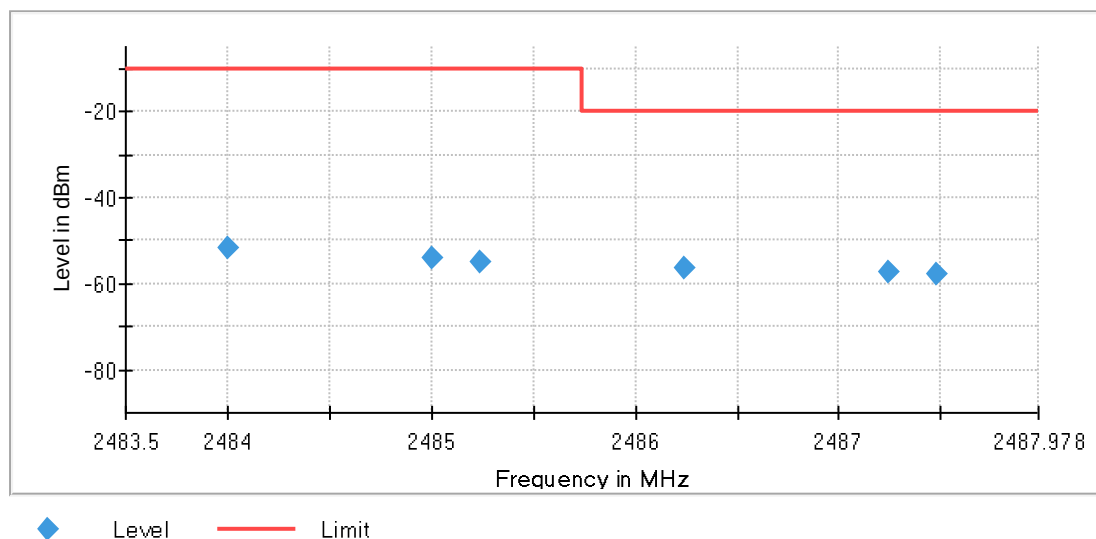
◆ Level — Limit

Thread 2480MHz

Out of band low



Out of band high



6.4.4 Result

The equipment met the requirement of this clause.

6.5 Radiated Spurious Emissions

6.5.1 Test Condition

Test Mode:	Transmitting
Ambient temperature:	24.2°C
Relative humidity:	50.1%
Ambient Pressure	101.0Kpa

6.5.2 Limit

Radiated Spurious Emissions Limits for Transmitter

Frequency range	Maximum Power e.r.p(≤1G) e.i.r.p(>1G)	Measurement Bandwidth
30MHz to 47MHz	-36dBm	100kHz
47MHz-74MHz	-54dBm	100kHz
74MHz-87.5MHz	-36dBm	100kHz
87.5MHz-118MHz	-54dBm	100kHz
118MHz-174MHz	-36dBm	100kHz
174MHz-230MHz	-54dBm	100kHz
230MHz-470MHz	-36dBm	100kHz
470MHz-694MHz	-54dBm	100kHz
694MHz-1GHz	-36dBm	100kHz
1GHz-12.75GHz	-30dBm	1MHz

Radiated Spurious Emissions Limits for Receiver

Frequency range	Maximum power, e.r.p	Measurement Bandwidth
30MHz to 1GHz	-57dBm	100kHz
1GHz to 12.75GHz	-47dBm	1MHz

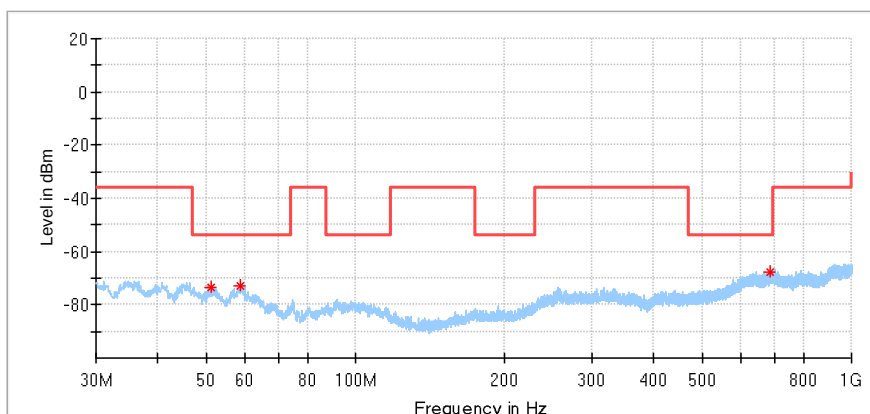
6.5.3 Test Result

The testing was applied on all the modes, only the worst case data was shown in the report.

6.5.3.1 Test result for Transmitter

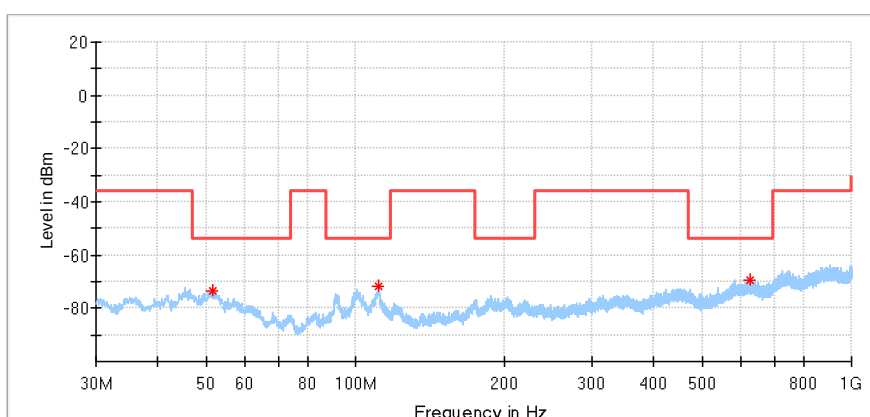
Note: The test results for testing range of "30 MHz to 12.75 GHz" showed as below is **the WORST case for all Test Modes and Channels**. The detected values which are noise floor or below the limit 20dB will not be recorded.

M/N: NL59-K-0002LW-18PK
 Test Specification: Horizontal
 Comment: AC 230V/50Hz



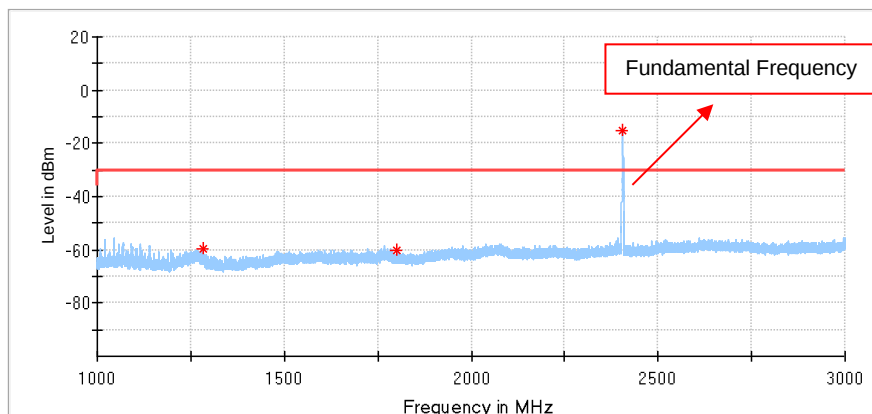
Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
51.178333	-73.53	-54.00	19.53	---	---	154.0	H	88.0	-119.3
58.830556	-72.96	-54.00	18.96	---	---	154.0	H	309.0	-117.8
685.773889	-67.60	-54.00	13.60	---	---	154.0	H	171.0	-113.8

M/N: NL59-K-0002LW-18PK
 Test Specification: Vertical
 Comment: AC 230V/50Hz



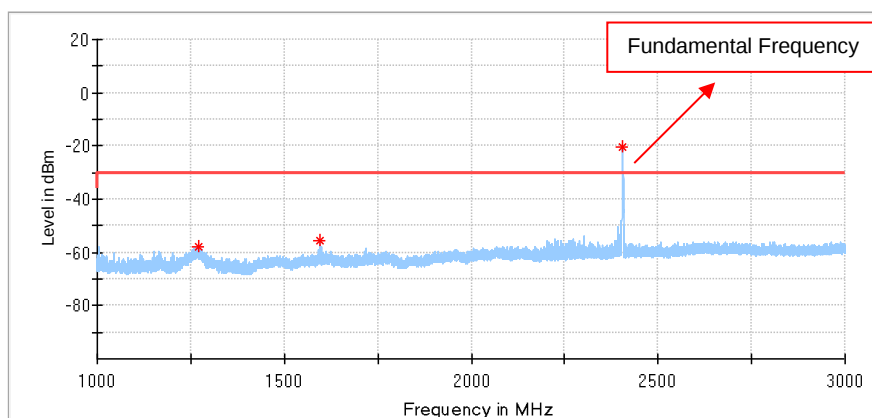
Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
51.717222	-73.70	-54.00	19.70	---	---	154.0	V	310.0	-118.2
111.641667	-71.88	-54.00	17.88	---	---	154.0	V	357.0	-118.4
623.262778	-69.18	-54.00	15.18	---	---	154.0	V	245.0	-116.3

Operating Condition: Thread (Tx 2405MHz, lowest Channel)
 Test Specification: Horizontal
 Comment: AC 230V/50Hz



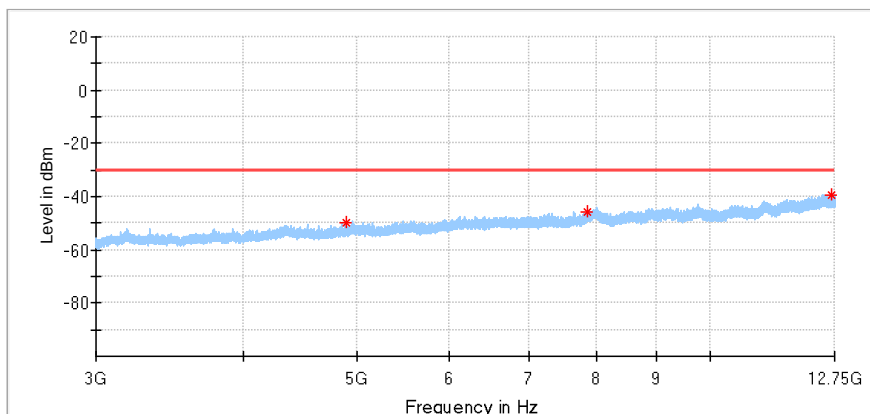
Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1284.312500	-59.48	-30.00	29.48	---	---	154.0	H	228.0	-110.2
1799.875000	-60.40	-30.00	30.40	---	---	154.0	H	9.0	-107.3
2404.437500	-14.91	-30.00	-15.09	---	---	154.0	H	265.0	-103.3

Operating Condition: Thread (Tx 2405MHz, lowest Channel)
 Test Specification: Vertical
 Comment: AC 230V/50Hz



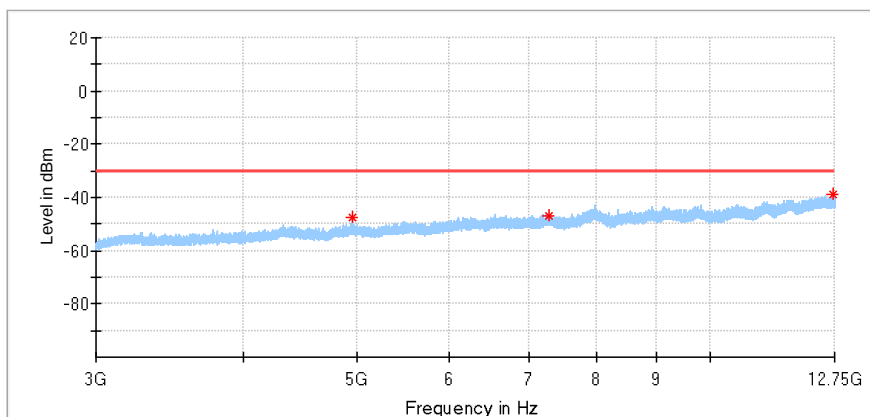
Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1270.250000	-58.10	-30.00	28.10	---	---	154.0	V	142.0	-108.9
1595.187500	-55.67	-30.00	25.67	---	---	154.0	V	227.0	-106.5
2404.500000	-20.36	-30.00	-9.64	---	---	154.0	V	335.0	-103.1

Operating Condition: Thread (Tx 2405MHz, lowest Channel)
 Test Specification: Horizontal
 Comment: AC 230V/50Hz



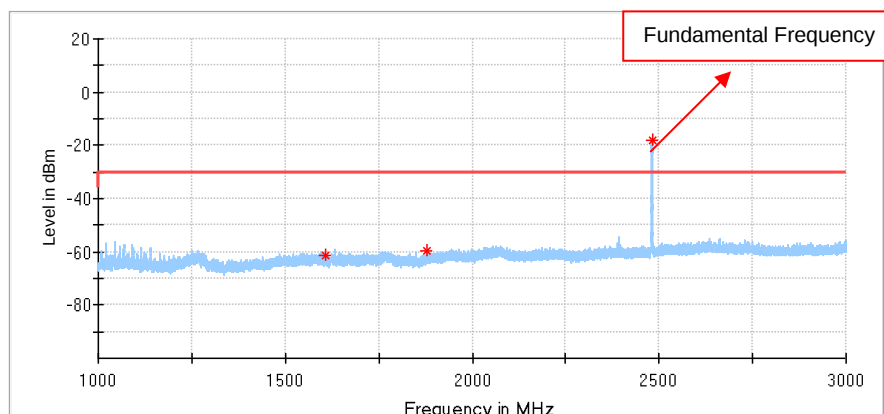
Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4895.460938	-50.00	-30.00	20.00	---	---	154.0	H	0.0	-94.6
7856.414063	-45.66	-30.00	15.66	---	---	154.0	H	44.0	-89.2
12658.593750	-39.45	-30.00	9.45	---	---	154.0	H	194.0	-83.2

Operating Condition: Thread (Tx 2405MHz, lowest Channel)
 Test Specification: Vertical
 Comment: AC 230V/50Hz



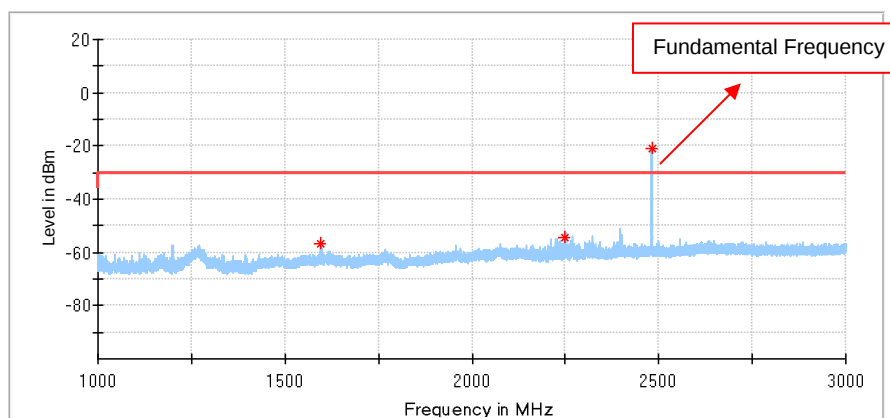
Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4962.492188	-47.47	-30.00	17.47	---	---	154.0	V	122.0	-94.3
7279.031250	-46.74	-30.00	16.74	---	---	154.0	V	0.0	-90.5
12718.921875	-39.10	-30.00	9.10	---	---	154.0	V	5.0	-82.6

Operating Condition: Thread (Tx 2480MHz, highest Channel)
 Test Specification: Horizontal
 Comment: AC 230V/50Hz



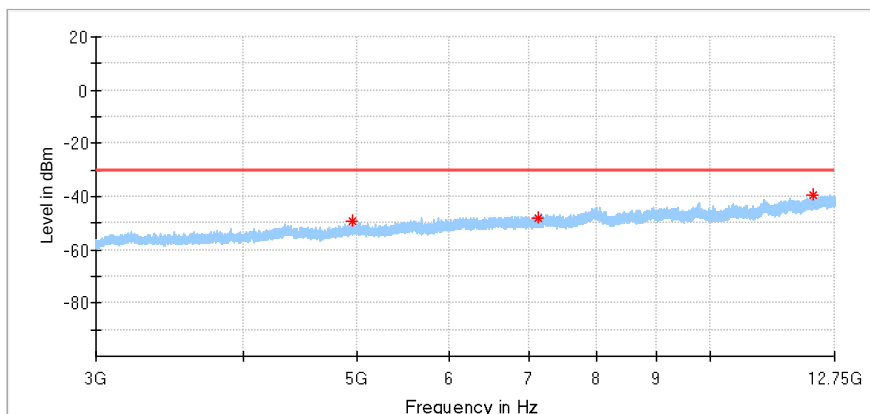
Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1608.250000	-61.47	-30.00	31.47	---	---	154.0	H	91.0	-107.2
1877.937500	-59.86	-30.00	29.86	---	---	154.0	H	296.0	-106.2
2480.625000	-17.91	-30.00	-12.09	---	---	154.0	H	272.0	-103.3

Operating Condition: Thread (Tx 2480MHz, highest Channel)
 Test Specification: Vertical
 Comment: AC 230V/50Hz



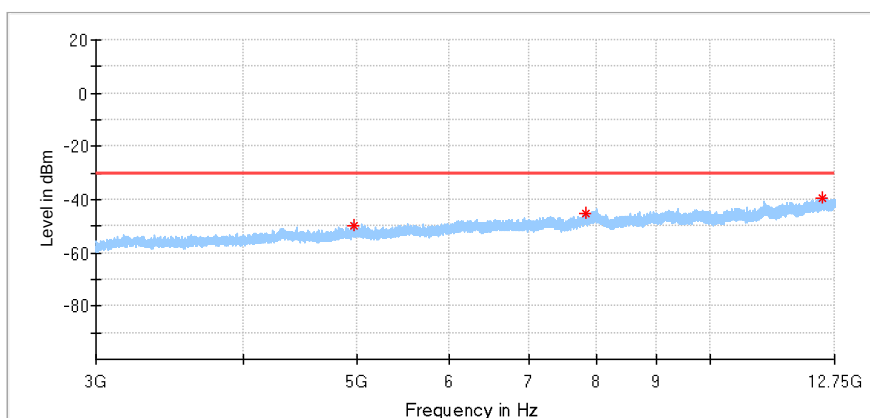
Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1595.312500	-56.59	-30.00	26.59	---	---	154.0	V	185.0	-106.5
2250.375000	-54.21	-30.00	24.21	---	---	154.0	V	206.0	-104.4
2480.562500	-21.05	-30.00	-8.95	---	---	154.0	V	217.0	-102.9

Operating Condition: Thread (Tx 2480MHz, highest Channel)
 Test Specification: Horizontal
 Comment: AC 230V/50Hz



Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4962.187500	-49.11	-30.00	19.11	---	---	154.0	H	252.0	-94.3
7128.820313	-48.13	-30.00	18.13	---	---	154.0	H	351.0	-91.4
12224.718750	-39.57	-30.00	9.57	---	---	154.0	H	34.0	-83.7

Operating Condition: Thread (Tx 2480MHz, highest Channel)
 Test Specification: Vertical
 Comment: AC 230V/50Hz

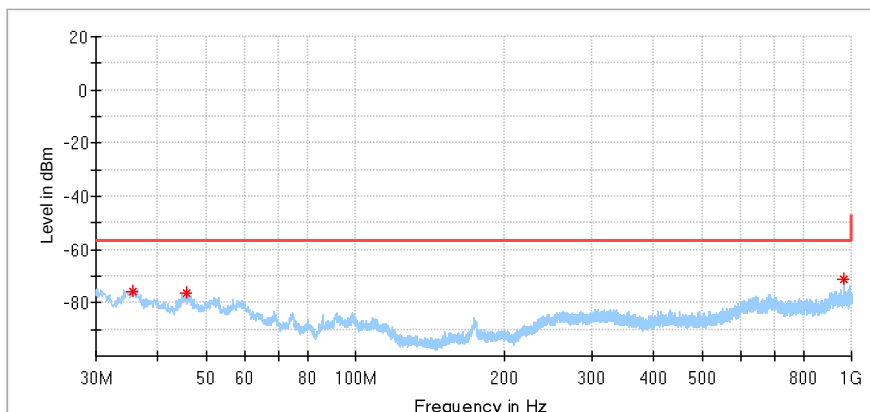


Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4975.898438	-49.67	-30.00	19.67	---	---	154.0	V	159.0	-94.3
7826.250000	-45.28	-30.00	15.28	---	---	154.0	V	216.0	-89.3
12455.671875	-39.38	-30.00	9.38	---	---	154.0	V	297.0	-83.0

6.5.3.2 Test result for receiver

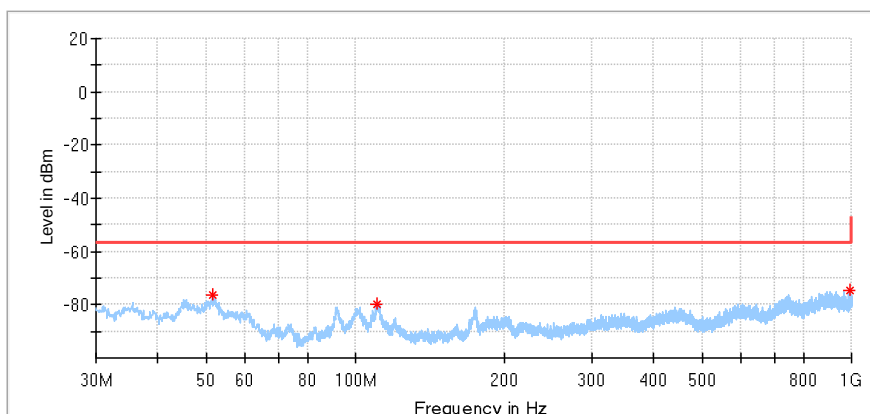
Note: The test results for testing range of "30 MHz to 12.75 GHz" showed as below is **the WORST case for all Test Modes and Channels**. The detected values which are noise floor or below the limit 20dB will not be recorded.

M/N: NL59-K-0002LW-18PK
 Test Specification: Horizontal
 Operating Condition: Thread (Rx)
 Comment: AC 230V/50Hz



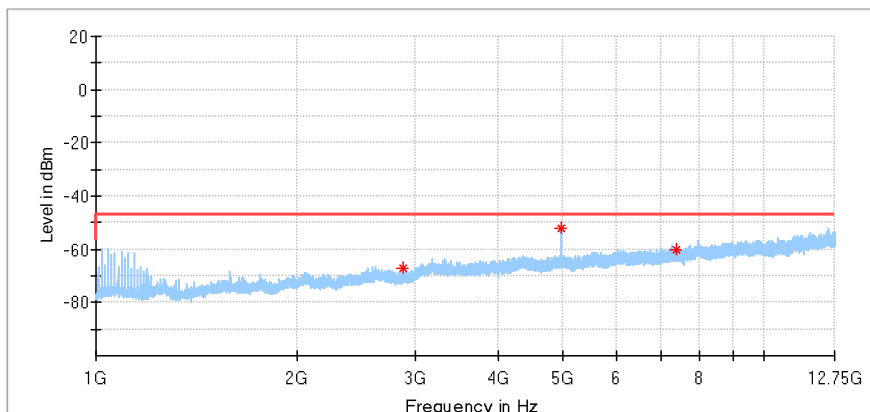
Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
35.550556	-75.71	-57.00	18.71	---	---	154.0	H	0.0	-116.7
45.573889	-76.59	-57.00	19.59	---	---	154.0	H	146.0	-116.7
966.696667	-70.99	-57.00	13.99	---	---	154.0	H	77.0	-111.6

M/N: NL59-K-0002LW-18PK
 Test Specification: Vertical
 Operating Condition: Thread (Rx)
 Comment: AC 230V/50Hz



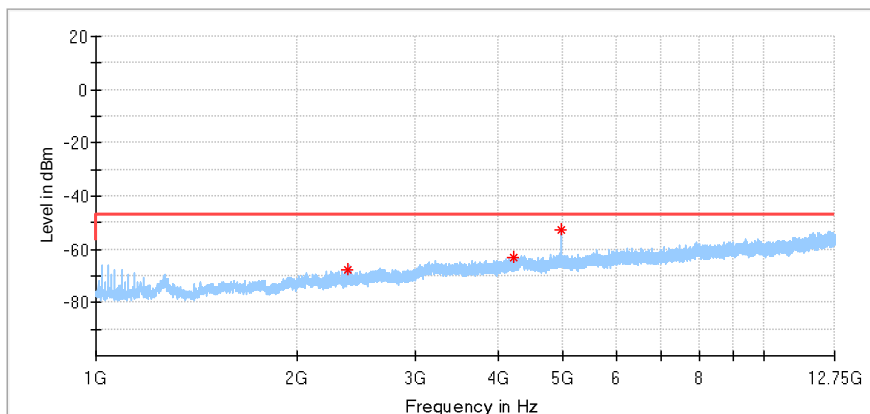
Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
51.447778	-76.39	-57.00	19.39	---	---	154.0	V	151.0	-118.3
110.671667	-79.90	-57.00	22.90	---	---	154.0	V	356.0	-117.8
994.072222	-74.87	-57.00	17.87	---	---	154.0	V	8.0	-111.8

M/N: NL59-K-0002LW-18PK
 Test Specification: Horizontal
 Operating Condition: Thread (Rx)
 Comment: AC 230V/50Hz



Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2879.265625	-66.86	-47.00	19.86	---	---	154.0	H	3.0	-102.2
4962.687500	-52.16	-47.00	5.16	---	---	154.0	H	259.0	-94.3
7378.414063	-60.28	-47.00	13.28	---	---	154.0	H	0.0	-91.2

M/N: NL59-K-0002LW-18PK
 Test Specification: Vertical
 Operating Condition: Thread (Rx)
 Comment: AC 230V/50Hz



Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2381.359375	-67.66	-47.00	20.66	---	---	154.0	V	222.0	-103.3
4228.312500	-63.28	-47.00	16.28	---	---	154.0	V	81.0	-96.0
4962.687500	-52.45	-47.00	5.45	---	---	154.0	V	128.0	-94.3

6.5.4 Result

The equipment met the requirement of this clause.

6.6 Receiver Blocking

6.6.1 Test Condition

Test Mode:	Transmitting
Ambient temperature:	24.2°C
Relative humidity:	50.1%
Ambient Pressure	101.0Kpa

6.6.2 Limit

Receiver Blocking parameters for Receiver Category 1 equipment

Blocking signal parameters for Receiver Category 2 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 dBm + 10 × log ₁₀ (OCBW)) or -68 dBm whichever is less (see note 2)	2 380 2 504	-34	CW
(-139 dBm + 10 × log ₁₀ (OCBW)) or -74 dBm whichever is less (see note 3)	2 300 2 330 2 360 2 524 2 584 2 674		
NOTE 1: OCBW is in Hz. NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to P_{min} + 26 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal. NOTE 3: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to P_{min} + 20 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal. NOTE 4: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.			

Receiver Blocking parameters receiver Category 2 equipment

Wanted signal mean power from companion device (dBm) (see notes 1 and 3)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 3)	Type of blocking signal
(-139 dBm + $10 \times \log_{10}(\text{OCBW})$ + 10 dB) or (-74 dBm + 10 dB) whichever is less (see note 2)	2 380 2 504 2 300 2 584	-34	CW
NOTE 1: OCBW is in Hz. NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to $P_{\min} + 26$ dB where $P_{\min}$ is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal. NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.			

Receiver Blocking parameters receiver Category 3 equipment

Wanted signal mean power from companion device (dBm) (see notes 1 and 3)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 3)	Type of blocking signal
(-139 dBm + $10 \times \log_{10}(\text{OCBW})$ + 20 dB) or (-74 dBm + 20 dB) whichever is less (see note 2)	2 380 2 504 2 300 2 584	-34	CW
NOTE 1: OCBW is in Hz. NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative the test may be performed using a wanted signal up to $P_{\min} + 30$ dB where $P_{\min}$ is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal. NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.			

6.6.3 Test result

Frequency	Sensitivity	Blocker Level at DUT Port	Blocker Frequency	PER	Limit max
(MHz)	(dBm)	(dBm)	(MHz)	(%)	(%)
2405	-69	-34	2380	3.8	10
			2300	2.0	
2480	-69	-34	2504	2.8	
			2584	4.2	

Note:

- 1, The maximum transmit power is 8.8dBm, so receiver category 2 is applicable.
- 2, The levels had been corrected by the actual antenna assembly gain.

6.6.4 Result

The equipment met the requirement of this clause.

7 Estimation of Exposure of Human to Electromagnetic Fields

The product [Nanoleaf Lines], Model No.[NL59-K-0002LW-18PK], has an operation frequency of [2405-2480MHz], and the maximum transmitted power is 8.8dBm.

According with EN 62479: 2010 Clause 4.2 or EN 50663:2017 Clause 6, Low-power electronic and electrical equipment is deemed to comply with the provisions of this standard 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 applicable low-power exclusion level P_{max} . The peak output power of 8.8dBm is 7.59mW; it is less than the limit 20mW which list in the table A1, so the equipment complies with EMF basic restrictions in EN 62479: 2010 and EN 50663:2017.

8 Lists of Test Instruments

TS8997 Test System

DESCRIPTION	MANUFACTURER	MODEL NO.	EQUIPMENT ID	SERIAL NO.	CAL INTERVAL (YEAR)	CAL. DUE DATE
Signal Generator	Rohde & Schwarz	SMB100A	68-4-48-14-001	108272	1	2022-6-3
Vector Signal Generator	Rohde & Schwarz	SMBV100A	68-4-48-18-001	262825	1	2022-6-3
Communication Synthetical Test Instrument	Rohde & Schwarz	CMW 270	68-4-48-18-003	101251	1	2022-6-3
Signal Analyzer	Rohde & Schwarz	FSV40	68-4-74-14-004	101030	1	2022-6-3
Vector Signal Generator	Rohde & Schwarz	SMU 200A	68-4-48-14-003	105324	1	2022-6-3
RF Switch Module	Rohde & Schwarz	OSP120/OSP-B157	68-4-93-14-003	101226/100851	1	2022-6-3
Power Splitter	Weinschel	1580	68-4-85-14-001	SC319	1	2022-6-3
10dB Attenuator	Weinschel	4M-10	68-4-81-14-003	43152	1	2022-6-3
10dB Attenuator	R&S	DNF	68-4-81-14-004	DNF-001	1	2022-6-3
10dB Attenuator	R&S	DNF	68-4-81-14-005	DNF-002	1	2022-6-3
10dB Attenuator	R&S	DNF	68-4-81-14-006	DNF-003	1	2022-6-3
10dB Attenuator	R&S	DNF	68-4-81-14-007	DNF-004	1	2022-6-3
Test software	Rohde & Schwarz	EMC32	68-4-48-14-003-A10	Version 10.60.10	N/A	N/A
Test software	Tonscend	System for BT/WIFI	68-4-74-14-006-A13	Version 2.6.77.0518	N/A	N/A
Shielding Room	TDK	TS8997	68-4-90-19-003	----	1	2022-11-07

Radiated Spurious Emission Test

DESCRIPTION	MANUFACTURER	MODEL NO.	EQUIPMENT ID	SERIAL NO.	CAL INTERVAL (YEAR)	CAL. DUE DATE
Signal Analyzer	Rohde & Schwarz	FSV40	68-4-74-14-003	101031	1	2022-6-3
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	68-4-80-14-003	708	1	2022-6-27
Horn Antenna	Rohde & Schwarz	HF907	68-4-80-14-004	102295	1	2022-7-21
Wideband Horn Antenna	Q-PAR	QWH-SL-18-40-K-SG	68-4-80-14-008	12827	1	2022-7-21
Loop Antenna	Rohde & Schwarz	HFH2-Z2	68-4-80-14-006	100398	1	2021-9-2
Pre-amplifier	Rohde & Schwarz	SCU 18	68-4-29-14-001	102230	1	2022-6-6
Pre-amplifier	Rohde & Schwarz	SCU 40A	68-4-29-14-002	100432	1	2022-7-27
Fully Anechoic Chamber	TDK	8X4X4	68-4-90-14-002	--	3	2022-12-6
Test software	Rohde & Schwarz	EMC32	68-4-90-14-002-A10	Version 9.15.00	N/A	N/A

Remark: N/A means Non-Calibration required

9 Measurement Uncertainty

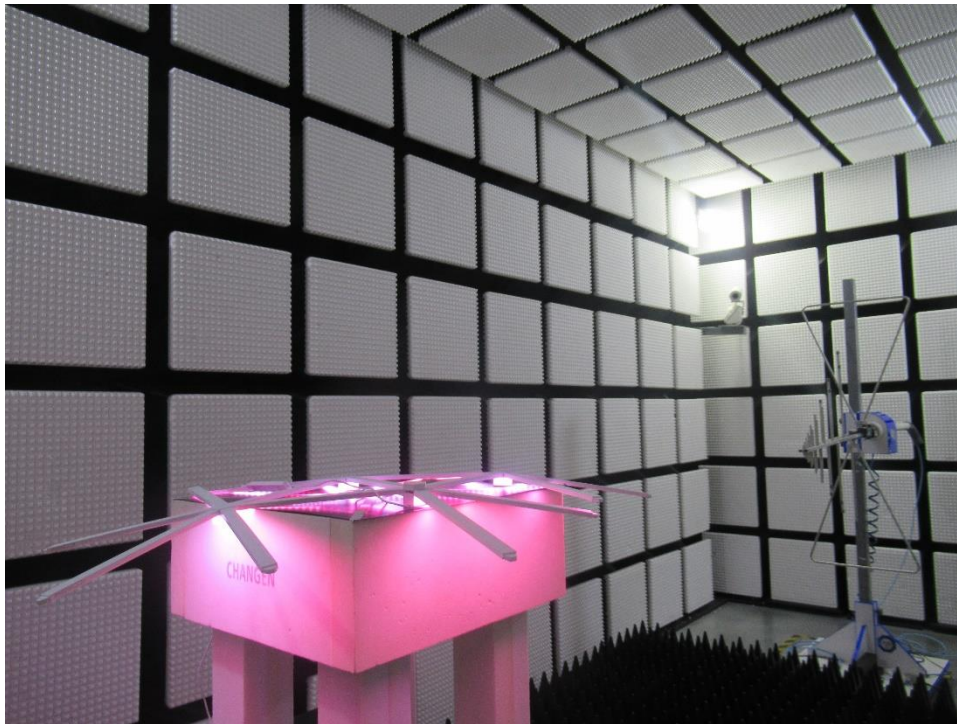
For the test methods, according to the harmonized standard and conformance testing standard, the measurement uncertainty figures shall be calculated in accordance with TR 100 028 and shall correspond to an expansion factor (coverage factor) $k = 1.96$ (which provides a confidence level of 95 % in the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

System Measurement Uncertainty	
Test Items	Extended Uncertainty
Uncertainty for Radiated Spurious Emission 25MHz-3000MHz	Horizontal: 4.35dB; Vertical: 4.44dB;
Uncertainty for Radiated Spurious Emission 3000MHz-18000MHz	Horizontal: 4.30dB; Vertical: 4.29dB;
Uncertainty for Radiated Spurious Emission 18000MHz-40000MHz	Horizontal: 4.51dB; Vertical: 4.50dB;
Uncertainty for Conducted RF test with TS 8997	RF Power Conducted: 1.31dB Frequency test involved: 0.6×10 ⁻⁷ or 1%

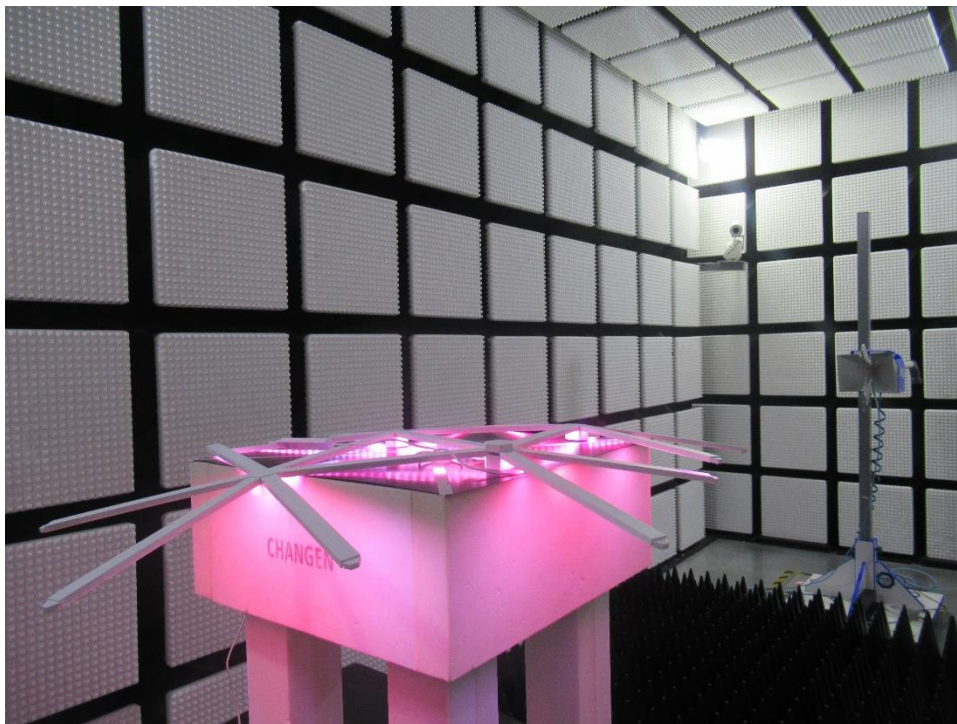
Measurement Uncertainty Decision Rule

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2007, clause 4.4.3 and 4.5.1.

10 Photographs of Test Set-ups



Radiated emission test below 1GHz

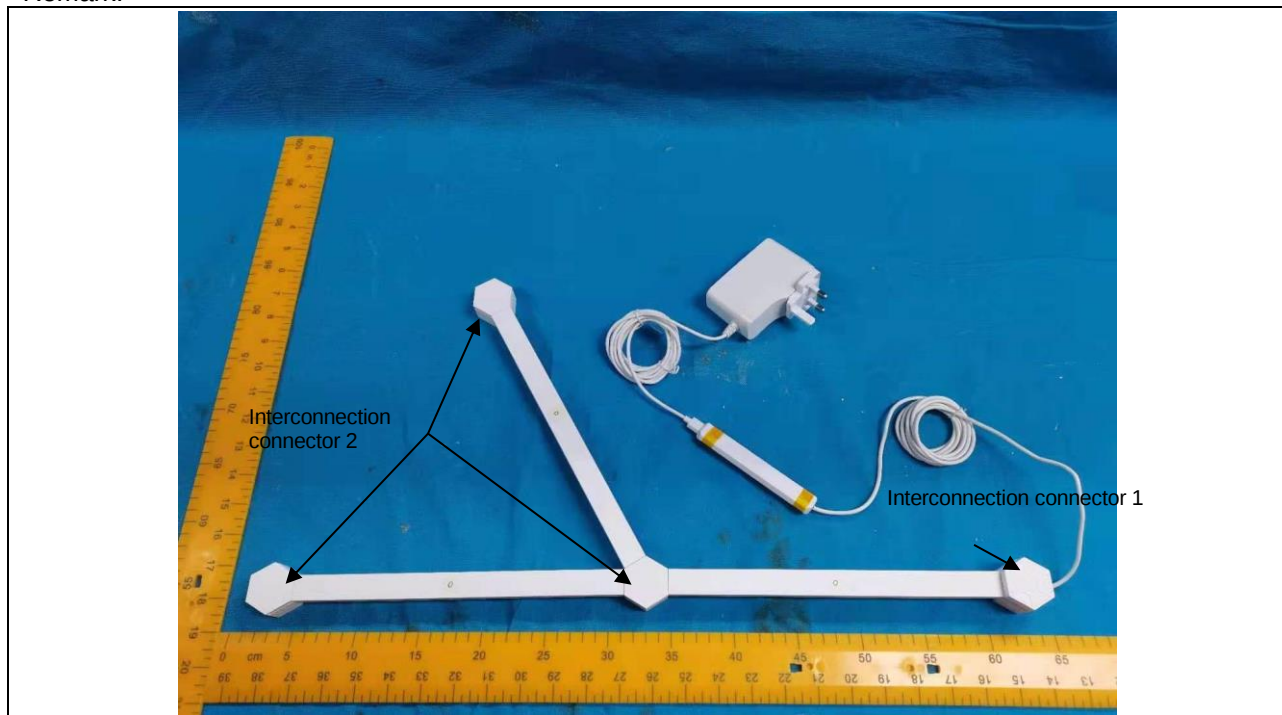


Radiated emission test above 1GHz

11 Photographs of EUT

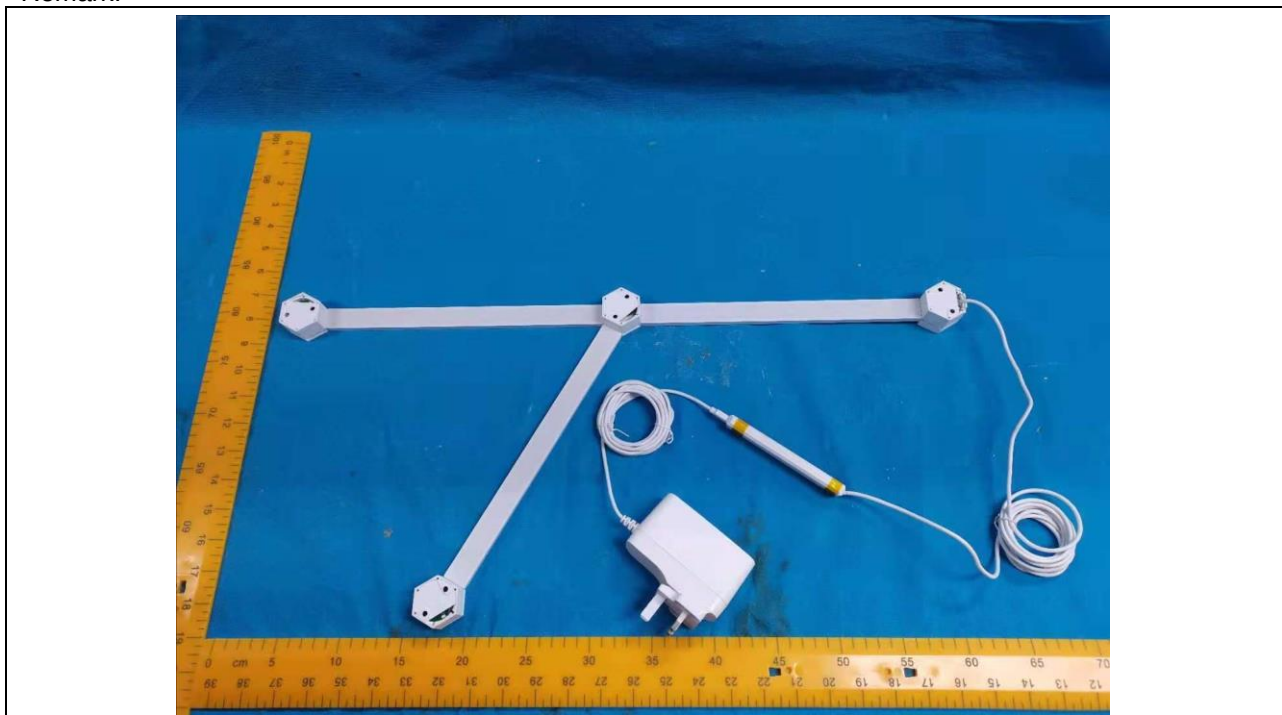
Details of: Front view for NL59-E-0002LW-3PK (representative model)

Remark:



Details of: Front view for NL59-E-0002LW-3PK (representative model)

Remark:



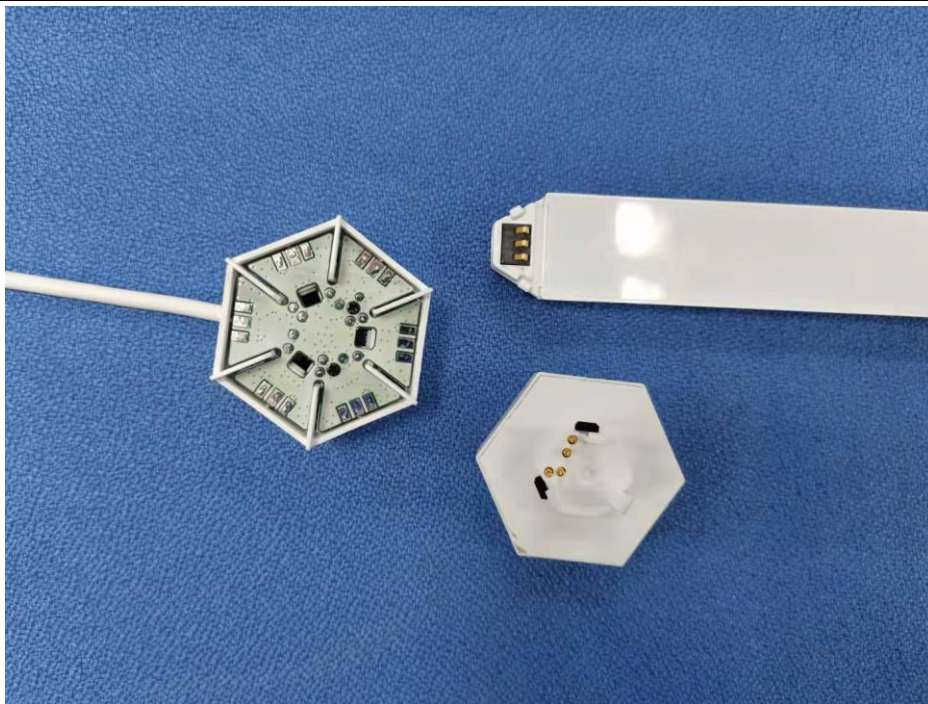
Details of: Output plug of LED driver and input socket of controller

Remark:



Details of: Interconnection connector connected to LED panel

Remark:



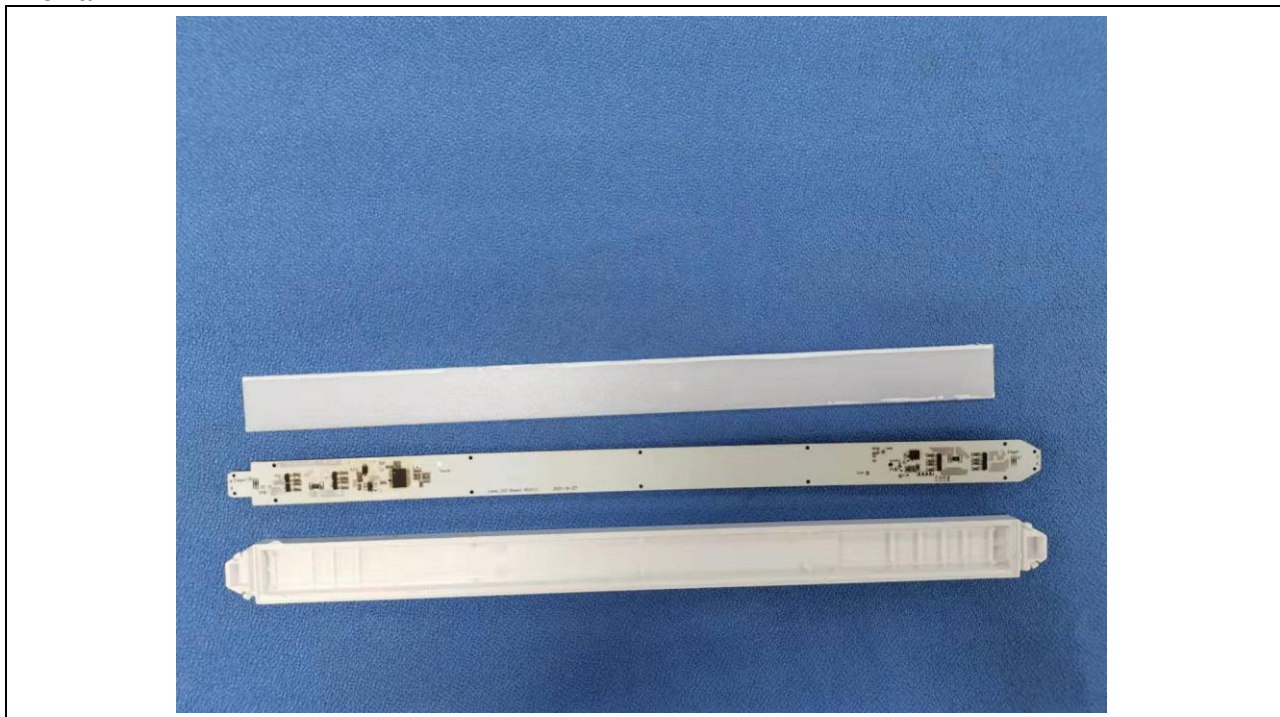
Details of: Internal view for LED panel

Remark:



Details of: Internal view for LED panel

Remark:



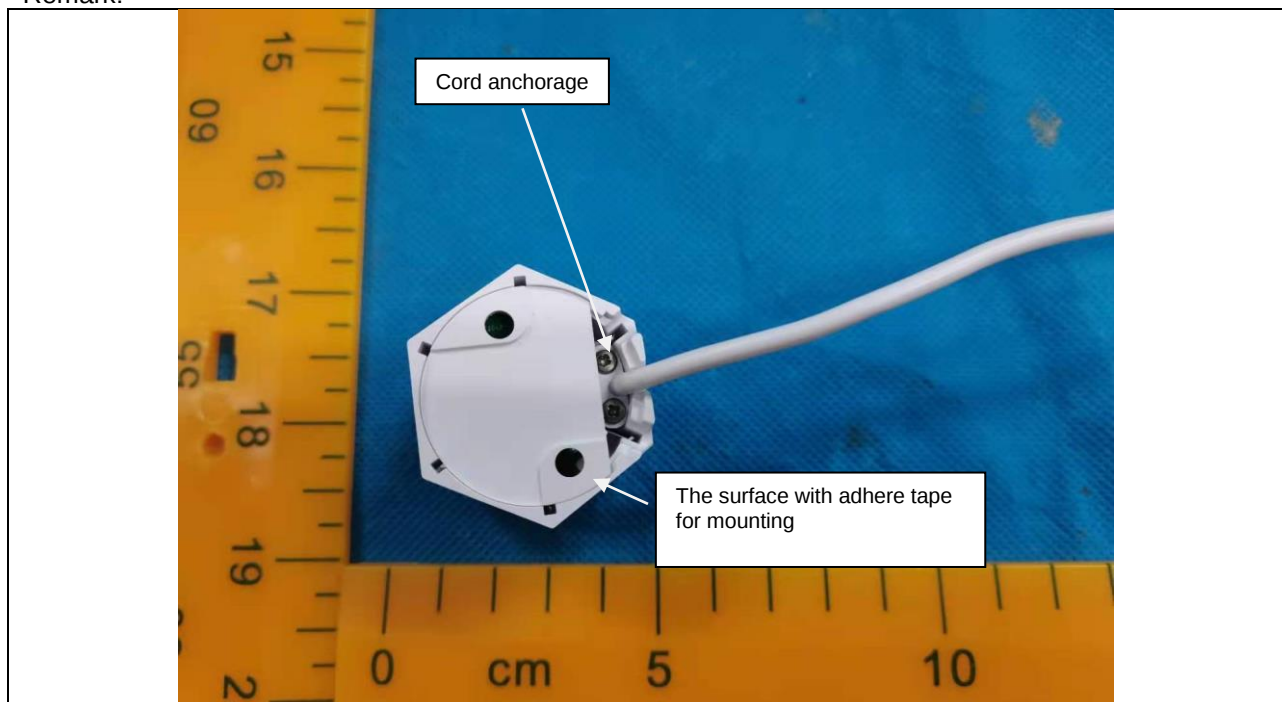
Details of: Interconnection connector 1 view

Remark:



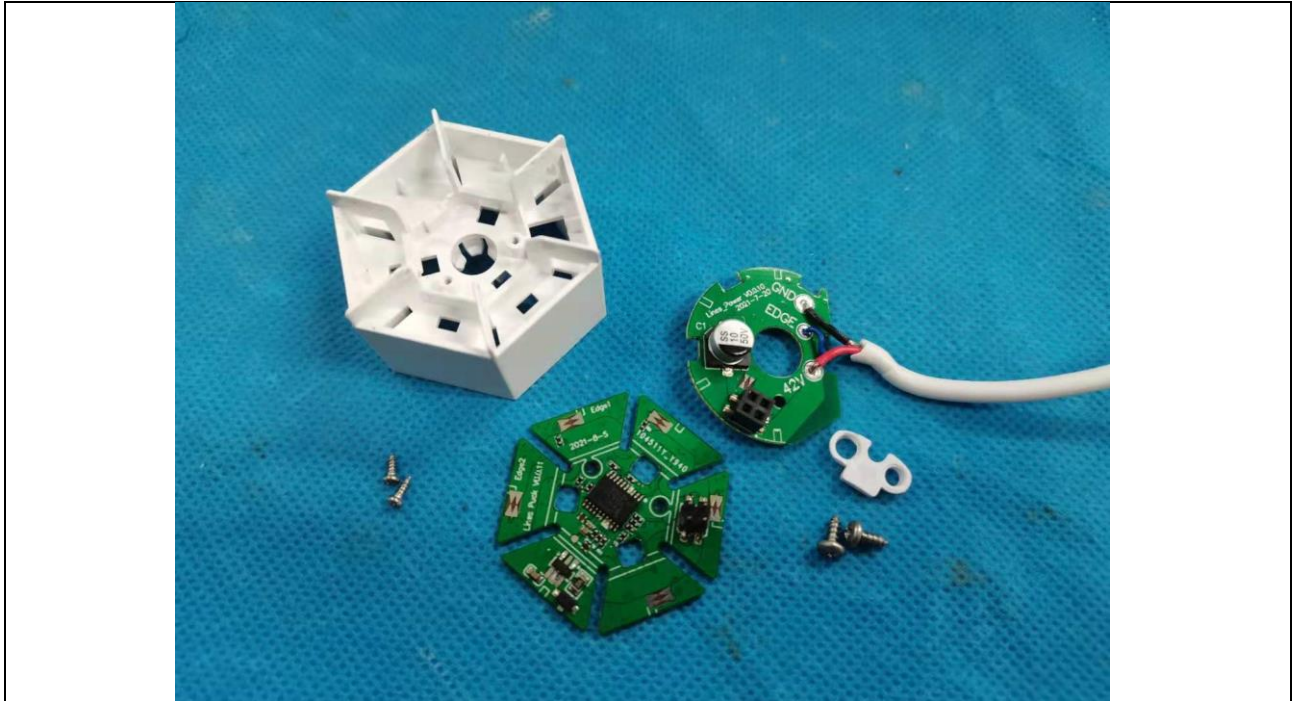
Details of: Interconnection connector 1 view

Remark:



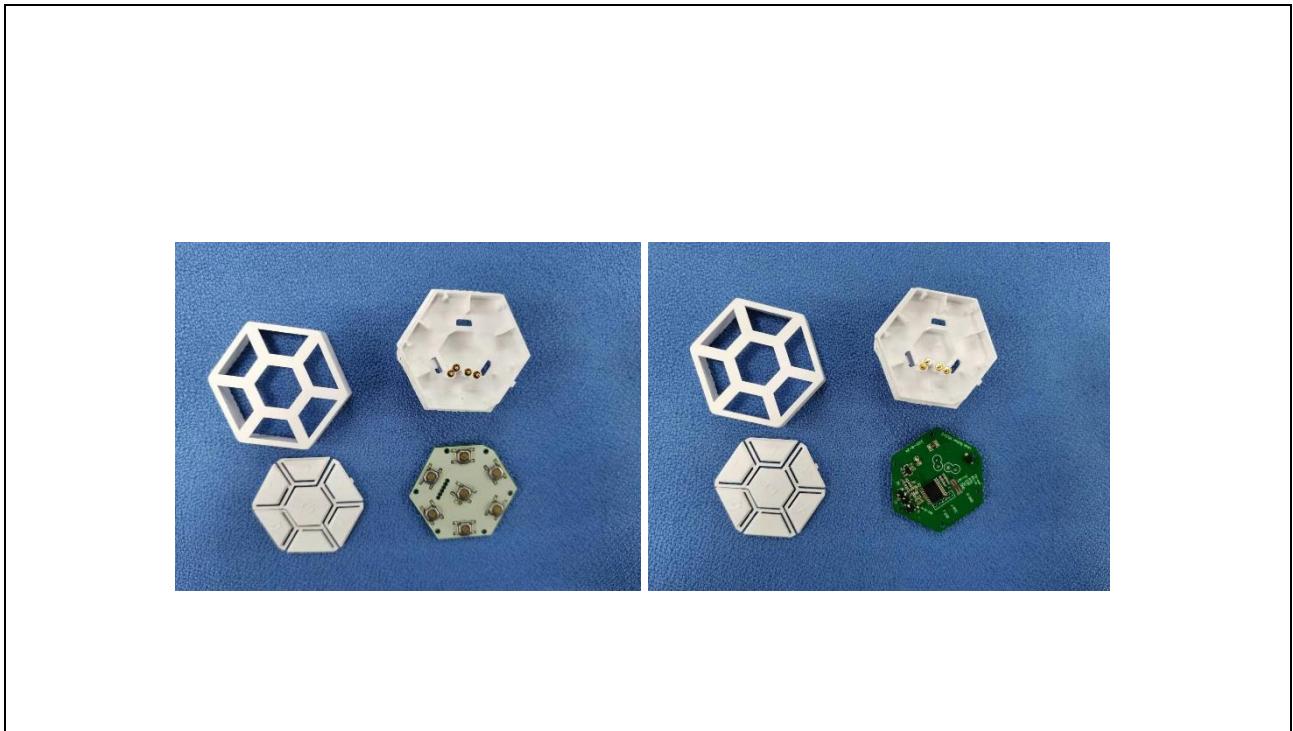
Details of: Interconnection connector 1 internal view

Remark:



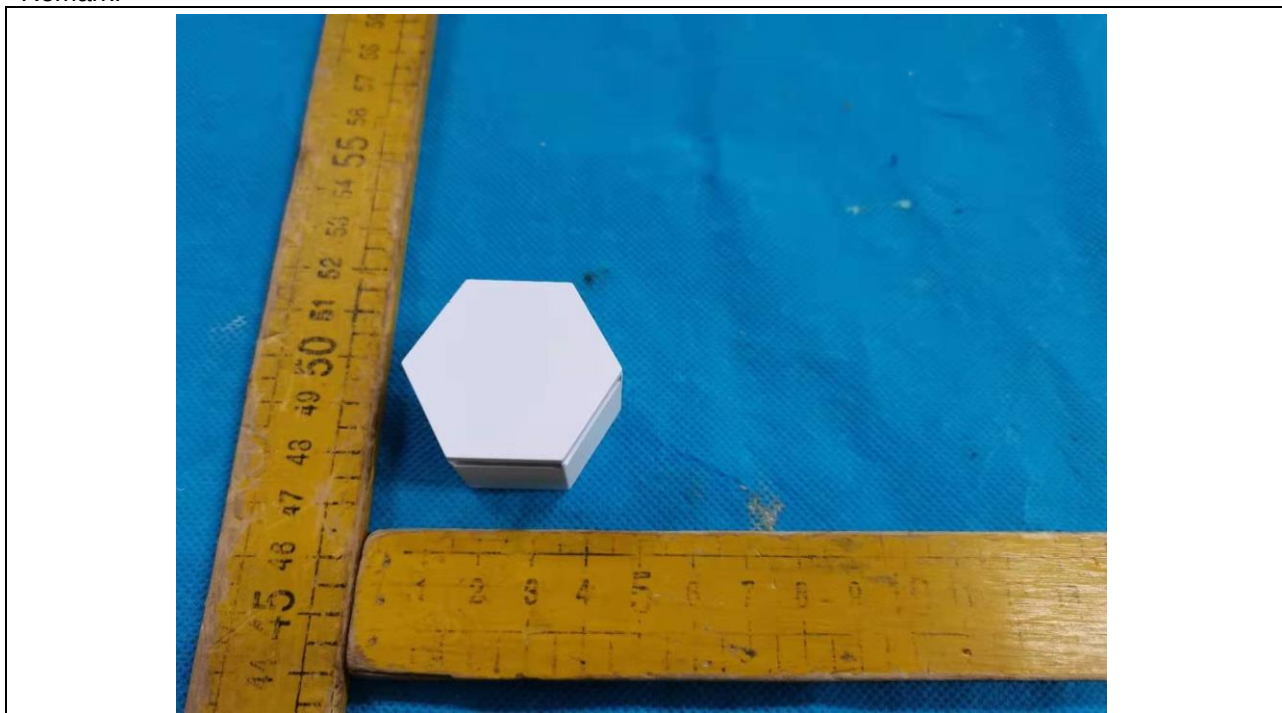
Details of: Interconnection connector 1 internal view

Remark:



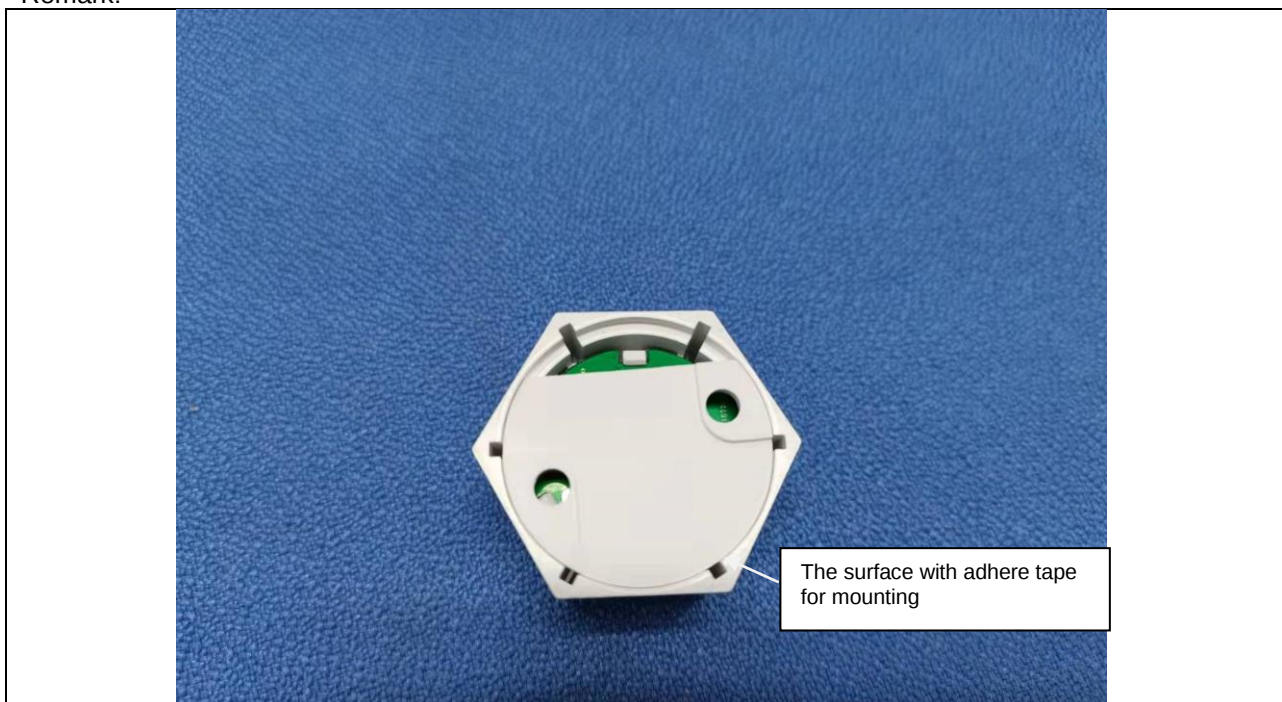
Details of: Interconnection connector 2 view

Remark:



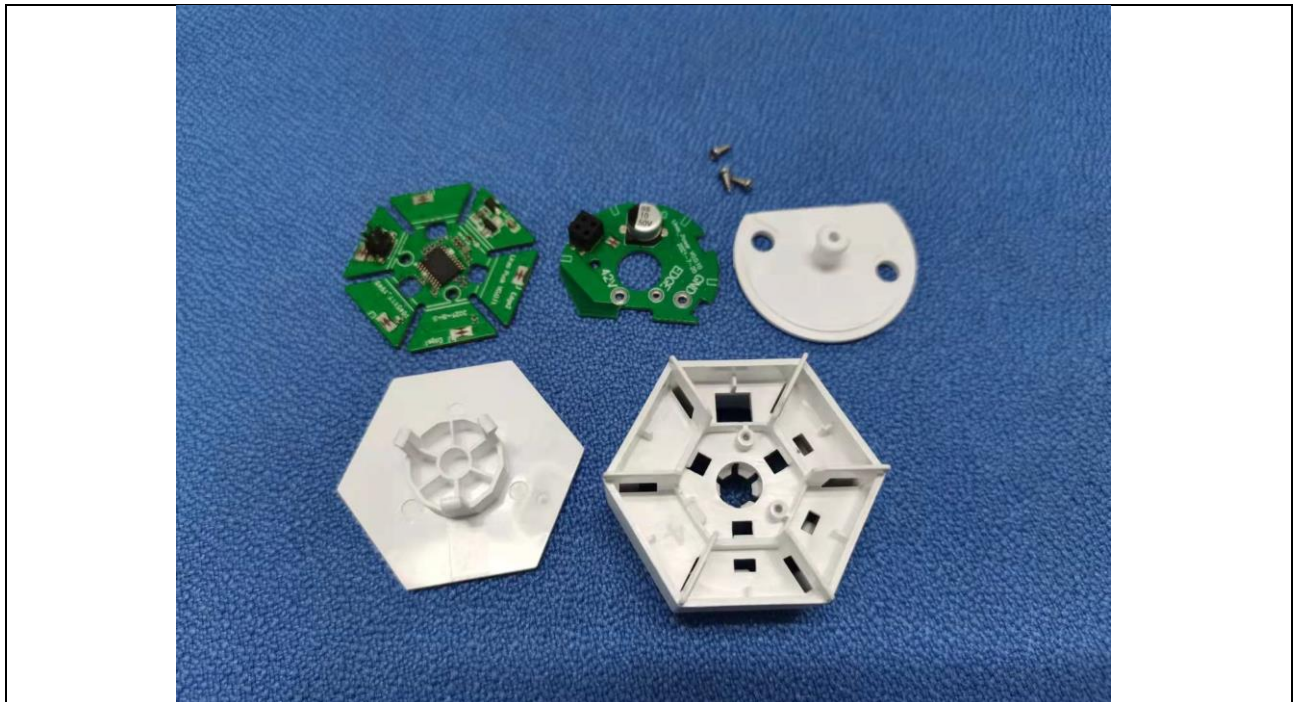
Details of: Interconnection connector 2 view

Remark:



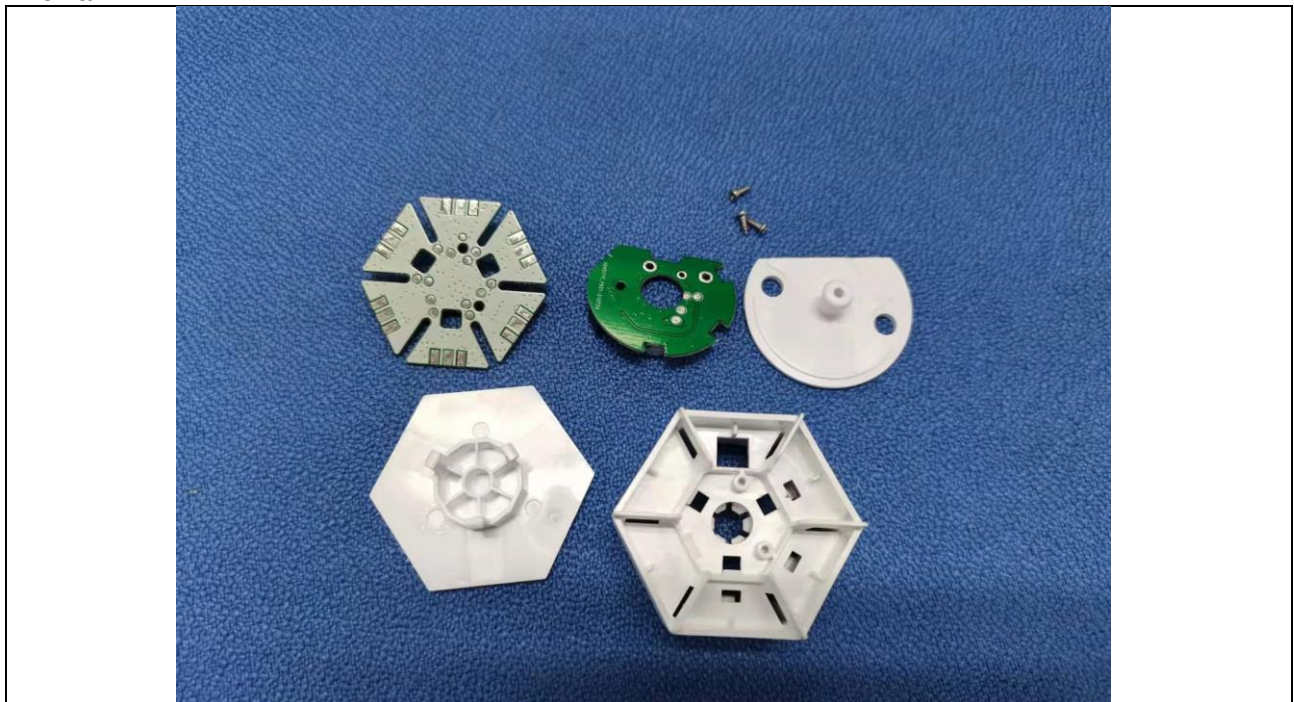
Details of: Interconnection connector 2 internal view

Remark:



Details of: Interconnection connector 2 internal view

Remark:



Details of: Controller view

Remark:



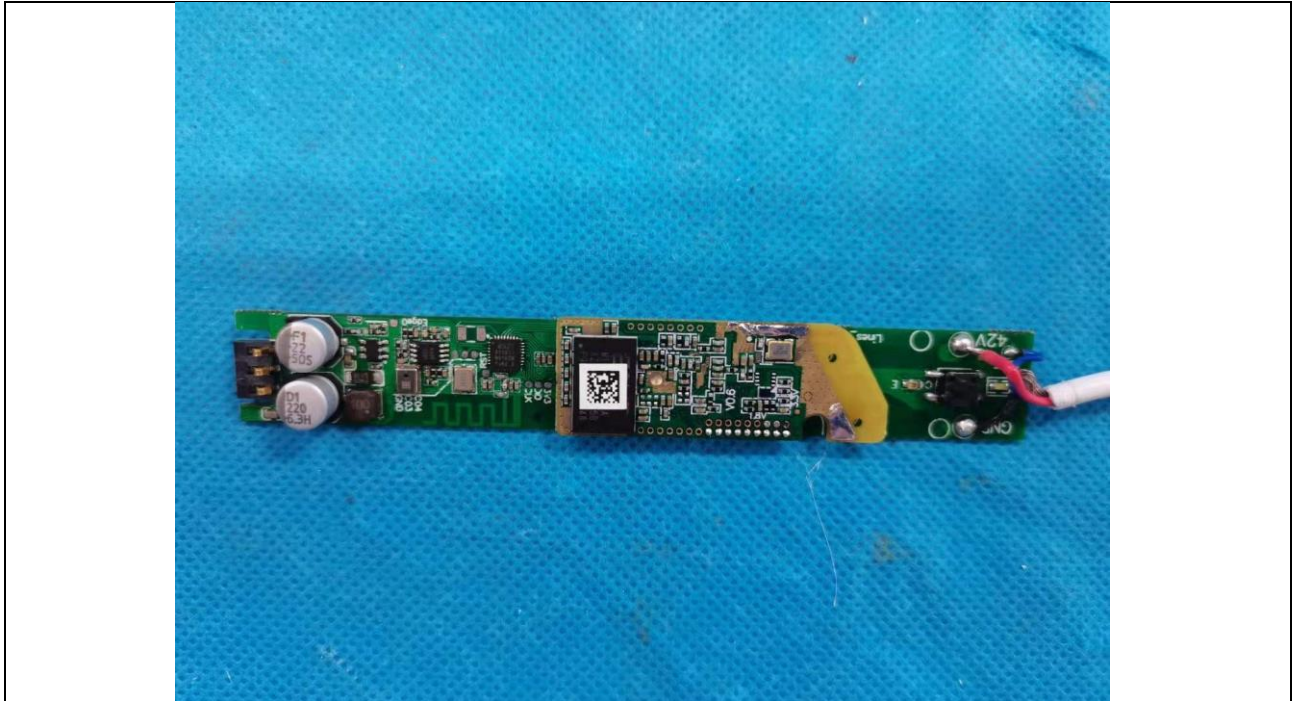
Details of: Controller internal view

Remark:



Details of: Controller PCB view

Remark:



Details of: Controller PCB view

Remark:



Details of: LED driver view (DSL-42WA-42 420100)

Remark:



Details of: LED driver view (LGSPS420100SPT)

Remark:



THE END