CE TEST REPORT

SCOPE OF WORK:
Article 3.2 of RE directive (2014/53/EU) – RF report

Model:
io-WiFi60w-s, io-WiFi60cct-s, io-WiFi60-2s, io-WiFi60rgb+cct-s, io-WiFi60, io-WiFi70w-s, io-WiFi70cct-s, io-WiFi70rgbw-s, io-WiFi70rgb+cct-s

REPORT NUMBER
200802085SHA-001

ISSUE DATE
Oct 16, 2020

DOCUMENT CONTROL NUMBER
TTRF300328-03_V1

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TEST REPORT

Report no. 200802085SHA-001

Applicant	:	**Hangzhou Hemos Lighting Company Limited.** **8F/A3 New Life of West, No.98 Gudun Road, Hangzhou, Zhejiang, China**
Manufacturer	:	**Hangzhou Hemos Lighting Company Limited.** **8F/A3 New Life of West, No.98 Gudun Road, Hangzhou, Zhejiang, China**
Manufacturing site	:	**Hangzhou Hemos Lighting Company Limited.** **8F/A3 New Life of West, No.98 Gudun Road, Hangzhou, Zhejiang, China**

Summary

The equipment complies with the requirements according to the following standard(s) or Specification:
EN 300 328 V2.2.2: Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz band; Harmonised Standard for access to radio spectrum

PREPARED BY:	**REVIEWED BY:**
Teddy Yin	Daniel Zhao
Project Engineer	Reviewer

Contents

Revision History

Report No.	Version	Description	Issued Date
200802085SHA-001	Rev. 01	Initial issue of report	Oct 16, 2020

Measurement result summary

TEST ITEM	TEST RESULT	NOTE
RF Output Power	NP	
Power Spectral Density	NP	
Duty Cycle, Tx-sequence, Tx-gap	NA	Only for non-adaptive equipment
Medium Utilization (MU) factor	NA	Only for non-adaptive equipment
Occupied Channel Bandwidth	NP	
Transmitter unwanted emissions in the out-of-band domain	NP	
Transmitter unwanted emissions in the spurious domain	Pass	
Adaptivity	NP	
Receiver Blocking	NP	
Receiver spurious emission	Pass	
Geo-location capability	NA	

Notes: 1: NA =Not Applicable
2. NP=Not Performed. Please refer to the RF modular report: ER9N1410
3. Determination of the test conclusion is based on IEC Guide 115 in consideration of measurement uncertainty.
4: Additions, Deviations and Exclusions from Standards: None.

1 GENERAL INFORMATION

1.1 Description of Equipment Under Test (EUT)

Product name	:	Self-ballasted LED Lamp
Type/Model	:	io-WiFi60w-s, io-WiFi60cct-s, io-WiFi60-2s, io-WiFi60rgb+cct-s, io-WiFi60, io-WiFi70w-s, io-WiFi70cct-s, io-WiFi70rgbw-s, io-WiFi70rgb+cct-s
Description of EUT	:	All models have the same WIFI modular. io-WiFi60w-s and io-WiFi70w-s are same except for the power and LED bulb number. io-WiFi60cct-s and io-WiFi70cct-s are same except for the power and LED bulb number. io-WiFi60-2s, io-WiFi60 and io-WiFi70rgbw-s are same except for the power and LED bulb number. io-WiFi60rgb+cct-s and io-WiFi70rgb+cct-s are the same except for the power and LED bulb number. io-WiFi70w-s, io-WiFi70cct-s, io-WiFi70rgbw-s and io-WiFi70rgb+cct-s were tested as representative. And the worst data is listed in the report.
Rating	:	220-240V~, 50/60Hz (Details see below table.)
Hardware version	:	/
Software version	:	/
Sample received date	:	Aug 25, 2020
Date of test	:	Aug 25~Sep 10, 2020

Model List

Model	Input current(A)	Wattage (W)	Cap	Color Temperature (K)
io-WiFi60w-s	0,07	8,5	E27/B22d	2700K
io-WiFi60cct-s	0,07	8,5	E27/B22d	2700K-6500K
io-WiFi60-2s	0,07	8,5	E27/B22d	2700K, RGB
io-WiFi60rgb+cct-s	0,07	8,5	E27/B22d	2700K-6500K, RGB
io-WiFi60	0,05	6	E27/B22d	2700K, RGB
io-WiFi70w-s	0,09	10	E27/B22d	2700K
io-WiFi70cct-s	0,09	10	E27/B22d	2700K-6500K
io-WiFi70rgbw-s	0,09	10	E27/B22d	2700K, RGB
io-WiFi70rgb+cct-s	0,09	10	E27/B22d	2700K-6500K, RGB

1.2 RF Technical Information

For WIFI mode

No.	Protocol	Channel Frequency (MHz)	Channel No.
1	802.11b	2412 - 2472	13
2	802.11g	2412 - 2472	13
3	802.11n(HT20)	2412 - 2472	13
4	802.11n(HT40)	2422 - 2462	9
Modulation: DBPSK, DQPSK, CCK, BPSK, QPSK, 16QAM, 64QAM			

For BLE Mode:

No.	Protocol	Channel Frequency (MHz)	Channel No.
1	Bluetooth Low Energy	2402 - 2480	40
Modulation: GFSK			

Antenna information:			
No.	Antenna Type	Gain (dBi)	Note
1	PCB antenna	1.0	-

Equipment types	
Modulation types:	
☐	Equipment using Frequency Hopping Spread Spectrum (FHSS) modulation
☒	Equipment using other types of wide band modulation (e.g. DSSS, OFDM, etc.).
Adaptive and 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 non-adaptive mode
Receiver categories:	
☒	Receiver category 1: Adaptive equipment with a maximum RF output power greater than 10 dBm e.i.r.p.
☐	Receiver category 2: • Non-adaptive equipment with a Medium Utilization (MU) factor greater than 1 % and less than or equal to 10 % (irrespective of the maximum RF output power); or • equipment (adaptive or non-adaptive) with a maximum RF output power greater than 0 dBm e.i.r.p. and less than or equal to 10 dBm e.i.r.p.

☐	Receiver category 3: • Non-adaptive equipment with a maximum Medium Utilization (MU) factor of 1 % (irrespective of the maximum RF output power) or • equipment (adaptive or non-adaptive) with a maximum RF output power of 0 dBm e.i.r.p.

802.11b/g/n(HT20)			
Channel	Frequency	Channel	Frequency
1	2412 MHz	8	2447 MHz
2	2417 MHz	9	2452 MHz
3	2422 MHz	10	2457 MHz
4	2427 MHz	11	2462 MHz
5	2432 MHz	12	2467 MHz
6	2437 MHz	13	2472 MHz
7	2442 MHz	-	-

802.11n(HT40)			
Channel	Frequency	Channel	Frequency
3	2422 MHz	8	2447 MHz
4	2427 MHz	9	2452 MHz
5	2432 MHz	10	2457 MHz
6	2437 MHz	11	2462 MHz
7	2442 MHz	-	-

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

1.3 Description of Test Facility

Name	:	Intertek Testing Services Shanghai
Address	:	Building 86, No. 1198 Qinzhou Road(North), Shanghai 200233, P.R. China
Telephone	:	86 21 61278200
Telefax	:	86 21 54262353
The test facility is recognized, certified, or accredited by these organizations	:	CNAS Accreditation Lab Registration No. CNAS L0139 FCC Accredited Lab Designation Number: CN1175 IC Registration Lab CAB identifier.: CN0051 VCCI Registration Lab Registration No.: R-14243, G-10845, C-14723, T-12252 A2LA Accreditation Lab Certificate Number: 3309.02

2 TEST SPECIFICATIONS

2.1 Standards or specification

EN 300 328 V2.2.2: Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz band; Harmonised Standard for access to radio spectrum

2.2 Mode of operation during the test

While testing transmitting mode of EUT, the continuously transmission was applied by following software.

Software name	Manufacturer	Version	Supplied by
SecureCRT	/	/	client

The lowest, middle and highest channel were tested as representatives.

Frequency Band (MHz)	Mode	Lowest (L) (MHz)	Middle (M) (MHz)	Highest (H) (MHz)
2400-2483.5	802.11b	2412	2442	2472
	802.11g	2412	2442	2472
	802.11n(HT20)	2412	2442	2472
	802.11n(HT40)	2422	2442	2462

The lowest, middle and highest channel were tested as representatives.

Frequency Band (MHz)	Modulation	Lowest (L) (MHz)	Middle (M) (MHz)	Highest (H) (MHz)
2400-2483.5	GFSK	2402	2440	2480

After this pretest, the following data rata was chosen to do the test as the worst case:

Frequency Band (MHz)	Mode	Data rate
2400-2483.5	802.11b	1Mbps
	802.11g	6Mbps
	802.11n(HT20)	MCS0
	802.11n(HT40)	MCS0

2.3 Test peripherals used

Item No	Description	Band and Model	S/No
1	Laptop computer	HP, 5480	NA

2.4 Record of normal and extreme test conditions

Test Item	Normal Temperature (°C)	Relative Humidity (%)
~~RF Output Power~~ ~~Duty Cycle, Tx-sequence, Tx-gap~~ ~~Medium Utilization (MU) factor~~ ~~Occupied Channel Bandwidth~~ Transmitter unwanted emissions in the ~~out-of-band domain~~ Hopping Frequency Separation, Accumulated Transmit time, Frequency Occupation and ~~Hopping Sequence~~ ~~Adaptivity~~ ~~Receiver Blocking~~	/	/
Transmitter unwanted emissions in the ~~spurious domain~~ ~~Receiver spurious emission~~	22	55

Extremes of the operating temperature range as declared by the manufacturer
-20 °C to 40 °C

Abbreviations	
Tnom	Normal Temperature
Tmin	Extreme Low Temperature
Tmax	Extreme High Temperature

2.5 Instrument list

Radiated Emission					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☒	Test Receiver	R&S	ESIB 26	EC 3045	2020-09-16
☒	Bilog Antenna	TESEQ	CBL 6112D	EC 4206	2020-09-24
☒	Pre-amplifier	R&S	AFS42-00101800-25-S-42	EC5262	2021-06-11
☒	Horn antenna	ETS	3117	EC 4792-1	2021-01-17
☒	Semi-anechoic chamber	Albatross	-	EC 3048	2021-07-31
Additional instrument					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☒	Therom-Hygrograph	ZJ1-2A	S.M.I.F.	EC 3481	2021-01-05
☒	Therom-Hygrograph	ZJ1-2A	S.M.I.F.	EC 3442	2021-01-05

Test software	Manufacturer	Version
ES-K1	R&S	V1.71
ETSI Certification of Regulations Test Solution	Keysight	V1.01.42

2.6 Measurement Uncertainty

Item No.	Test Items	Expanded Uncertainty (k=2)
1	Radio frequency	± 0.84 × 10-7
2	RF power, conducted	± 0.74 dB
3	RF power, radiated	± 5.92 dB
4	Maximum Frequency Deviation	± 2.77 %
5	Adjacent channel power	± 1.45 dB
6	Spurious emissions of transmitter, conducted	± 2.89 dB
7	Spurious emissions of receiver, conducted	± 2.80 dB
8	Spurious emissions, radiated	± 5.93 dB
9	Power Spectral Density, conducted	± 2.99 dB
10	Occupied Channel Bandwidth	± 0.88 %
11	Time	± 1.15 %
12	Temperature	± 1 °C
13	Humidity	± 5 %
14	DC and low frequency voltages	± 1.3 %

3 Transmitter unwanted emissions in the spurious domain

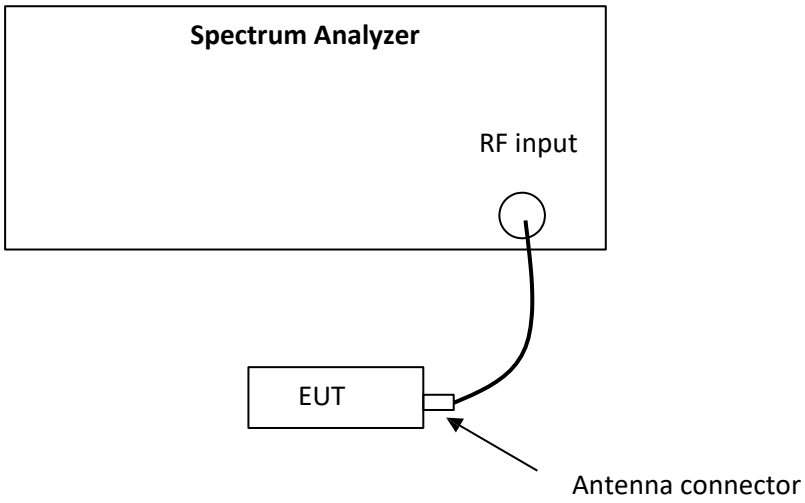
Test result: **Pass**

3.1 Limit

Frequency range	Maximum power, e.r.p. (≤1 GHz) e.i.r.p. (> 1 GHz)	Bandwidth
30 MHz to 47 MHz	-36 dBm	100 kHz
47MHz to 74MHz	-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

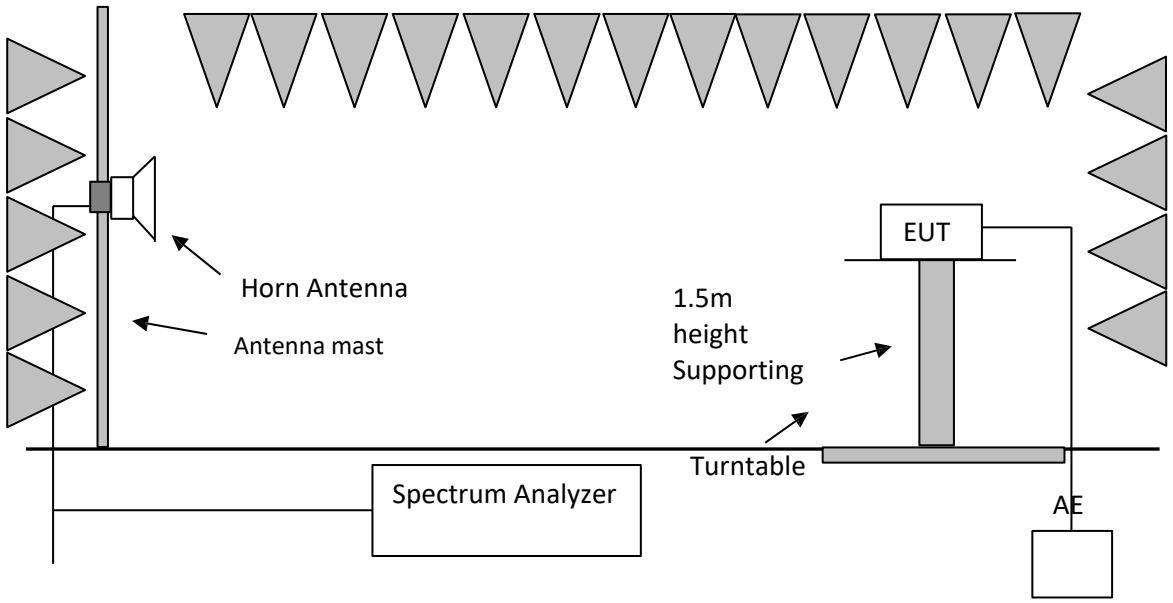
3.2 Block Diagram of Test Setup

3.2.1 For conducted method

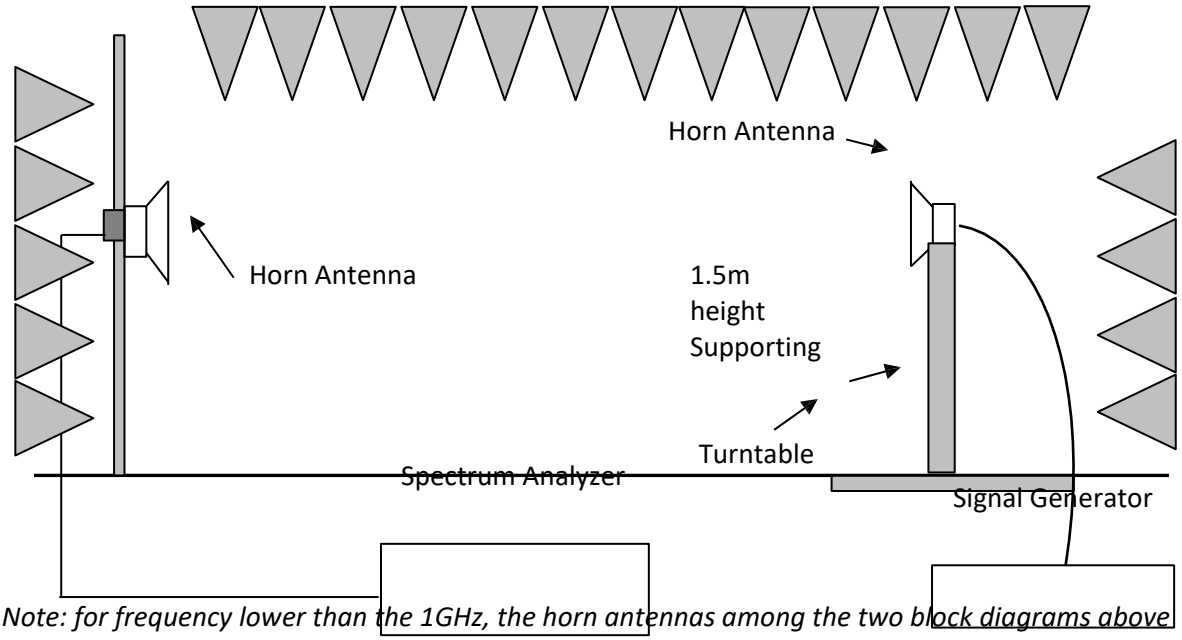


3.2.2 For radiated method

Step one



Step two



Note: for frequency lower than the 1GHz, the horn antennas among the two block diagrams above should be replaced with dipole antennas (or other antennas provided they can be referenced to a dipole).

3.3 Test Conditions and Test Method

These measurements shall only be performed at normal test conditions.

For FHSS equipment, the measurements may be performed when normal hopping is disabled. In this case measurements need to be performed when operating at the lowest and the highest hopping frequency. When this is not possible, the measurement shall be performed during normal operation (hopping).

For non-FHSS equipment, the measurement shall be performed at the lowest and the highest channel on which the equipment can operate. These operating channels shall be recorded.

The equipment shall be configured to operate under its worst case situation with respect to output power.

If the equipment can operate with different Nominal Channel Bandwidths (e.g. 20 MHz and 40 MHz), then the equipment shall be configured to operate under its worst case situation with respect to spurious emissions.

☐ For conducted method

The EUT was connected to the spectrum analyzer directly. Please refer to EN 300 328 Clause 5.4.9.2.1 for test method.

☒ For radiated method

The measurement was applied in a semi-anechoic chamber. Please refer to EN 300 328 Clause 5.4.9.2.2 for test method.

3.4 Test Result

All the modes were pretested and the mode 802.11b was the worst, the data of 802.11b was listed in the report.

Channel	Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Antenna Polarization	Pass/Fail
L	204.94	-73.30	-54.00	H	Pass
	659.81	-69.40	-54.00	H	Pass
	4824.61	<-40.00	-30.00	H	Pass
	7236.47	<-40.00	-30.00	H	Pass
	195.23	-75.70	-54.00	V	Pass
	640.38	-69.70	-54.00	V	Pass
	4824.65	<-40.00	-30.00	V	Pass
	7236.42	<-40.00	-30.00	V	Pass
H	204.94	-74.10	-54.00	H	Pass
	659.81	-70.30	-54.00	H	Pass
	4944.25	<-40.00	-30.00	H	Pass
	7416.58	<-40.00	-30.00	H	Pass
	195.23	-75.20	-54.00	V	Pass
	640.38	-69.20	-54.00	V	Pass
	4944.69	<-40.00	-30.00	V	Pass
	7416.37	<-40.00	-30.00	V	Pass

4 Receiver spurious emission

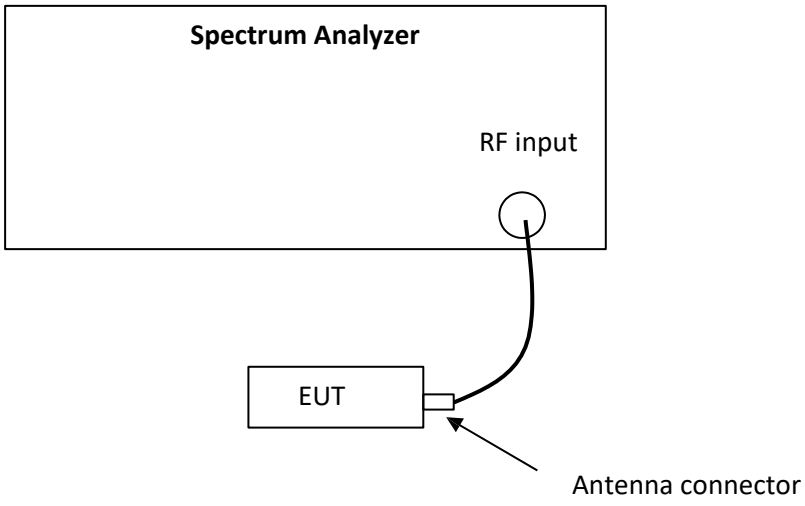
Test result: Pass

4.1 Limit

Frequency range	Maximum power, e.r.p. (≤1 GHz) e.i.r.p. (> 1 GHz)	Bandwidth
30 MHz to 1 GHz	-57 dBm	100 kHz
1 GHz to 12,75 GHz	-47 dBm	1 MHz

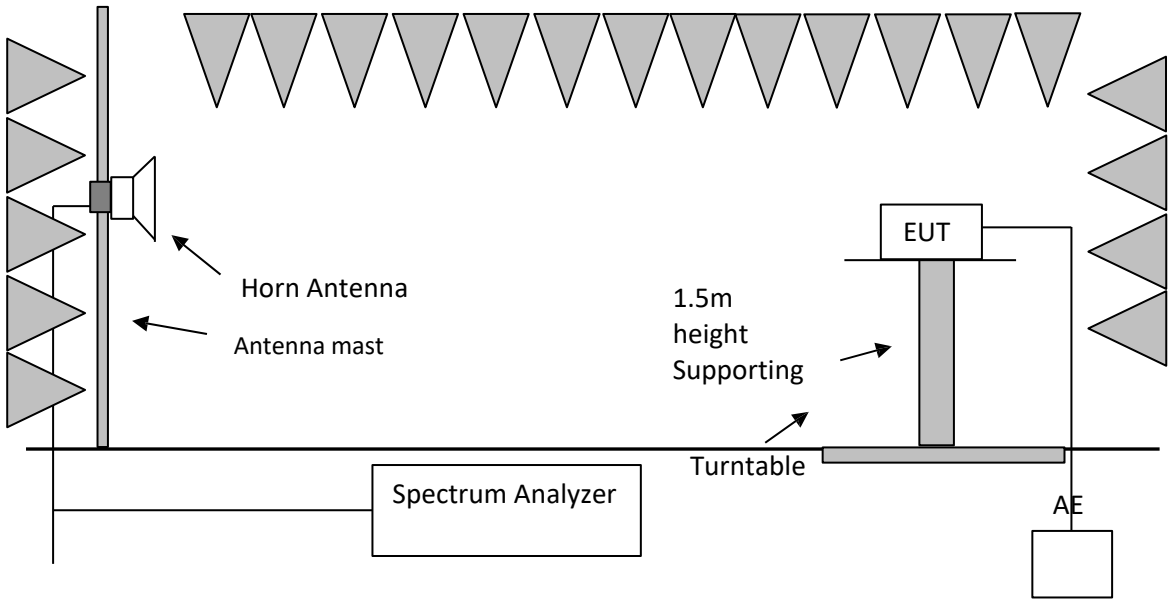
4.2 Block Diagram of Test Setup

4.2.1 For conducted method

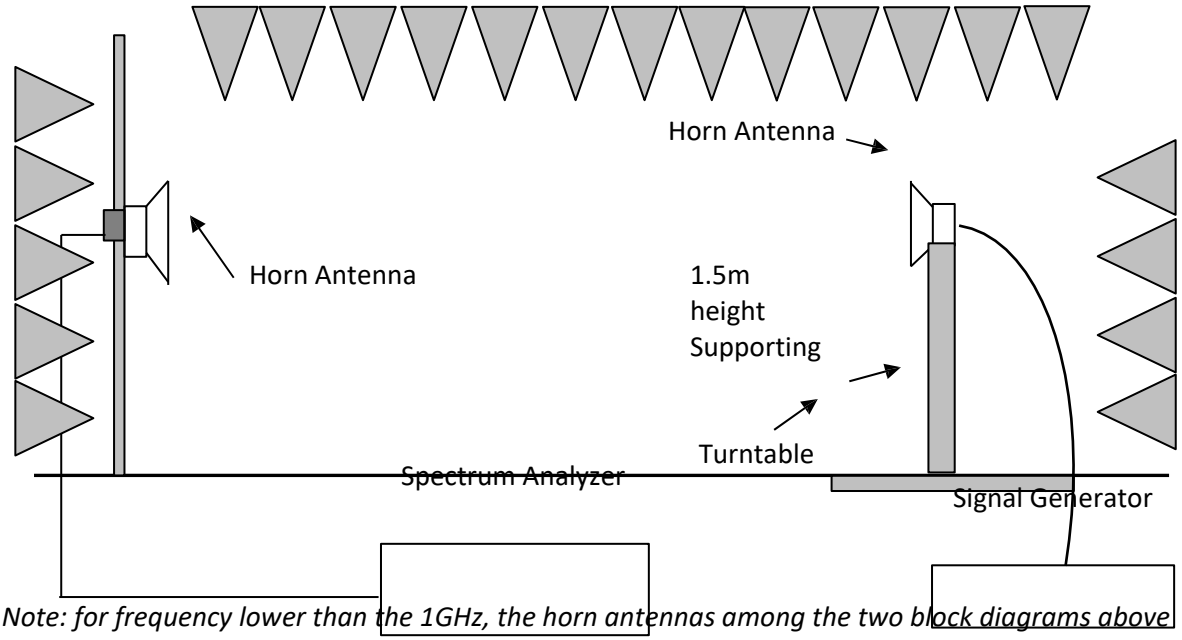


4.2.2 For radiated method

Step one



Step two



Note: for frequency lower than the 1GHz, the horn antennas among the two block diagrams above should be replaced with dipole antennas (or other antennas provided they can be referenced to a dipole).

4.3 Test Conditions and Test Method

These measurements shall only be performed at normal test conditions.

Testing shall be performed when the equipment is in a receive-only mode.

For non-FHSS equipment, the measurement shall be performed at the lowest and the highest channel on which the equipment can operate. These frequencies shall be recorded.

For FHSS equipment, the measurements may be performed when normal hopping is disabled. In this case measurements need to be performed when operating at the lowest and the highest hopping frequency. These frequencies shall be recorded. When disabling the normal hopping is not possible, the measurement shall be performed during normal operation (hopping).

☐ For conducted method

The EUT was connected to the spectrum analyzer directly. Please refer to EN300 328 Clause 5.4.10.2.1 for test procedure.

☒ For radiated method

The measurement was applied in a semi-anechoic chamber. Please refer to EN300 328 Clause 5.4.10.2.2 for test procedure.

4.4 Test protocol

All the modes were pretested and the mode 802.11b was the worst, and the data of 802.11b was listed in the report.

Channel	Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Antenna Polarization	Pass/Fail
L	<1000	<-67.00	-57.00	H	Pass
	>1000	<-57.00	-47.00	H	Pass
	<1000	<-67.00	-57.00	V	Pass
	>1000	<-57.00	-47.00	V	Pass
H	<1000	<-67.00	-57.00	H	Pass
	>1000	<-57.00	-47.00	H	Pass
	<1000	<-67.00	-57.00	V	Pass
	>1000	<-57.00	-47.00	V	Pass

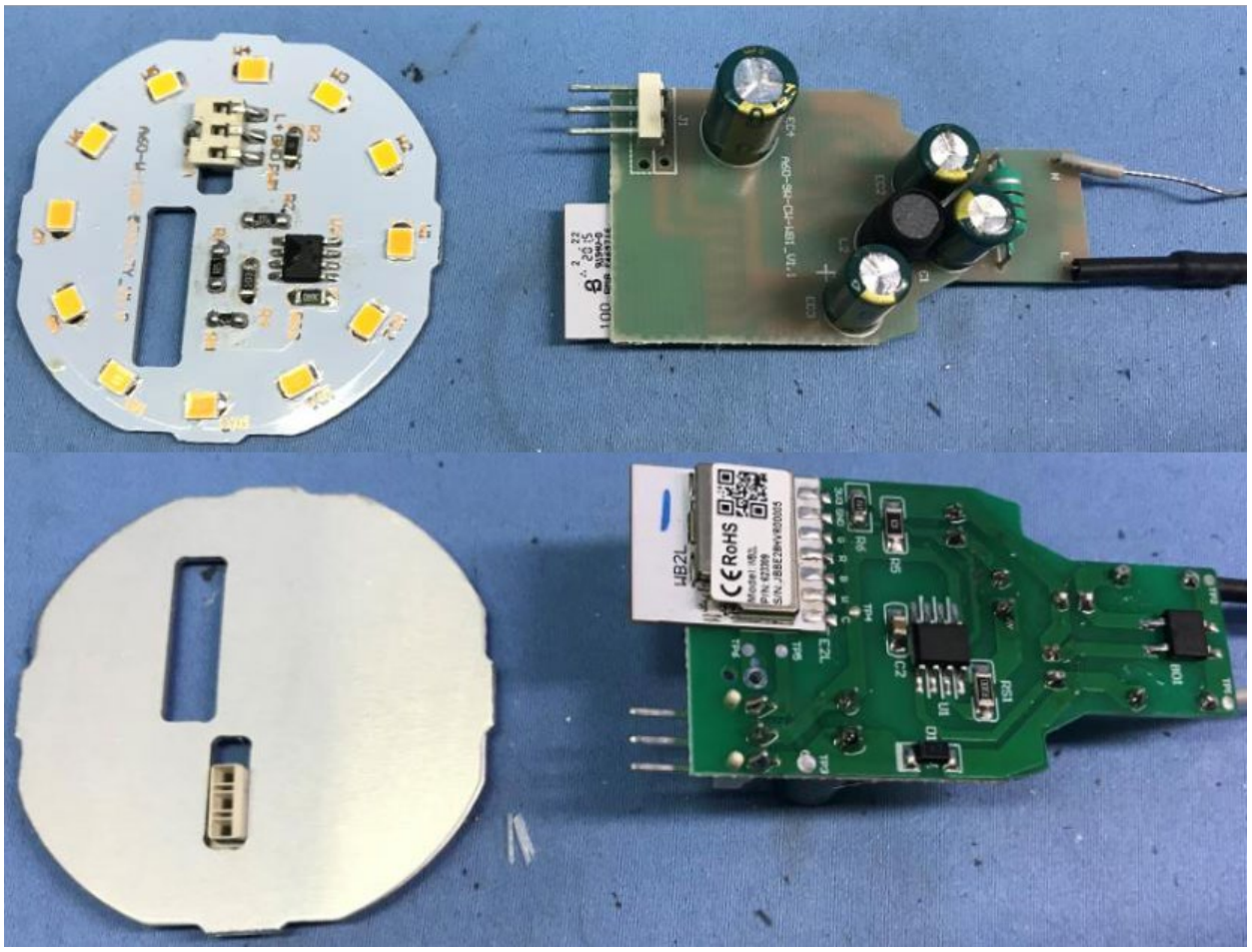
Appendix I: Photograph of equipment under test

Overview of io-WiFi60w-s

Construction of io-WiFi60w-s with E27 lamp

Construction of io-WiFi60w-s with B22d lamp

LED PCB and driver PCB of io-WiFi60w-s

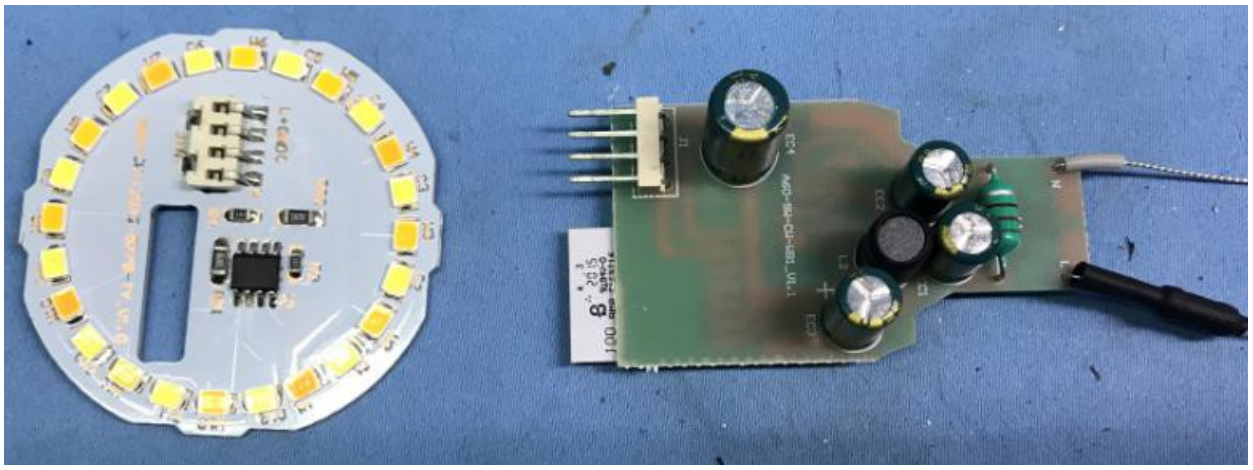


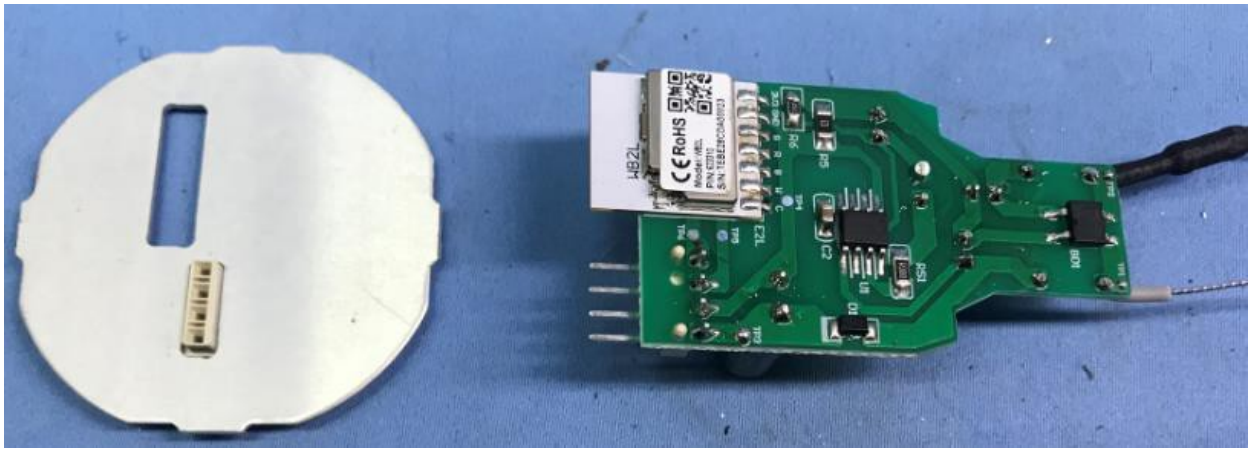
Overview of io-WiFi60cct-s

Construction of io-WiFi60cct-s with E27 lamp

Construction of io-WiFi60cct-s with B22d lamp

LED PCB and driver PCB of io-WiFi60cct-s



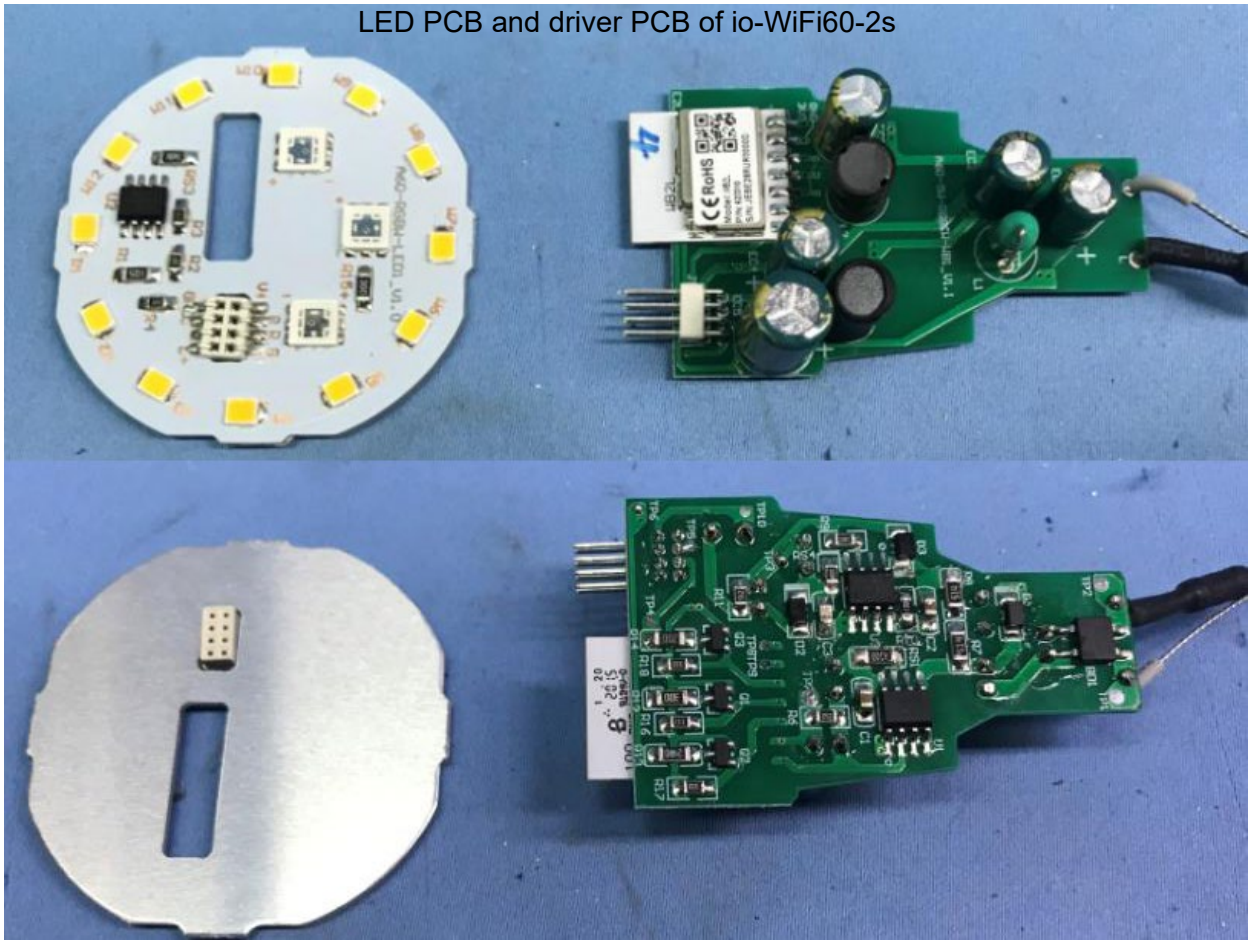


Overview of io-WiFi60-2s

Construction of io-WiFi60-2s with E27 lamp cap

Construction of io-WiFi60-2s with B22d lamp cap

LED PCB and driver PCB of io-WiFi60-2s

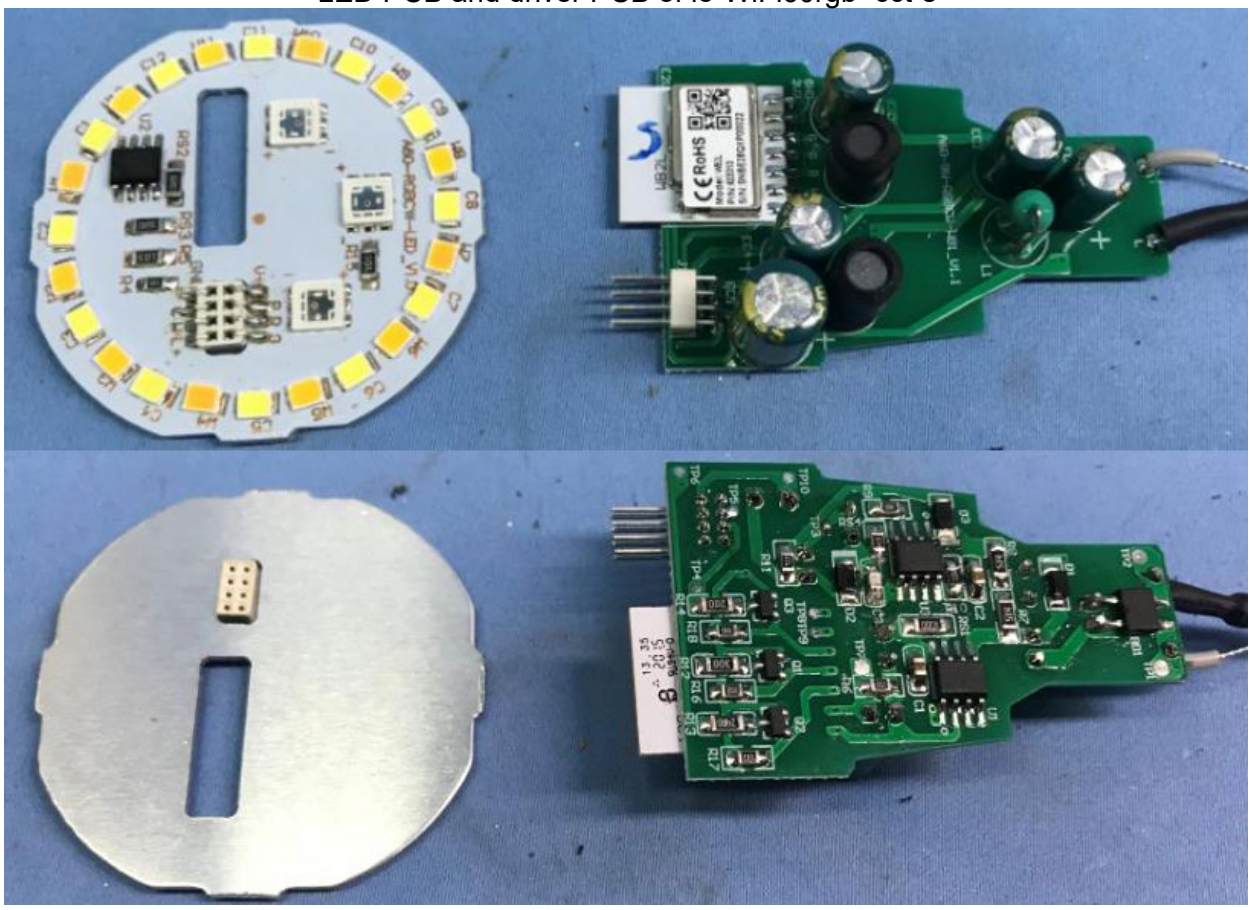


Overview of io-WiFi60rgb+cct-s

Construction of io-WiFi60rgb+cct-s with E27 lamp cap

Construction of io-WiFi60rgb+cct-s with B22d lamp cap

LED PCB and driver PCB of io-WiFi60rgb+cct-s

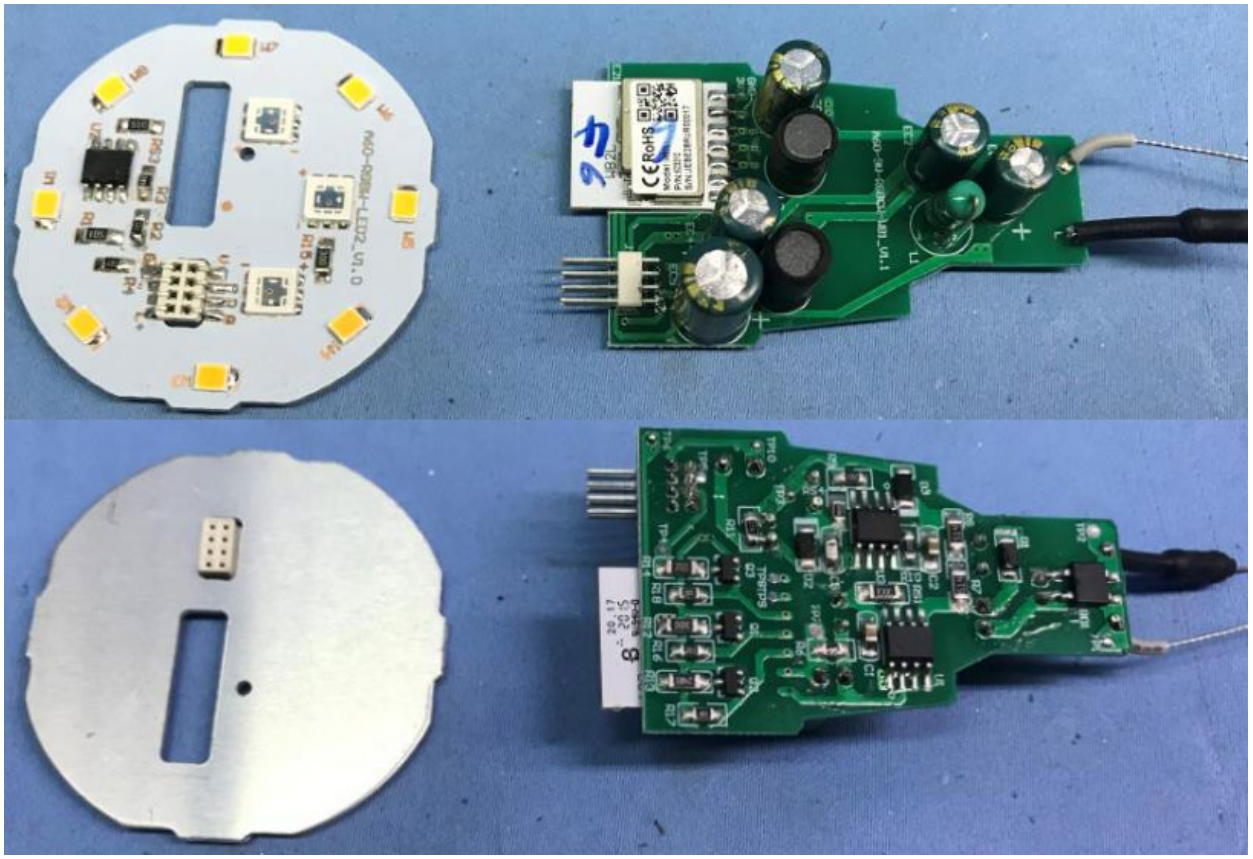


Overview of io-WiFi60

Construction of io-WiFi60 with E27 lamp cap

Construction of io-WiFi60 with B22d lamp cap

LED PCB and driver PCB of io-WiFi60

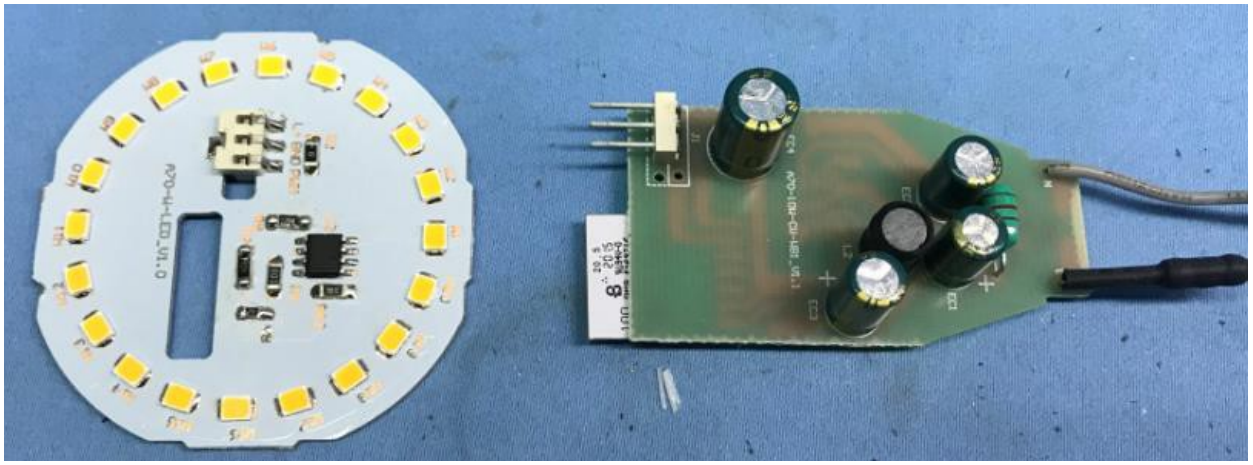


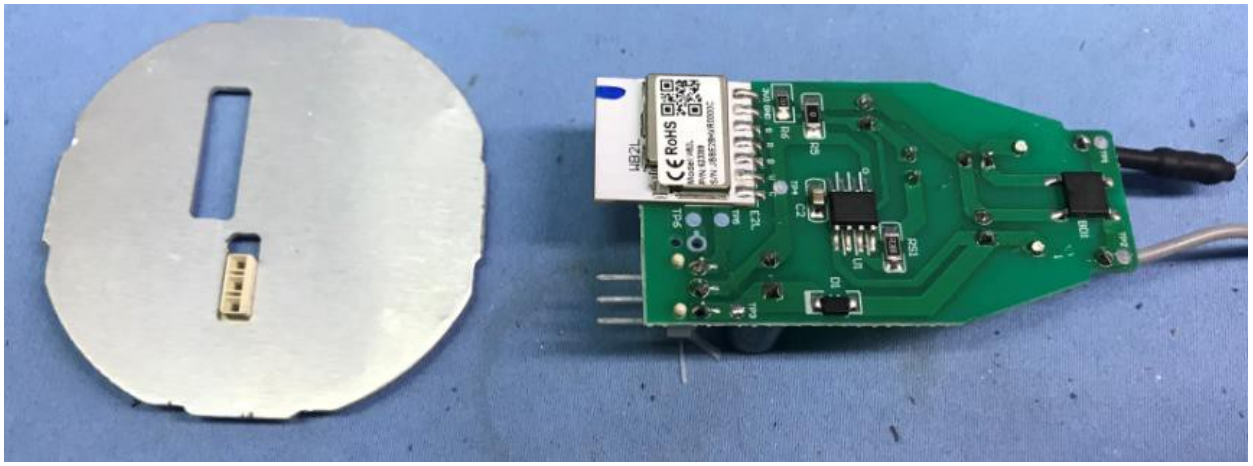
Overview of io-WiFi70w-s

Construction of io-WiFi70w-s with E27 lamp cap

Construction of io-WiFi70w-s with B22d lamp cap

LED PCB and driver PCB of io-WiFi70w-s



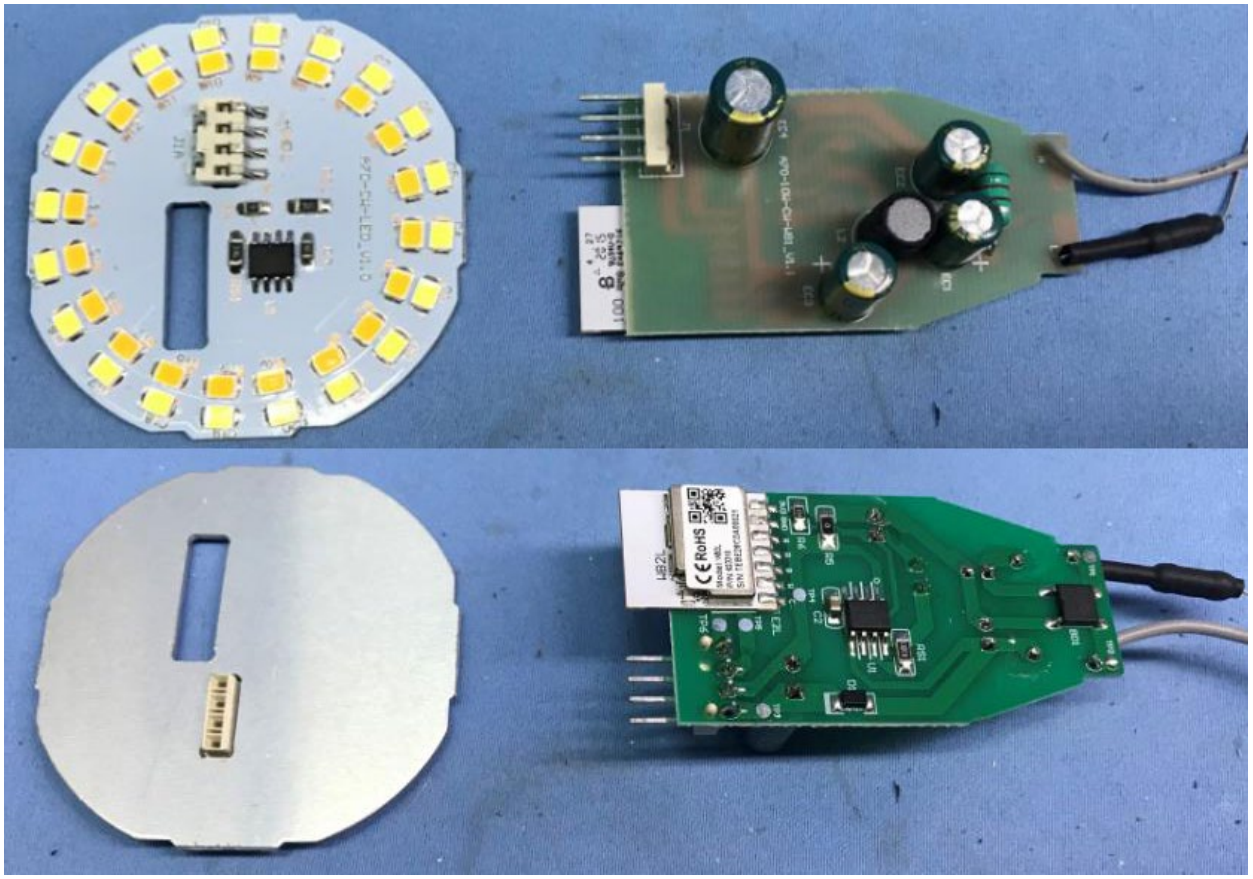


Overview of io-WiFi70cct-s

Construction of io-WiFi70cct-s with E27 lamp cap

Construction of io-WiFi70cct-s with B22d lamp cap

LED PCB and driver PCB of io-WiFi70cct-s

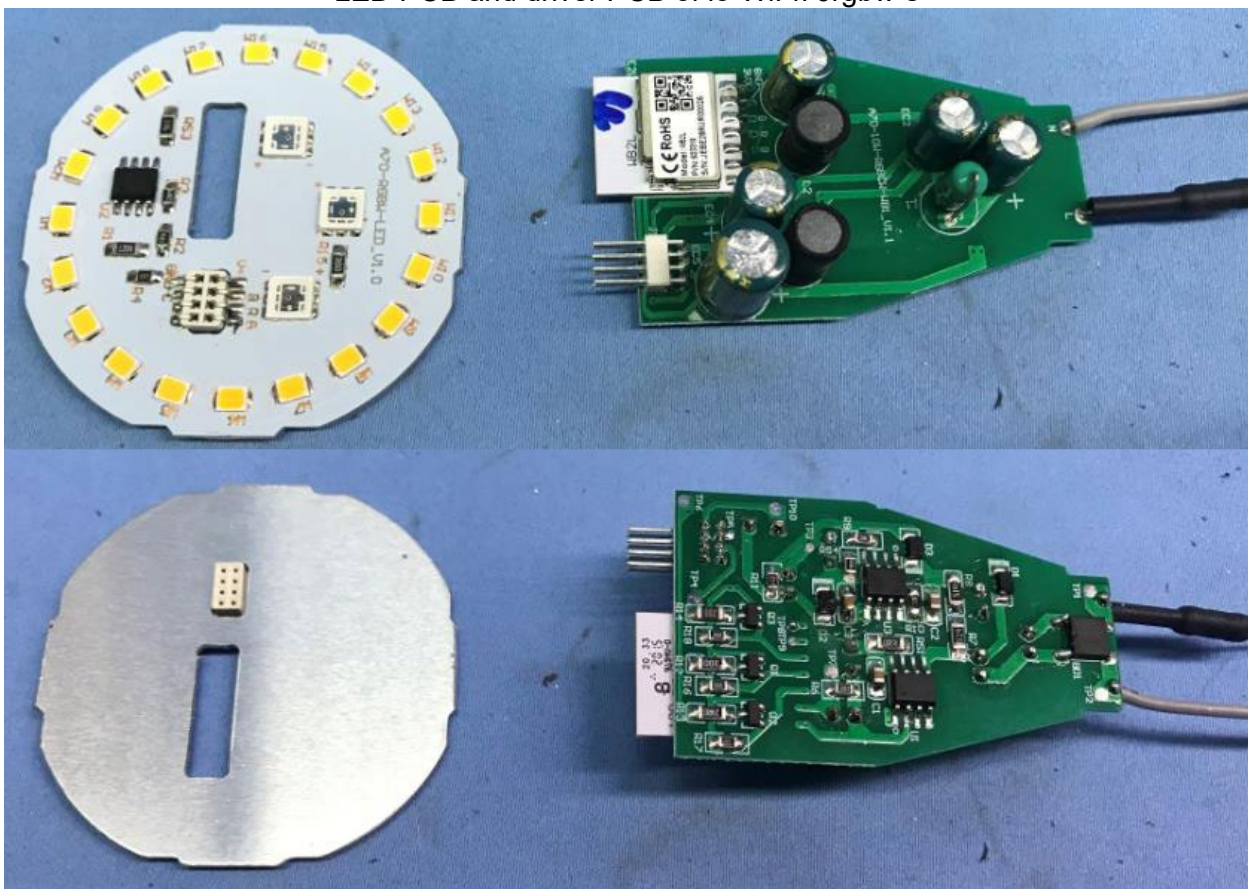


Overview of io-WiFi70rgbw-s

Construction of io-WiFi70rgbw-s with E27 lamp cap

Construction of io-WiFi70rgbw-s with B22d lamp cap

LED PCB and driver PCB of io-WiFi70rgbw-s

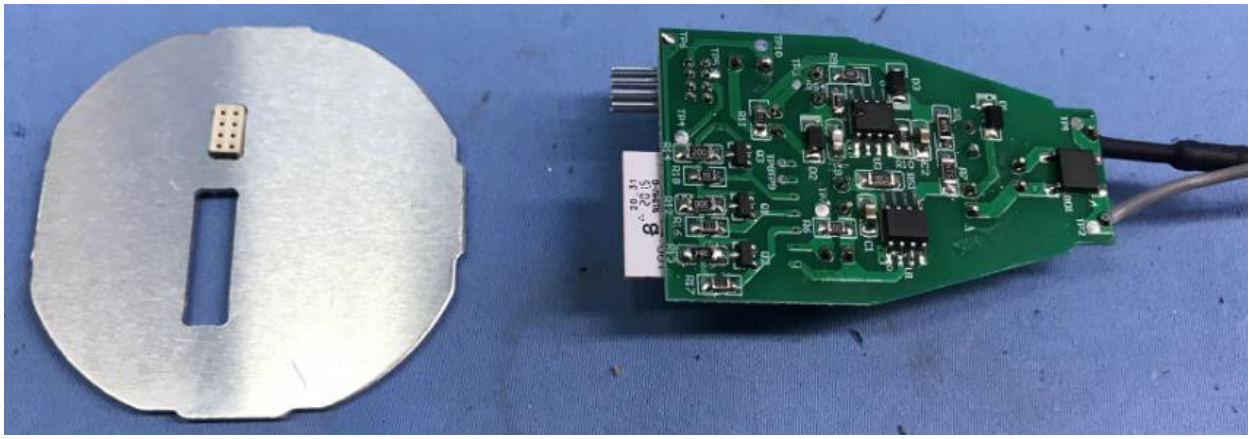


Overview of io-WiFi70rgb+cct-s

Construction of io-WiFi70rgb+cct-s with E27 lamp cap

Construction of io-WiFi70rgb+cct-s with B22d lamp cap

LED PCB and driver PCB of io-WiFi70rgb+cct-s



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