

iML8683 – 220V_{AC} 8W T5 Tube EVM

– Application Notes –

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1. IC Description

The iML8683 is a Three Terminal Current Controller (TTCC) for regulating the current flowing through an LED string.

The application of the iML8683 is configured in parallel with an LED string. The iML8683 can work as voltage controlled current source, current regulator, or cut-off. It is suitable for the applications adopting periodical AC voltage source.

The PCB layout is also very flexible to meet various shape requirements. It is especially suitable for replacing incandescent light bulb and linear type fluorescent lamp.

2. Features

■ System

- ✓ All solid state components
- ✓ No electrolytic capacitor needed
- ✓ Compact size
- ✓ High Power Factor and Low Total Harmonic Distortion Performance
- ✓ High efficiency
- ✓ Flexible PCB layout style
- ✓ Wide range of LED forward voltage selection

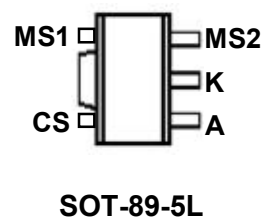
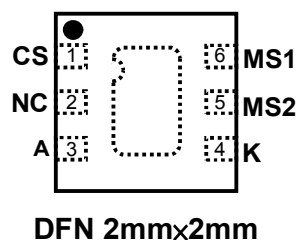
■ Chip

- ✓ 88V input sustaining voltage.
- ✓ 3V dropout voltage for up to 150mA regulating current.
- ✓ Chip-on-board process available.

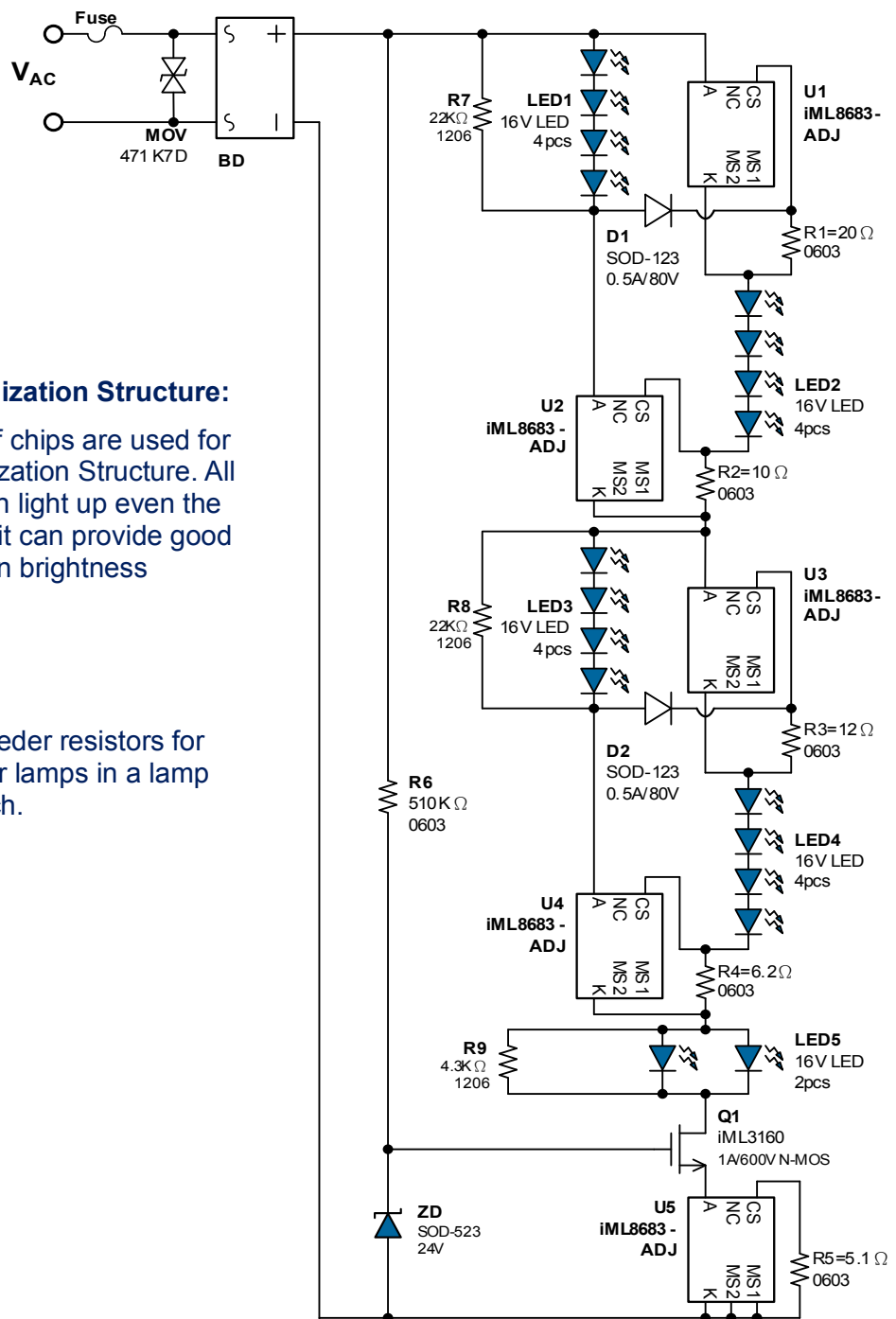
■ Applications

- ✓ AC LED lighting engine.
- ✓ LED light bulb.
- ✓ LED light tube.

3. Package and Pin Diagrams



4. Application Circuit (Balanced Utilization Structure)



Remark:

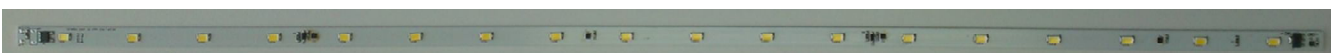
1. Balanced Utilization Structure:

Totally 5pcs of chips are used for Balanced Utilization Structure. All of the LED can light up even the V_{AC} is low, so it can provide good performance in brightness uniformity.

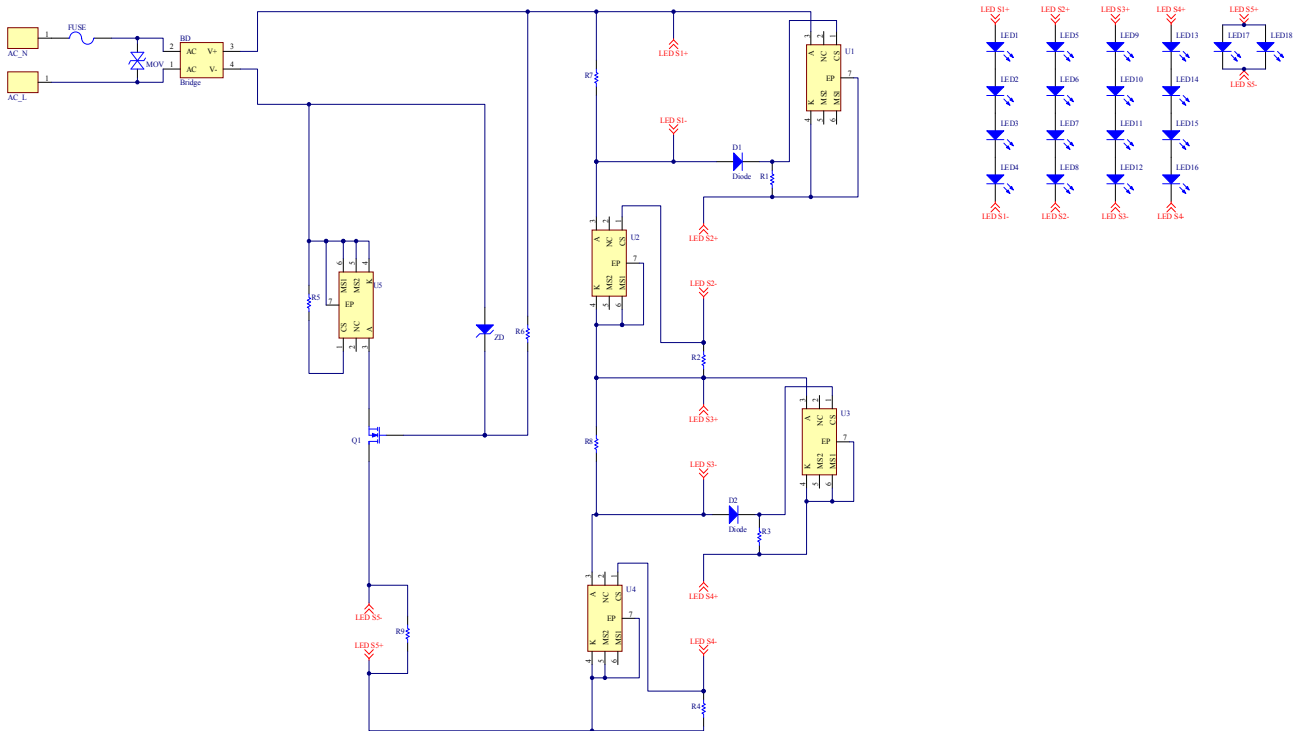
2. R5/R8/R9:

These are bleeder resistors for some indicator lamps in a lamp ON/OFF switch.

5. PCB Layout and Photograph



6. Schematic of PCB



7. Bill of Materials

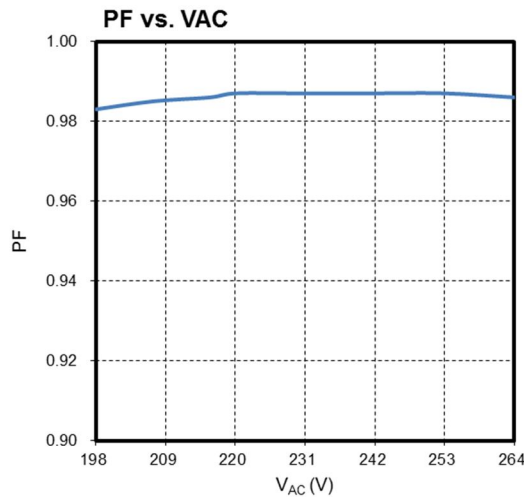
| Component | Description | Package |
|--------------------|---|------------|
| Fuse | NC (0Ω) | 1206 |
| BD | Bridge Diode, MDB10S, 1000V, 1A | |
| MOV | 471K7D | Φ 7mm |
| U1, U2, U3, U4, U5 | iML8683NL-ADJ | DFN-2x2-6L |
| LED1 ~ LED18 | Edison, 16V LED (CCT=3000K) | 5630 |
| R1 | Resistor, 20Ω | 0603 |
| R2 | Resistor, 10Ω | 0603 |
| R3 | Resistor, 12Ω | 0603 |
| R4 | Resistor, 6.2Ω | 0603 |
| R5 | Resistor, 5.1Ω | 0603 |
| R6 | Resistor, 510KΩ | 0603 |
| R7 | Resistor, 22KΩ | 1206 |
| R8 | Resistor, 22KΩ | 1206 |
| R9 | Resistor, 4.3KΩ | 1206 |
| D1 | 80V/0.5A Schottky Diode, MBR 0580-TP | SOD-123 |
| ZD | Zener Diode, 24V | SOD-523 |
| Q1 | HV NMOS, iML3160, 600V/1A, V _{GS,MAX} =30V | SOT-223 |

8. Performance Data and Typical Characteristic

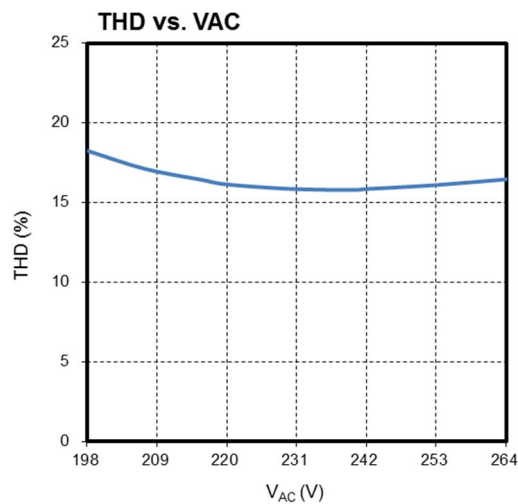
8.1 Test Result

| V _{AC} (V) | I _{IN} (mA) | PF | THD (%) | P _{IN} (W) | I _{IN} Line Reg. |
|---------------------|----------------------|-------|---------|---------------------|---------------------------|
| 198 | 36.59 | 0.983 | 18.25 | 7.158 | -5.99% |
| 207 | 37.66 | 0.985 | 17.12 | 7.716 | -3.24% |
| 216 | 38.49 | 0.986 | 16.42 | 8.200 | -1.11% |
| 220 | 38.92 | 0.987 | 16.13 | 8.488 | 0.00% |
| 230 | 39.66 | 0.987 | 15.85 | 9.009 | 1.90% |
| 240 | 40.33 | 0.987 | 15.78 | 9.563 | 3.62% |
| 242 | 40.47 | 0.987 | 15.84 | 9.675 | 3.98% |
| 253 | 41.16 | 0.987 | 16.09 | 10.322 | 5.74% |
| 264 | 41.67 | 0.986 | 16.45 | 10.857 | 7.06% |

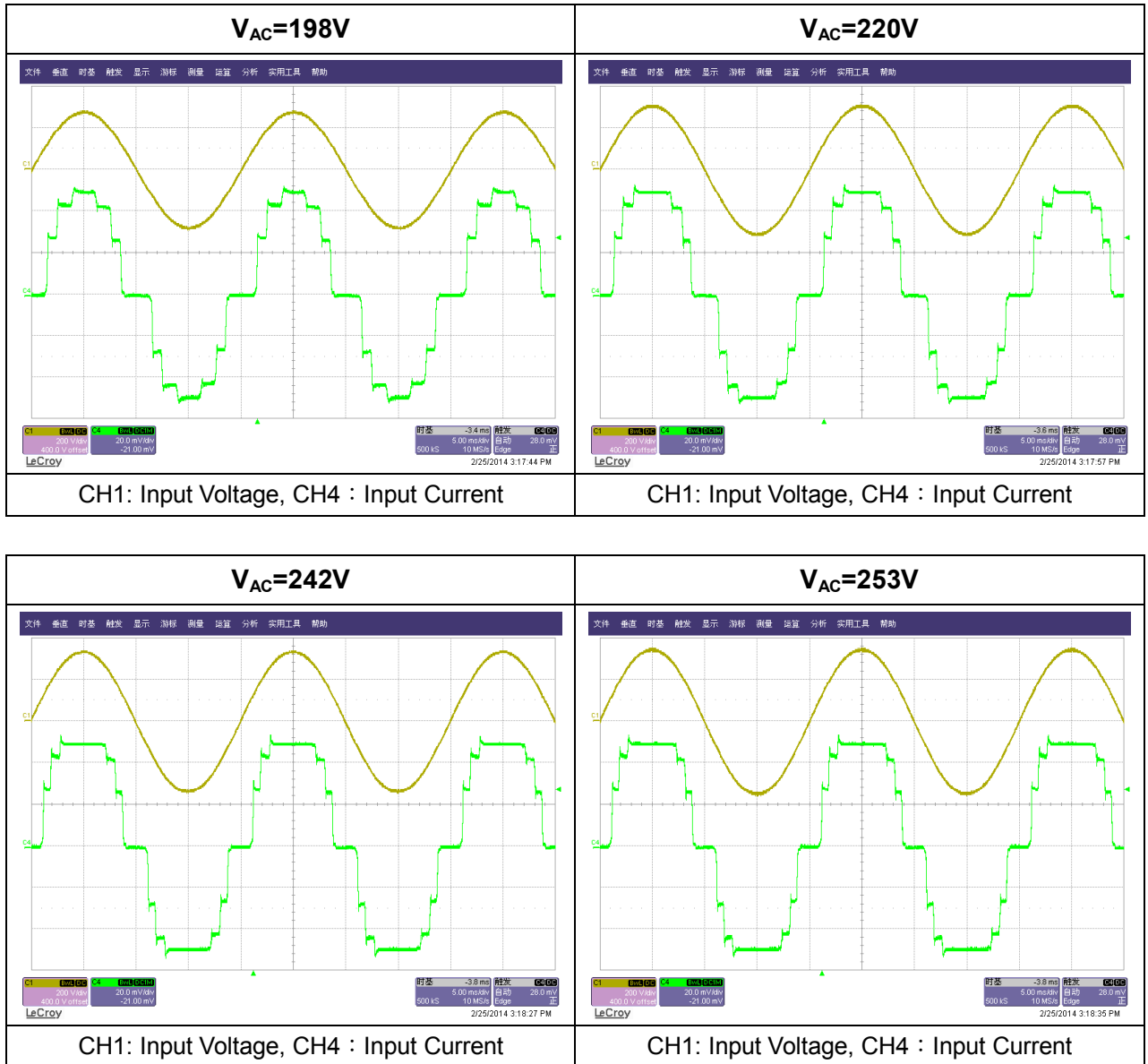
8.2 Power Factor vs. V_{AC}



8.3 THD vs. V_{AC}



8.4 Input Voltage and Input Current



9. Surge Performance

In order to pass 1KV surge test (IEC61000-4-5), a MOV is required. Without MOV, the light engine can pass 750V surge. Here are the test results.



Worldwide Testing Services(Taiwan) Co., Ltd.

Surge

Applicant: Integrated Memory Logic, Inc.

Standard: EN 61000 - 4 - 5

Device: iML8683 220V/ 8W T5 LED tube Module

Date: 2014.03.04

| | |
|---------------|-----------|
| Temperature | : 22.4 °C |
| Pressure | : 990 hPa |
| Rel. humidity | : 49.4 % |

| Model | Test mode | Voltage Angle | Waveform T _r / T _b | Repetition | Number of Tests/ Total | Performance criteria |
|--------------|---------------------|---------------|---|------------|---------------------------|-------------------------|
| #1 | 220VAC-line to line | +500V 90° | 1.2/50 μs | 30s | 5/5 | A |
| | | -500V 270° | 1.2/50 μs | 30s | 5/5 | A |
| #2 | 220VAC-line to line | +750V 90° | 1.2/50 μs | 30s | 5/5 | A |
| | | -750V 270° | 1.2/50 μs | 30s | 5/5 | A |
| #3 MOV471 | 220VAC-line to line | +1000V 90° | 1.2/50 μs | 30s | 5/5 | A |
| | | -1000V 270° | 1.2/50 μs | 30s | 5/5 | A |

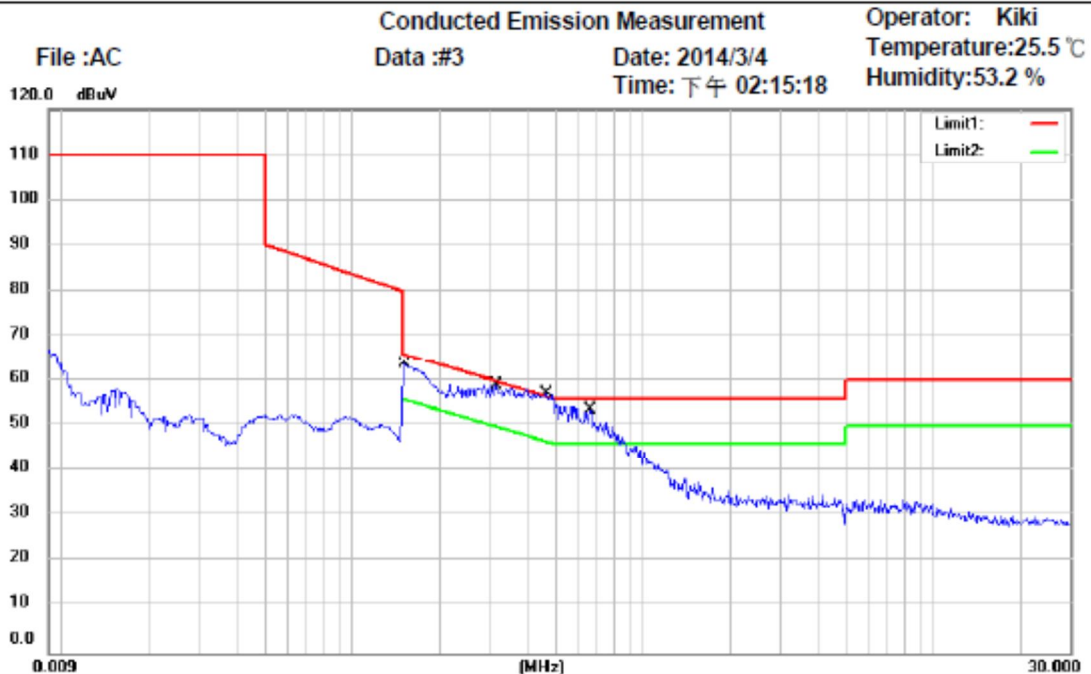
Performance criteria:

- A : No loss of performance or function
- B : Temporary loss of function or performance which is self recoverable
- C : Temporary loss of function or perform. which req. operate. intervention or system reset
- D : Loss of function which is not recoverable

10. EMI Performance



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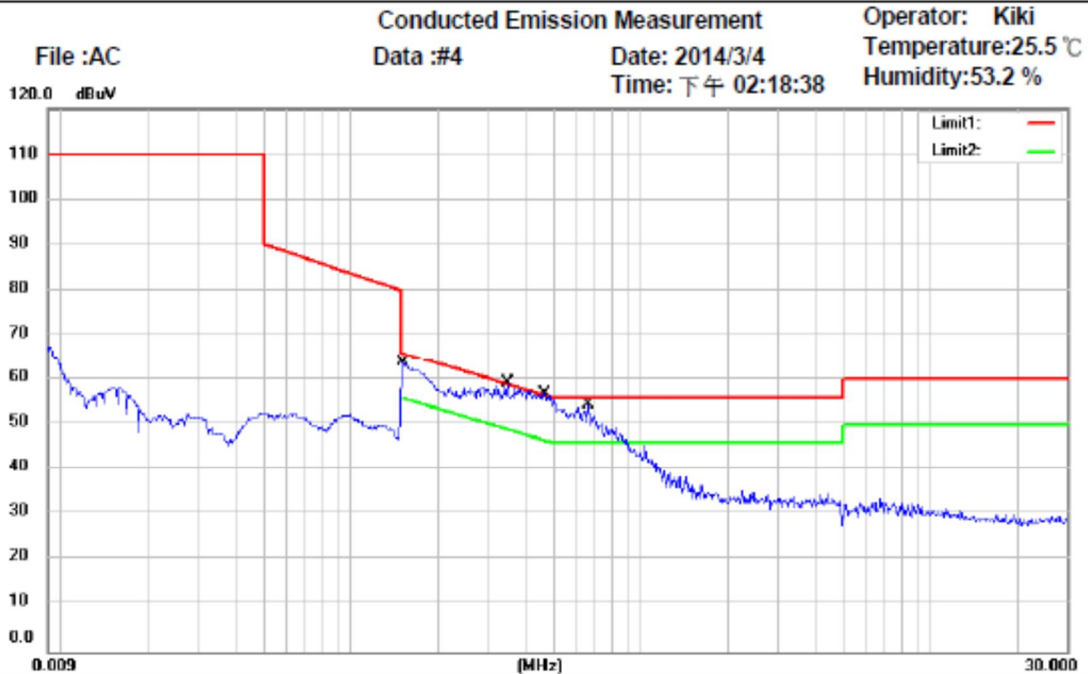


| Mk. | Frequency (MHz) | Reading (dBuV) | Detector | Corrected factor(dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Comment |
|-----|-----------------|----------------|----------|----------------------|---------------|--------------|-------------|---------|
| | 0.1505 | 44.50 | QP | 9.66 | 54.16 | 65.97 | -11.81 | |
| | 0.1505 | 28.64 | AVG | 9.66 | 38.30 | 55.97 | -17.67 | |
| | 0.3191 | 41.29 | QP | 9.66 | 50.95 | 59.73 | -8.78 | |
| | 0.3191 | 28.43 | AVG | 9.66 | 38.09 | 49.73 | -11.64 | |
| * | 0.4660 | 39.84 | QP | 9.67 | 49.51 | 56.58 | -7.07 | |
| | 0.4660 | 26.74 | AVG | 9.67 | 36.41 | 46.58 | -10.17 | |
| | 0.6691 | 35.97 | QP | 9.68 | 45.65 | 56.00 | -10.35 | |
| | 0.6691 | 22.73 | AVG | 9.68 | 32.41 | 46.00 | -13.59 | |

*:Maximum data x:Over limit !:over margin



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Site : Chamber_03

Condition : EN55015 Conduction(QP)

Phase: N

EUT :

Power : 220 V.a.c.

M/N: iML8683 220V 8W T5 LED tube Module

Test Mode :

Note :

| Mk. | Frequency (MHz) | Reading (dBuV) | Detector | Corrected factor(dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Comment |
|-----|-----------------|----------------|----------|----------------------|---------------|--------------|-------------|---------|
| | 0.1504 | 44.52 | QP | 9.67 | 54.19 | 65.98 | -11.79 | |
| | 0.1504 | 28.60 | AVG | 9.67 | 38.27 | 55.98 | -17.71 | |
| | 0.3495 | 41.09 | QP | 9.68 | 50.77 | 58.97 | -8.20 | |
| | 0.3495 | 28.19 | AVG | 9.68 | 37.87 | 48.97 | -11.10 | |
| * | 0.4660 | 40.00 | QP | 9.68 | 49.68 | 56.58 | -6.90 | |
| | 0.4660 | 26.79 | AVG | 9.68 | 36.47 | 46.58 | -10.11 | |
| | 0.6635 | 36.11 | QP | 9.69 | 45.80 | 56.00 | -10.20 | |
| | 0.6635 | 22.90 | AVG | 9.69 | 32.59 | 46.00 | -13.41 | |

*:Maximum data x:Over limit !:over margin