

Description

The IS31LT3916 is a primary side, peak current mode, isolated or non-isolated type HBLED driver. The device works at a constant frequency in discontinuous conduction mode to provide a constant power to the output. It eliminates the need for an opto-coupler, TL431, or any other type of secondary side feedback. It operates from a wide input voltage range of 90VAC to 260VAC. The IS31LT3916 integrates over current protection, over voltage protection, as well as includes a thermal shutdown to halt the switching action in the case of abnormally high operating temperatures.

Features

- Power factor correction to > 0.90
- 5% typical current accuracy
- High efficiency
- No loop compensation required
- Wide input voltage range: 90V to 260VAC
- Isolation and Non-isolation application
- Internal over-temperature protection
- Over voltage protection
- Primary side over current protection

Applications

- LED bulb lamp
- LED tube lamp
- General LED lamp

Order information

| Part Number | Package Type |
|----------------------|--------------|
| IS31LT3916-SLS2-EBT8 | MSOP-8 |

Quick Start

Recommended Equipment

- 90~260VAC/50~60Hz power supply
- LED array(12 LEDs in series)

Recommended Input and Output Ratings

- Input: 90~260VAC
- Output: 12LEDs in series(40V/450mA)

Absolute Maximum Ratings

≤ 265VAC power supply
 ≤ 50V Vout (Total Vf)

Caution: Do not exceed the conditions listed above, otherwise the board will be damaged or the output will be limited.

Procedure

The IS31LT3916 DEMO Board is fully assembled and tested. Follow the steps listed below to verify board operation.

Caution: Do not turn on the power supply until all connections are completed.

- 1) Connect the positive terminal of the LEDs to the LED+ pin of the DEMO and the negative terminal of the LEDs to the LED- pin of the DEMO.
- 2) Connect the input pins (L and N) of the DEMO via the main power switch to AC power supply.
- 3) Turn on the power supply.

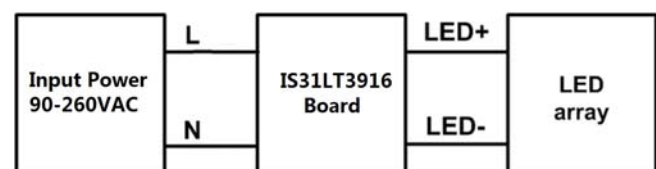


Figure 1 Picture of DEMO Board

NOTE: Physical dimensions are (L x W x H): 255mm x 17mm x 12mm



IS31LT3916 Isolation T8 Lighting DEMO Board Guide

Bill of Materials

| No. | Name | Description | Ref Des. | Qty. | Cost(RMB) |
|-----|-------------------|---|-------------------|------|-----------|
| 1 | Fuse | 1A,250V,3*10 | F1 | 1 | 0.1 |
| 2 | MOV | 7D471K | MOV | 1 | 0.1 |
| 3 | X Cap | 0.1uF,275VAC | CX1,CX2 | 2 | 0.3 |
| 4 | Y Cap | JN102M | CY | 1 | 0.15 |
| 5 | SMD Cap | NC | C1,C5 | 1 | 0 |
| 6 | SMD Cap | 1nF±10%,500V,1206 | C2 | 1 | 0.1 |
| 7 | AL Cap | 330uF±10%,63V,10mm*20mm | C3,C4 | 2 | 0.4 |
| 8 | CBB Cap | 100nF±10%,400V | C6 | 1 | 0.15 |
| 9 | SMD Cap | 1nF±10%,16V,0805 | C7 | 1 | 0.04 |
| 10 | SMD Cap | 1uF±10%,50V,0805 | C8 | 1 | 0.1 |
| 11 | SMD Cap | 10uF±10%,50V,1206 | C9 | 1 | 0.1 |
| 12 | SMD Cap | 1uF±10%,50V,1206 | C10 | 1 | 0.1 |
| 13 | Rectifying Bridge | DB107,1A,1000V,DB-1 | BD1 | 1 | 0.3 |
| 14 | FR Diode | ES2G,2A,400V,SMA | D1 | 1 | 0.15 |
| 15 | FR Diode | RS1M,1A,1000V,SMA | D2 | 1 | 0.15 |
| 16 | SMD Diode | 1N4148,200mA,75V,LL34 | D4 | 1 | 0.05 |
| 17 | SMD Diode | NC | D3 | 1 | 0 |
| 18 | SMD Diode | M7,1A,1000V,SMA | D5 | 1 | 0.05 |
| 19 | SMD Resistor | NC | R1 | 1 | 0 |
| 20 | SMD Resistor | 4.7KΩ±5%,0805 | R2 | 1 | 0.006 |
| 21 | SMD Resistor | NC | R4 | 1 | 0 |
| 22 | SMD Resistor | 180KΩ±5%,1206 | R3,R24 | 1 | 0.016 |
| 23 | SMD Resistor | 1MΩ±1%,1206 | R5,R7,R9 | 3 | 0.024 |
| 24 | SMD Resistor | 180KΩ±5%,1206 | R6,R10 | 2 | 0.016 |
| 25 | SMD Resistor | 62KΩ±5%,1206 | R8 | 1 | 0.008 |
| 26 | SMD Resistor | 910KΩ±1%,1206 | R11 | 1 | 0.008 |
| 27 | SMD Resistor | 30Ω±5%,0805 | R12 | 1 | 0.006 |
| 28 | SMD Resistor | NC | R14 | 1 | 0 |
| 29 | SMD Resistor | 2.2MΩ±1%,0805 | R15 | 1 | 0.006 |
| 30 | SMD Resistor | 13KΩ±1%,0805 | R16 | 1 | 0.006 |
| 31 | SMD Resistor | 240KΩ±1%,0805 | R17 | 1 | 0.006 |
| 32 | SMD Resistor | 13KΩ±1%,0805 | R18 | 1 | 0.006 |
| 33 | SMD Resistor | 20KΩ±1%,0805 | R19 | 1 | 0.006 |
| 34 | SMD Resistor | 1.2Ω±1%,1206 | R13,R20,R21,R21-2 | 4 | 0.032 |
| 35 | SMD Resistor | 160KΩ±1%,0805 | R22 | 1 | 0.006 |
| 36 | SMD Resistor | 10KΩ±1%,0805 | R23 | 1 | 0.006 |
| 37 | Inductor | 3mH±10%,8*10mm,Isat≥200mA | L1 | 1 | 0.15 |
| 38 | Common Mode Chock | EE12,L2-1=L2-2=30mH±10%, 0.25mm,90Ts | L2 | 1 | 0.3 |
| 39 | Inductor | NC | L3 | 1 | 0 |

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| | | | | | |
|------------------------|-------------|--|----|---|-------|
| 40 | Transformer | ER4008, Tp:Ts:Ta=23:12:5, Lp=0.41mH±5% | TR | 1 | 2.5 |
| 41 | NMOS | 6N80, 6A/800V, TO-220 | Q1 | 1 | 1.8 |
| 42 | PCB | 255mm x 17mm | | 1 | 1 |
| 43 | IC | IS31LT3916, MSOP-8 | U1 | 1 | - |
| Total Cost(Exclude IC) | | | | | 8.239 |

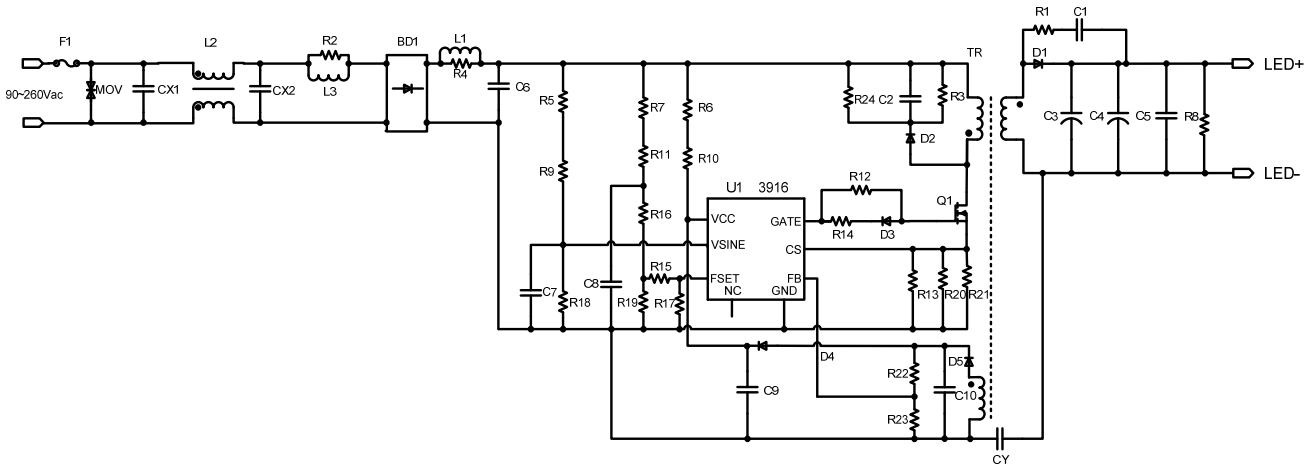


Figure 2. Schematic of DEMO Board

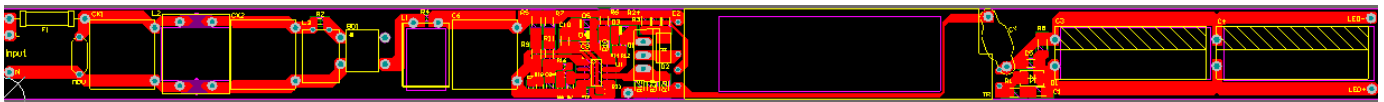


Figure 3 PCB Layout- Top Layer

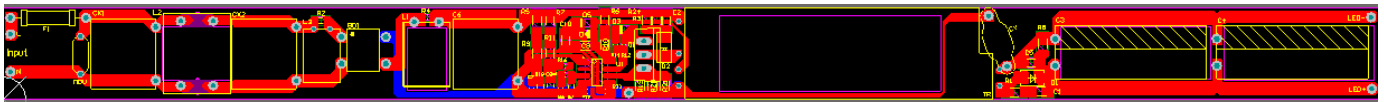


Figure 4 PCB Component Placement Guide - Top Layer

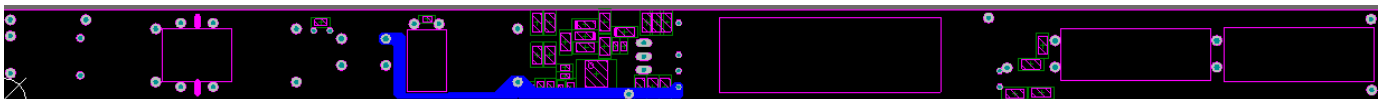


Figure 5 PCB Layout- Bottom Layer

Transformer Design

ELECTRICAL SPECIFICATIONS:

1. Primary inductance (L_p)=410uH@10kHz
2. Primary Leakage Inductance (L_k) <= 20uH @10KHz
3. Electrical Strength = 3KV, 50/60Hz, 1Min

MATERIALS:

1. Core: ER4008 (Ferrite Material TDK PC40 or equivalent)
2. Bobbin: ER4008, Primary 5pins, Secondary 3pins
3. Magnet Wires (Pri&Aux): Type 2-U EW
4. Magnet Wire (Sec): Triple Insulated Wires
5. Layer Insulation Tape: 3M1298 or equivalent

IS31LT3916 Isolation T8 Lighting DEMO Board Guide

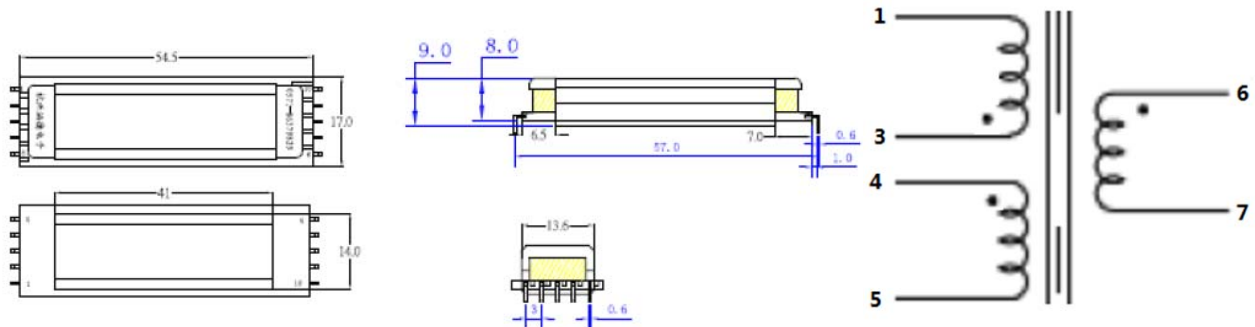


Figure 6 Transformer

| NO. | winding | Start | End | number of turns | number of plies | diameter | number of plies | tape | remarks |
|-----|---------|-------|-----|-----------------|-----------------|---------------|-----------------|----------|---------|
| 1 | NP | 3 | 1 | 23T | 2 | 0.30mm-2-UEW | 2 | 0.02*4mm | |
| 2 | NS | 6 | 7 | 12T | 2 | 0.40mm-TEX | 3 | 0.02*4mm | |
| 3 | NA | 4 | 5 | 5T | 1 | 0.13mm- 2-UEW | 3 | 0.02*4mm | |

Test result

| Input voltage(VAC) | PF | THD(%) | Input power(W) | Output voltage(V) | Output current(mA) | Output power(W) | Efficiency(%) |
|--------------------|-------|--------|----------------|-------------------|--------------------|-----------------|---------------|
| 90 | 0.999 | 1.7 | 21.04 | 40.2 | 440 | 17.69 | 84.07 |
| 100 | 0.999 | 1.7 | 21.33 | 40.2 | 448 | 18.01 | 84.43 |
| 110 | 0.998 | 1.7 | 21.10 | 40.2 | 447 | 17.97 | 85.16 |
| 120 | 0.997 | 1.7 | 21.22 | 40.2 | 450 | 18.09 | 85.25 |
| 130 | 0.997 | 1.7 | 21.62 | 40.2 | 460 | 18.49 | 85.53 |
| 140 | 0.996 | 1.7 | 21.25 | 40.2 | 456 | 18.33 | 86.26 |
| 150 | 0.995 | 1.7 | 21.29 | 40.2 | 456 | 18.33 | 86.10 |
| 160 | 0.994 | 1.7 | 21.36 | 40.2 | 457 | 18.37 | 86.01 |
| 170 | 0.992 | 1.9 | 21.29 | 40.2 | 460 | 18.49 | 86.86 |
| 180 | 0.990 | 1.9 | 21.37 | 40.2 | 460 | 18.49 | 86.53 |
| 190 | 0.987 | 1.9 | 21.22 | 40.2 | 457 | 18.37 | 86.58 |
| 200 | 0.984 | 1.9 | 20.94 | 40.2 | 451 | 18.13 | 86.58 |
| 210 | 0.980 | 2.0 | 21.14 | 40.2 | 456 | 18.33 | 86.71 |
| 220 | 0.977 | 2.0 | 21.21 | 40.2 | 457 | 18.37 | 86.62 |
| 230 | 0.973 | 2.0 | 21.16 | 40.2 | 456 | 18.33 | 86.63 |
| 240 | 0.968 | 2.0 | 21.25 | 40.2 | 457 | 18.37 | 86.45 |
| 250 | 0.962 | 2.1 | 21.18 | 40.2 | 456 | 18.33 | 86.55 |
| 260 | 0.957 | 2.1 | 21.02 | 40.1 | 452 | 18.13 | 86.23 |

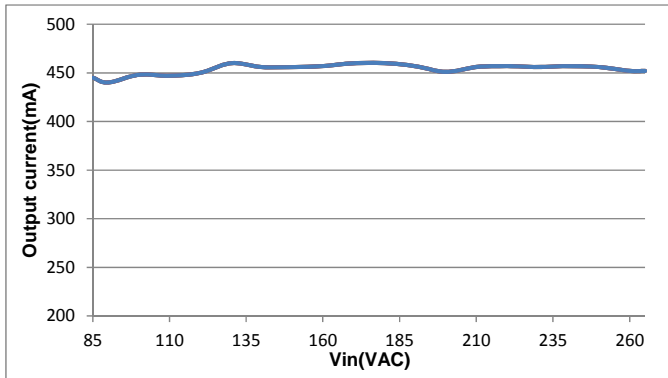


Figure 7 Line regulation

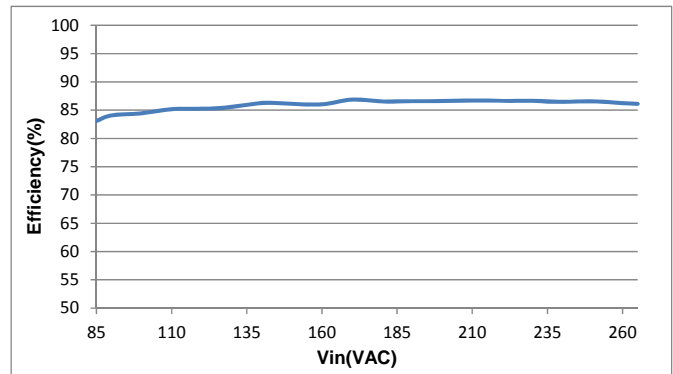


Figure 8 Efficiency & Vin

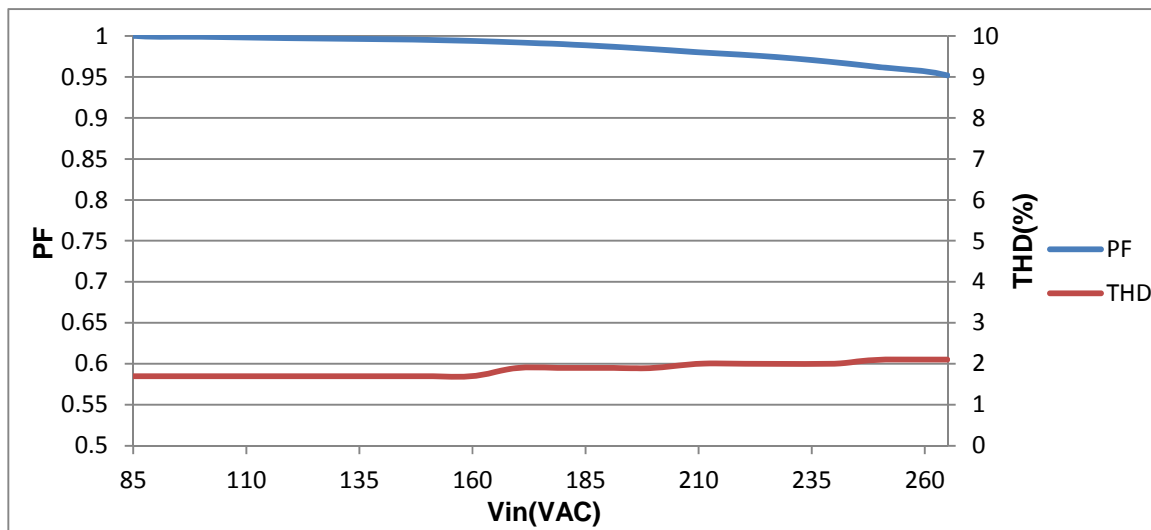


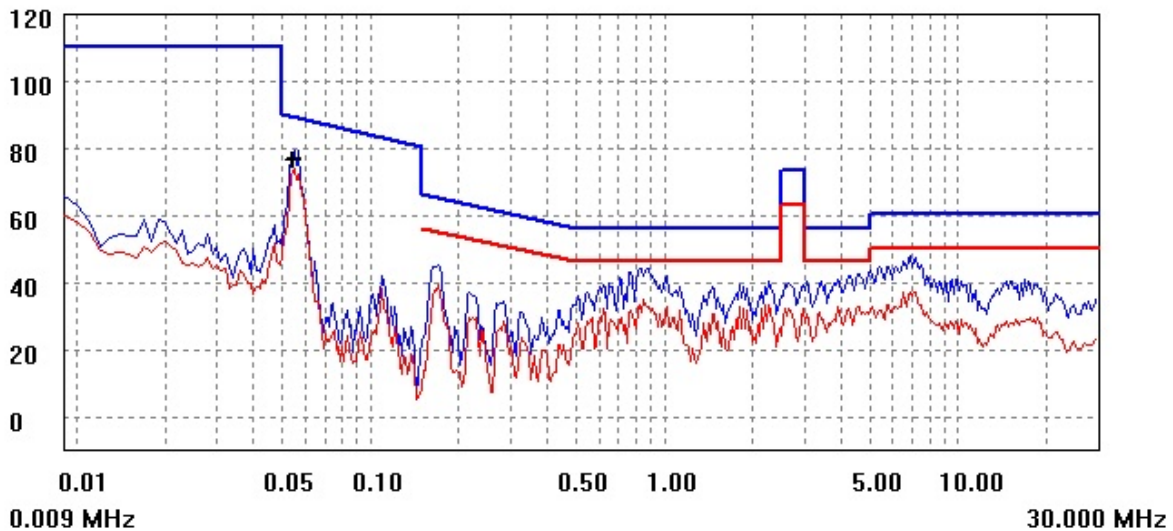
Figure 9 PF, THD & Vin

EMI TEST REPORT

| | | | |
|--------------------------------|-----------------------|-----------|-----------|
| Organization: ISSI | Operator: Jason | EUT: 3916 | parameter |
| Place: XM | Time: 2013/3/12/11:54 | | |
| Detector: PK+AV | Test-time(ms): 10 | | |
| Limit: EN55015 | Transductor: PK0 | | |
| Remark: 3916 220VAC 40V450mA L | | | |

| | | | |
|------------|----------|-----------|------------|
| Start(MHz) | End(MHz) | Step(MHz) | freq, step |
| 0.009 | 0.150 | 0.001 | |
| 0.150 | 3.000 | 0.002 | |
| 3.000 | 10.000 | 0.020 | |
| 10.000 | 30.000 | 0.025 | |

dBuV scan result



final test

| | | | | |
|-------------|-----------|-----------|-----------|--------------------|
| [AV] | freq(MHz) | lev(dBuV) | Lim(dBuV) | Δ (lev-Lim) |
| | 0.054 | 76.6 | 0.0 | 76.6 |

Figure 10 Conduction EMI_L

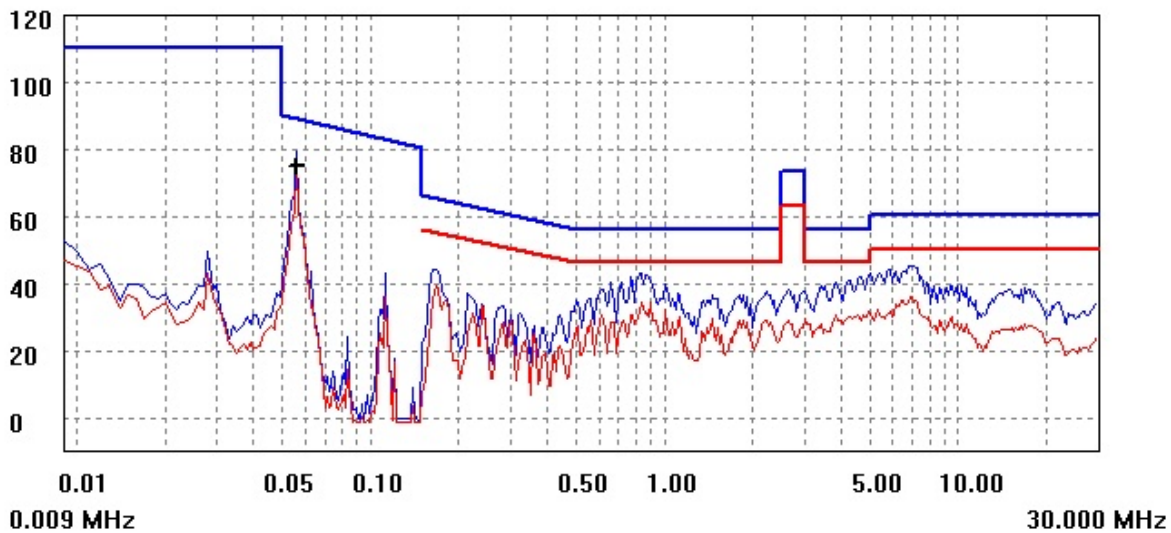
EMI TEST REPORT

| | | | |
|---------------------------------------|------------------------------|------------------|-----------|
| Organization: ISSI | Operator: Jason | EUT: 3916 | parameter |
| Place: XM | Time: 2013/3/12/11:58 | | |
| Detector: PK+AV | Test-time(ms): 10 | | |
| Limit: EN55015 | Transductor: PK0 | | |
| Remark: 3916 220VAC 40V450mA N | | | |

| | | | |
|-------------------|-----------------|------------------|------------|
| Start(MHz) | End(MHz) | Step(MHz) | freq, step |
| 0.009 | 0.150 | 0.001 | |
| 0.150 | 3.000 | 0.002 | |
| 3.000 | 10.000 | 0.020 | |
| 10.000 | 30.000 | 0.025 | |

scan result

dBuV



final test

| [AV] | freq(MHz) | lev(dBuV) | Lim(dBuV) | Δ (lev-Lim) |
|------|-----------|-----------|-----------|--------------------|
| | 0.056 | 74.5 | 0.0 | 74.5 |

Figure 11 Conduction EMI_N