

RFI Test Report – Web Power Switch

Manufacturer: Digital Loggers, Inc. Model: 120-240V Smart Switch

Model number: Universal Input PDU

<https://dlidirect.com/products/universal-input-voltage-pdu>

Description: Ethernet power switch, 15A, 8 outlets, 1U rackmount

Purchased from: Amazon

Price: \$189

Test equipment: Isolation transformer, 50 uH LISN, HP 8560A with 20 dB preamp, Tek TDS320A.

Tested by: Gary Johnson, NA6O Date: Mar 19, 2019

Summary

Recommend for amateur radio stations: **NO**, not without modifications (see text).

FCC Part 15 conducted emissions: **NON-COMPLIANT**.

FCC Part 15 labeling: **NON-COMPLIANT**. No markings or notices anywhere.



Observations:

Switching frequency 25 kHz appears only when outlets are on, otherwise very quiet. Normal-mode noise is primarily glitches with a ringdown frequency around 23 MHz. HF noise increases with each added outlet, at least when tested without any loads. Non-compliant with FCC Part 15 below 3 MHz. On the datasheet, it states compliance as "FCC Part 15 S/D" which makes no sense. It could be class A or B, but S/D is meaningless. This device also carries no NRTL mark, such as UL.

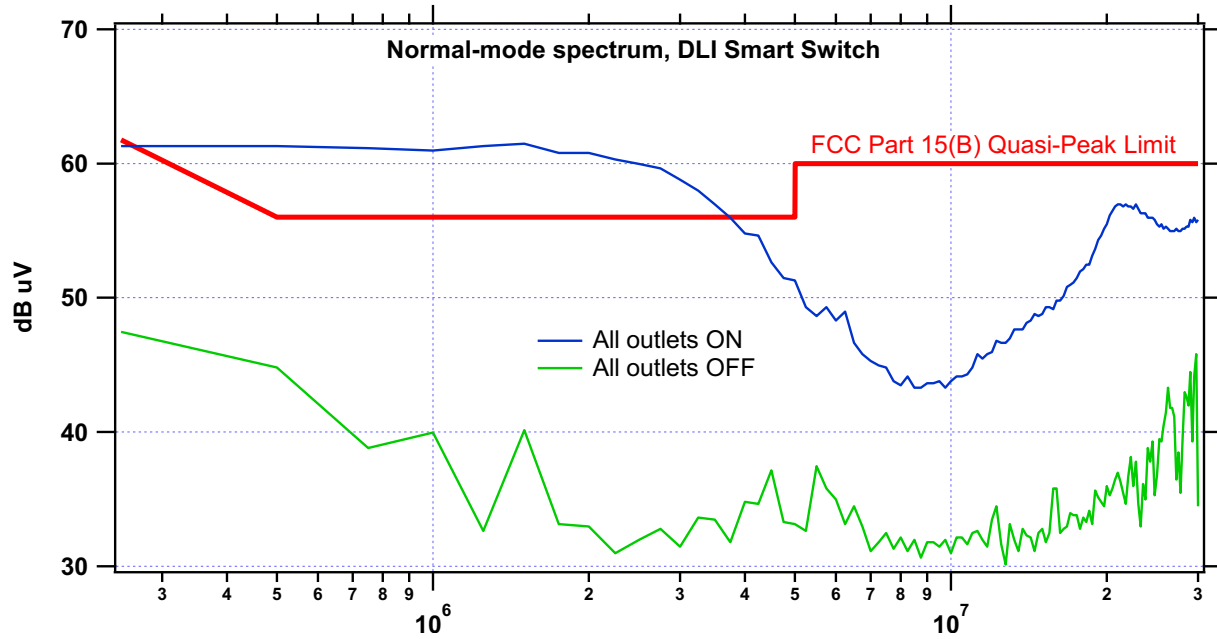
This device can generate broad spurious signals every 25 kHz at least through the 6m band. **As an absolute minimum, a large common-mode choke is required on the power cord.** It will also inject noise onto all the load cords for re-radiation, so **all of those must be choked as well.** With chokes in place, common-mode current is reduced but may still be problematic at 21 MHz and higher.

Recommended chokes: 2.4-inch or 4-inch type 31 toroid, 10 turns. Smaller core requires plug removed from the cord. Fair-Rite part numbers 2631803802 and 2631814002, respectively.

IMPROVED MODEL AVAILABLE: After consulting with the company, they now offer a version with the PWM disabled. This version is easily Part 15(B) compliant, and should be acceptable in most ham radio installations, though you may still need common-mode chokes. **To obtain this version, you must order directly from the factory, and ask for the firmware version with PWM disabled.** Versions that you buy from dealers may or may not have PWM enabled.

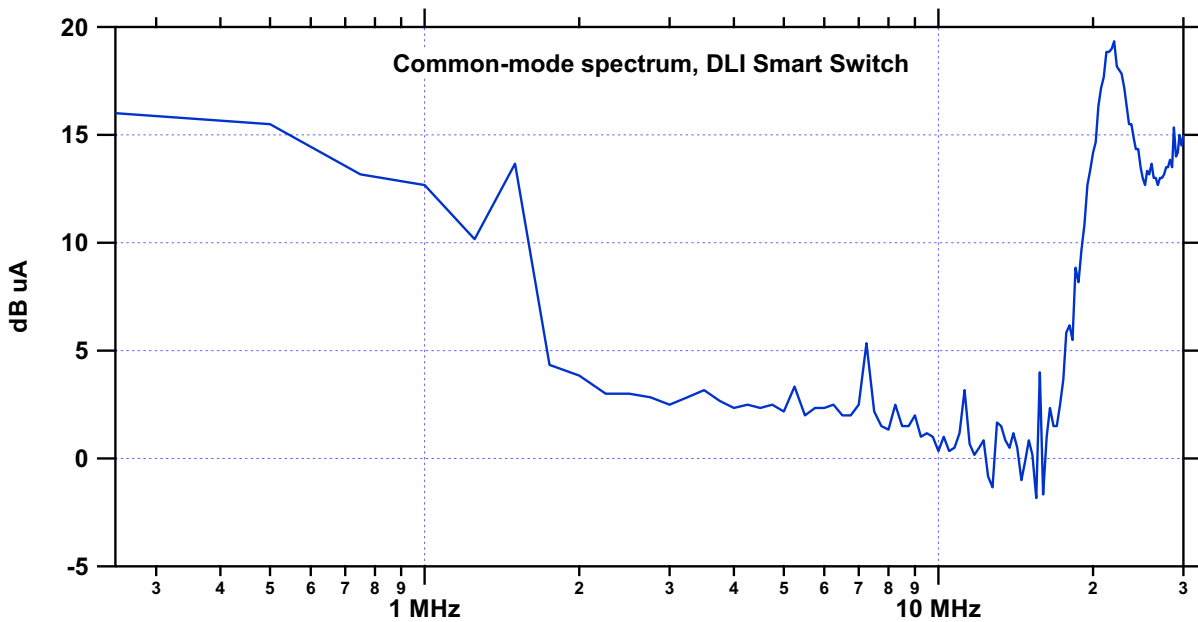
Normal-mode Spectrum

Exceeds the FCC limit below 3 MHz when outlets are on. Compliant when all outlets are off. Overall, this is a very noisy device when used in a normal manner (unmodified).



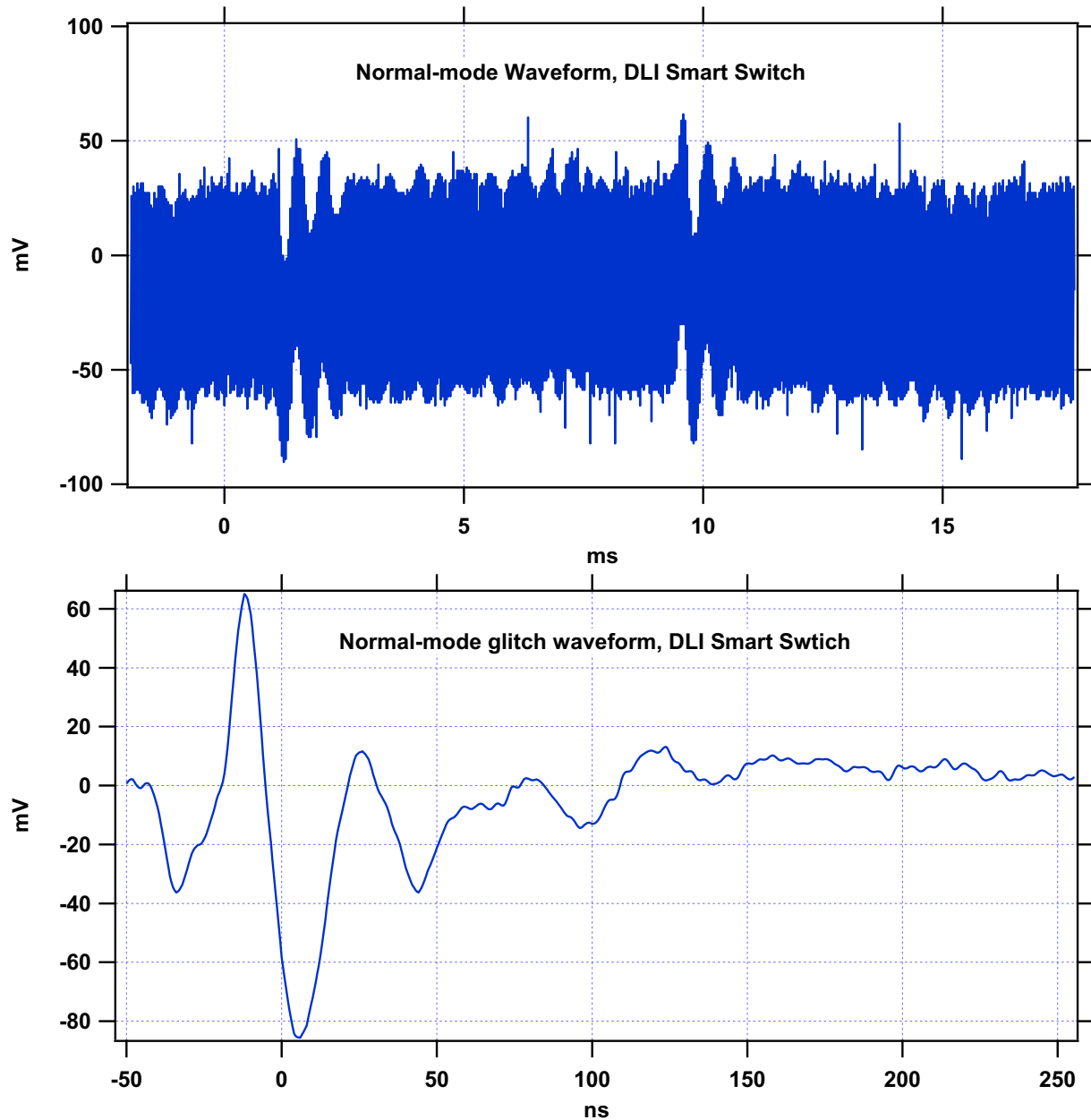
Common-mode Spectrum

Noise above 20 MHz will cause interference to amateur radio reception.



Normal-mode Waveform

Peak-detect mode. Waveform consists almost entirely of high-speed glitches, about 10 ns wide and a ringdown frequency around 23 MHz. That is visible as a hump in the normal-mode spectrum. Turning off all the outlets eliminates these glitches almost entirely.



Root Cause of Noise

Unlike many modern electronic devices, the switchmode power supply inside this unit is not the primary cause of RFI. In fact, the unit is fairly quiet if all the outlets are off.

The root cause of the noise is that the relay coils are driven by a 25 kHz square wave from the 12 V supply. If no relays are on, there is no added noise, and as more relays are energized, more noise current is generated. I can only surmise that this was done to reduce power dissipation. The problem is that the edges are very fast (falltime 18 ns, risetime 140 ns) and the cables plus PC board traces allow this high-frequency energy to couple to the AC line.

I made some simple mitigation attempts to no avail. The correct solution is for the manufacturer to eliminate the PWM drive and instead use plain old DC.

Below is the noise received via a 15m dipole located about 20 ft from the DLI switch. "Growlers" every 25 kHz are obvious. This data was taken WITH a common-mode choke on the power cord and nothing plugged into any of the outlets, all of which were activated. If your antenna is located further away, the noise will diminish with distance.

