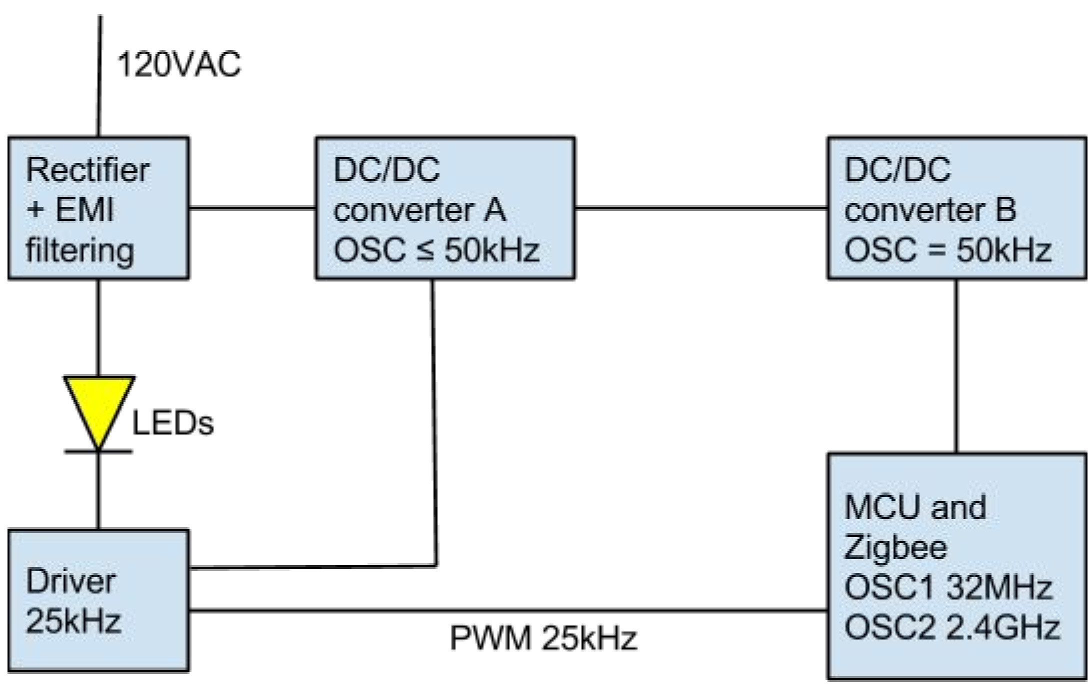
STACK LABS, INC.

STACK DOWNLIGHT
MODEL BR30-01E26-26Z
FCC DESCRIPTION

1 BR30-01E26-26Z Oscillator Overview

The Stack Downlight is a responsive LED lamp that adjusts to ambient light, movement, and its environment. It does this using built in sensors, mesh connections to other Stack lamps, connections to the cloud, and processing intelligence to couple this all together. In order to do all this it employs multiple oscillators. From the rectified and filtered line voltage (120VAC) a Buck Switch Mode Power Supply (SMPS), converter A, converts down to a DC rail voltage, this converter operates at 50 KHz or less depending on load. The Rail A is used to feed the LED Driver and Converter B. Converter B is another SMPS that also operates at 50 KHz. Converter B's rail feeds the MCU and transmitter that operate at 32MHz and 2.4GHz respectively. The MCU also controls the Driver which operates at 25 KHz.

2 BR30-01E26-26Z Oscillator Block Diagram



3 BR30-01E26-26Z Pulsed Operation

§ 15.35(c)

Unless otherwise specified, e.g. §15.255(b), when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to notification or verification.

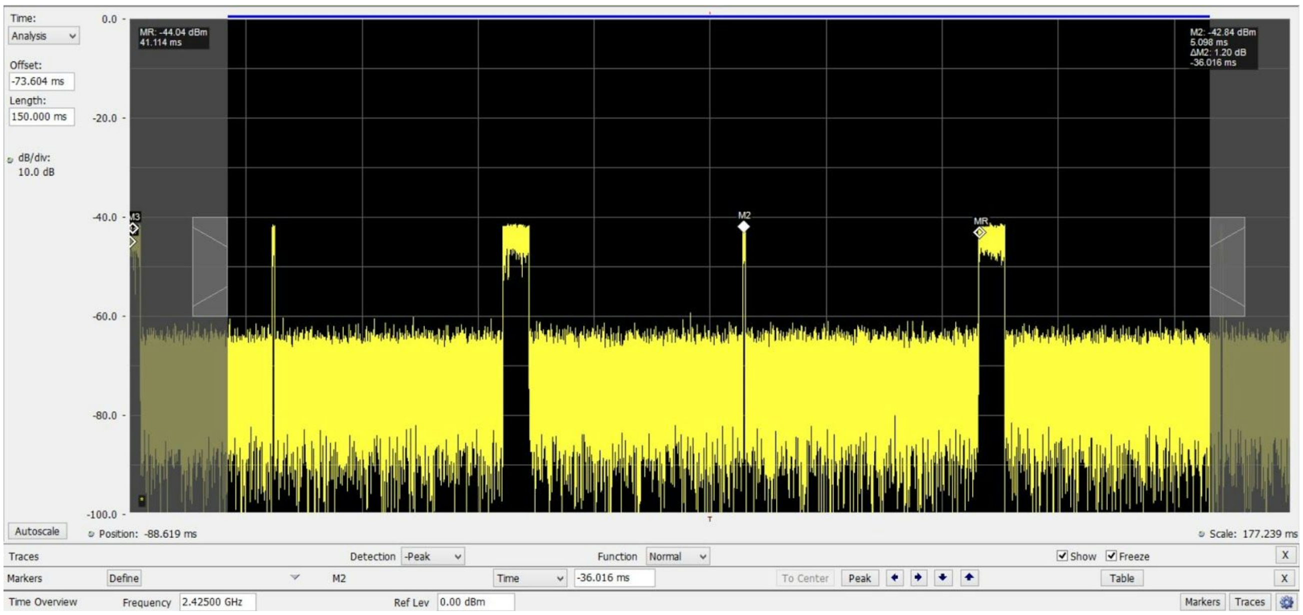
One of the main features of the ZigBee protocol is that it is designed for low power consumption so that battery operated devices can utilize it for communication without quickly draining their resources. With that in mind ZigBee transmitters are operated as pulsed transmitters only putting power out into the air when it is required for them to. This pulsed operation is thus used for getting a realistic average value of the signal being put out.
Our Worst case operation will be during our Over The Air (OTA) update procedure, where we utilize our biggest packets and continually transmit the data needed to update the software on the device. During this procedure we transmit one large packet (120 Bytes) followed by a smaller packet (50 Bytes) and then repeat this until all the data is sent. At the 250 KB/s data rate we operate at, each byte means 32us of transmission air time. Between sends it takes our processor an average of 32ms to process and queue up the next data to be sent.

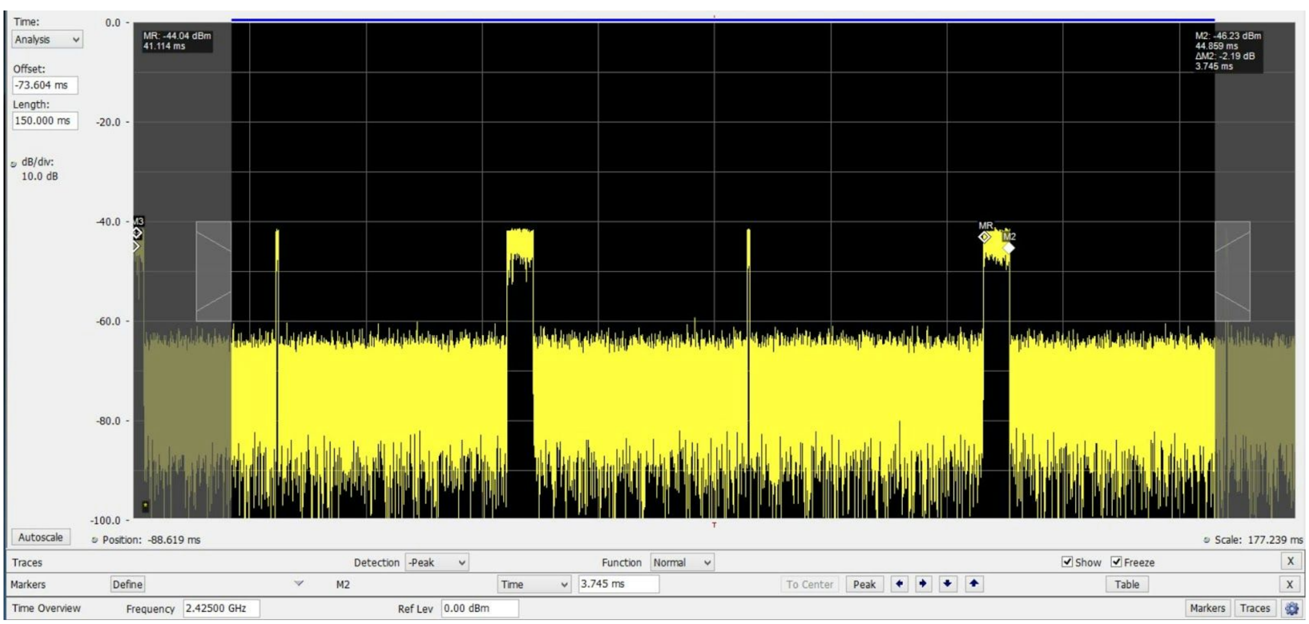
To do this on a 100ms timescale the sequence of events as requested in 15.35(c) would look like this:

120 Bytes(3.84ms) -----32ms Processing ----- 50 Bytes (1.6ms) ----- 32ms Processing-----120 Bytes(3.84ms) ---

$$DutyCycle = \frac{Ton}{Ton+Toff} = \frac{3.84ms+1.6ms+3.84ms}{100ms} = 9.28\%$$

As can also be seen when capturing data on a spectrum analyzer:





4 Testing:

In order to create this OTA scenario though another device must be present for communication. As the second device's output would corrupt the test results, we instead loop a data transmission at 10% duty cycle to replicate the same resulting average value. The setup specifics are 76 Byte Payload with a 22ms wait interval between packets.

$$DutyCycle = \frac{2.432ms}{2.432ms+22ms} = 9.95\%$$