

Luminescent detector for free-space optical communication: supplementary material

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Experimental Methods

For the LD measurements in figure 2a and 3 we use a Hamamatsu S8664-20K avalanche photodiode (see Fig. S1). It is reverse biased at 350 V, and its photocurrent is amplified using a trans-impedance amplifier (TIA). The combination APD and TIA system acts as a second-order low-pass filter with a cut-off frequency of 175MHz and $Q = 3.4$. For the measurements in figure 2b and 2c we use a Newport 1601FS-AC photodiode, which has a 0.4mm diameter and 1 GHz bandwidth. As a source we use a 405 nm laser diode (Sanyo DL-5146-101S), driven from a DC current source and modulated through a bias tee using an arbitrary waveform generator (Keysight AWG M8190A). All OFDM measurements are performed by modulating the laser with a computer-generated waveform. The received signal is recorded using a fast scope (Tektronix DSOS404A) and processed and analyzed offline. We used a DC-biased version of OFDM because of its optimal spectral efficiency [1]. The waveform consists of a frame-acquisition sequence of 16 symbols modulated using 16 pulse-position modulation (16-PPM) with a pulse width of 70ns in order to align the oscilloscope and AWG waveforms. A 128 symbol header sequence is used to estimate the gain and phase response of the channel, followed by 6000 data symbols. Each symbol is 256 ns long and has a 10 ns cyclic prefix. Currently, the noise floor of the OFDM measurements is determined by the scope readout noise and the signal distortion due to the clipping of the OFDM waveform.

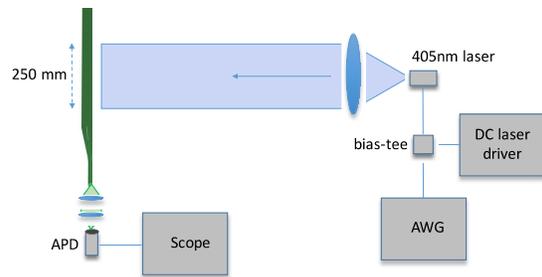


Fig. S1. Schematic of the experimental setup for the bandwidth and communications experiment presented in figure 2 and 3 in the main text.

References

1. D. Tsonev, S. Sinanovic and H. Haas "Complete modeling of nonlinear distortion in OFDM-based optical wireless communication", *J. Lightwave Technol.* **31**, 3064-3076 (2013).