Active POF splitter light sources:
an approach to RGB light in POF

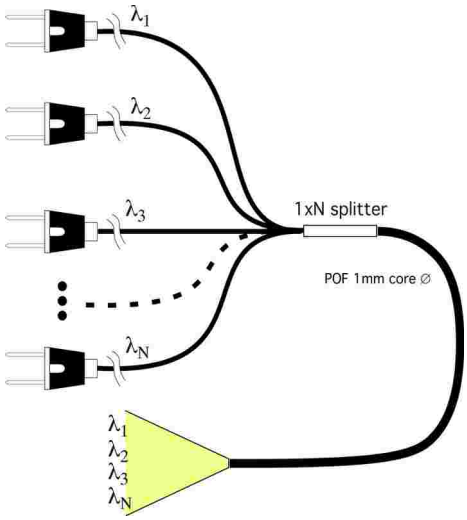
Application:

Light consisting of several wavelengths (RGB light) is needed inside polymer optical waveguides (POF), if:

- POF fiber optic sensor systems require 2 or more wavelengths to acquire the measurand,
- the POF cable is designated to illuminate a small target at a hard-to-reach place with light of different colours,
- a WDM (wavelength devision multiplex) transmission system shall transmit signals with at least 2 different wavelenghts.

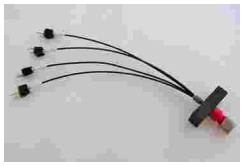
In order to calculate the system's performance, e.g. optical output power, the splitter insertion loss and symmetry, respectively, must be known.

The paper at hand shall provide typical technical figures for the combined active splitter devices and help to design POF coupled RGB transmitters for many potential applications.



Schematic drawing "Active 1xN splitter for RGB light generation in POF"

Active 1x2 POF splitter



Active 1x4 POF splitter

There are various technical options for POF splitter fabrication. Available splitter types are:

splitting ratio	*splitting loss*	*excess loss*	*Insertion loss*
1x2	3dB	1.5dB -2.5dB	4.5dB – 5.5dB
1x3	4.8dB	1.8dB -2.9dB	6.6dB – 7.7dB
1x4	6dB	2dB - 3dB	8dB - 9dB
1x5	7dB	2.2dB - 3.2dB	9.2dB – 10.2dB
1x7	8.5dB	3dB – 4dB	11.5dB – 12.5dB

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The design of active optical splitters finally requires the knowledge of feasible POF coupled optical power with available LED.
The table below gives exemplarily the performance of some interesting LED dice:

LED colour	*center wavelength*	*typically 1mm SI POF coupled optical power @20mA*
infra red	740nm	+2dBm - +3dBm
red	642nm	+6dBm - + 8dBm
red, data transmission	650nm	-1,5dBm - 0dBm
amber	595nm	-2dBm - 0dBm
green, ultra	540nm	+2,5dBm - + 3,5dBm
green	520nm	+4dBm - +5dBm
blue	460nm	+8dBm - +10dBm

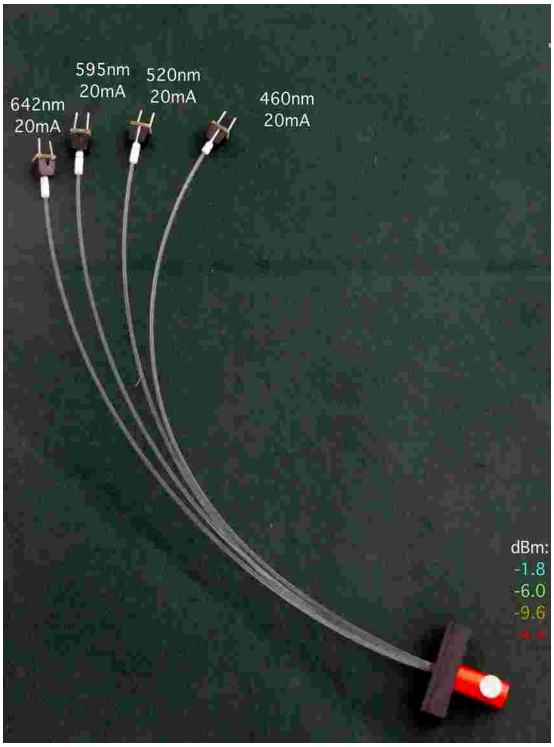
LED according to customer specific requirements are processed of course, too.

With the knowledge of POF coupled optical power and splitter insertion loss the performance of active optical splitters is calculated.

E.g., a splitter that comes with an insertion loss of 9dB (typical 1x4 splitter) is coupled to LED modules to realize an active splitter device. An LED module that emits +5dBm@20mA into a 1mm standard POF (typical green LED), will generate at the splitter output a POF coupled output power -4dBm.

An active 1x4 splitter was equipped with 4 LED modules of different colours. LED dice with wavelengths blue (460nm), green (520nm), amber (595nm) and red (642nm) were chosen. The resulting active splitter as shown on the photo right generated fiber coupled optical output powers of -1.8dBm (460nm), -6dBm (520nm), -9.6dBm (595nm) and -4.4dBm (642nm), if each LED is driven with 20mA DC. The loss due to the output coupled fiber must be taken into account.

This example shall provide an idea which technical performance may be expected from state of the art in splitter and fiber chip coupling technology.



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