

Adventures at 850nm

It all started with a Beacon



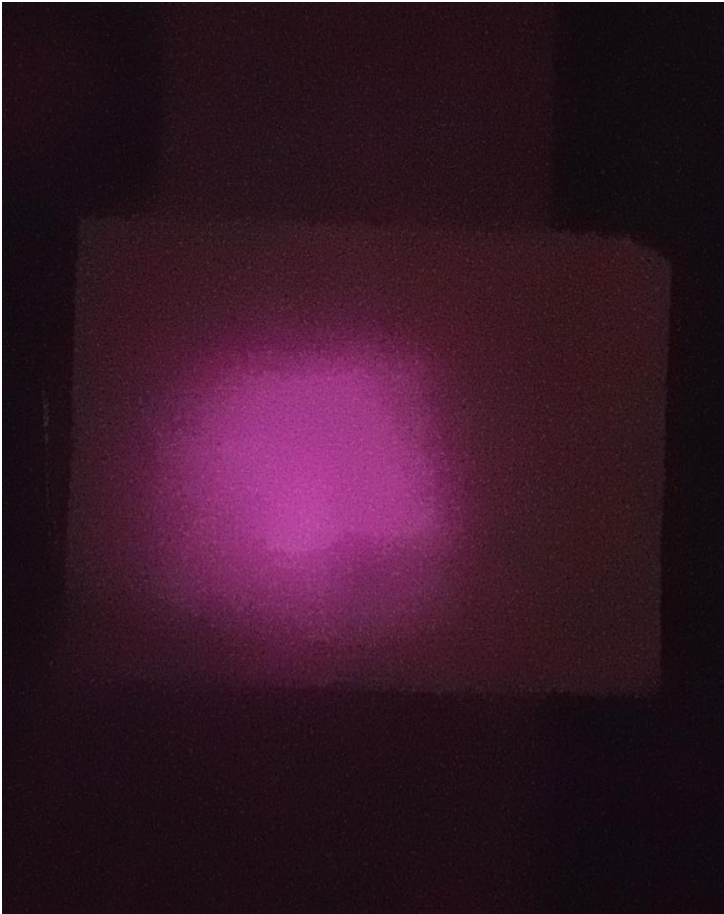
- 2015
- Atmel ATtiny85 chip
- 50% duty cycle
- 4 SFH4550 IR LEDs
- 280mw output

MCW Transmitter

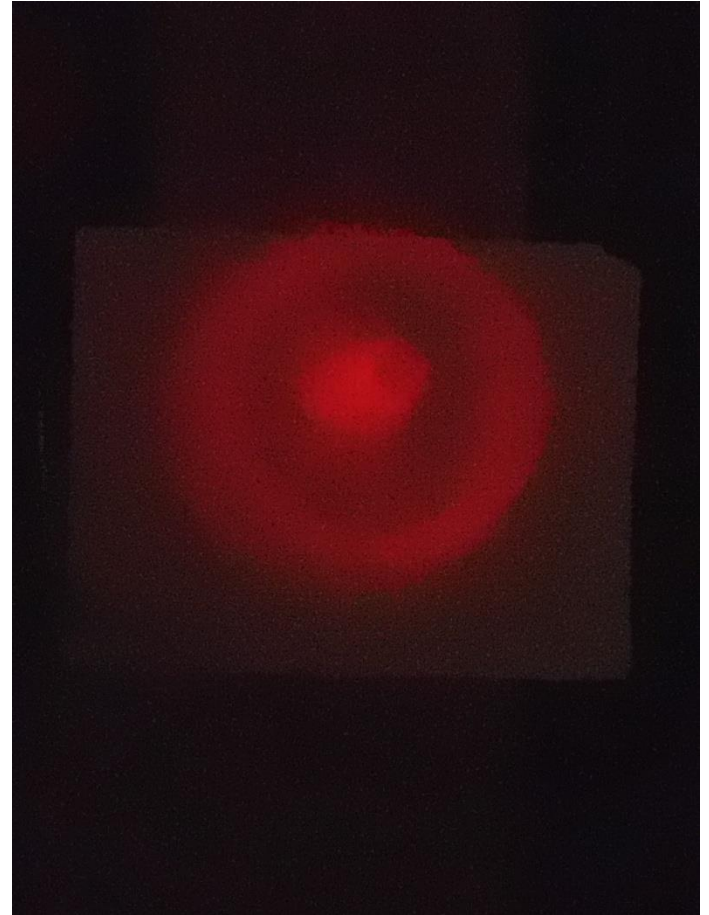


- 2016
- Atmel ATtiny25 chip
- 50% duty cycle
- 1 MSB90TA Red LED
- Radio Shack Jumbo LED
- 16 degree beamwidth
- 200mw output
- 2 modes
 - Beacon
 - Tone for on/off keying

Beamwidth comparison

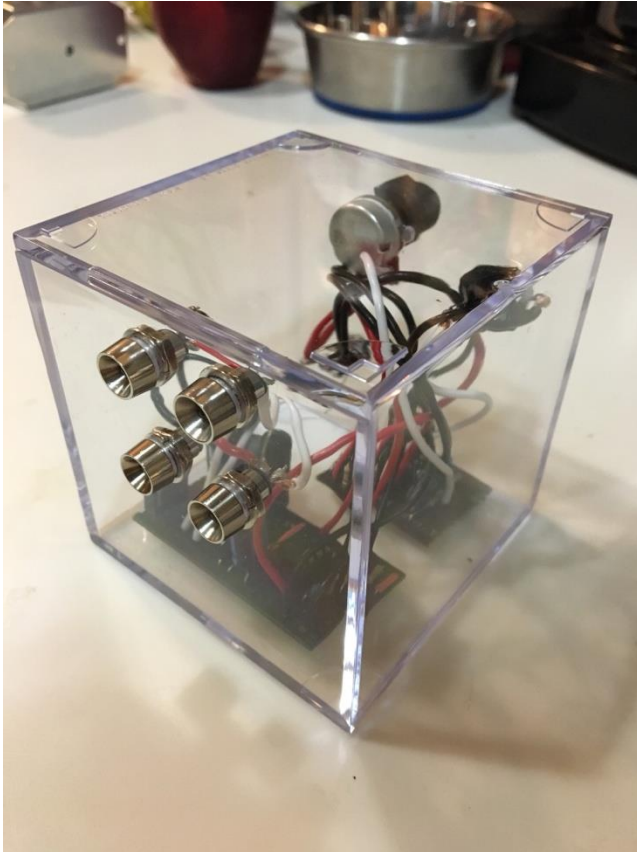


8 ½cm Square



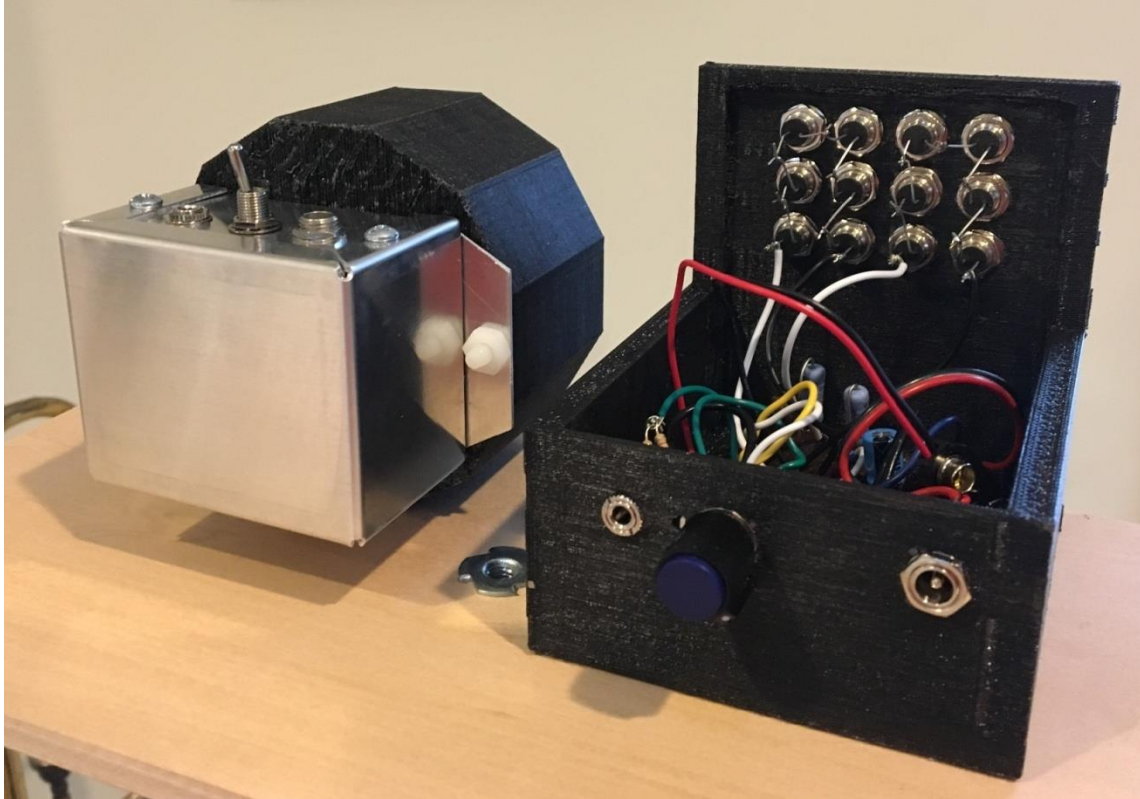
20cm Circle

The Baseball



- 2017
- 555 timer PWM
- 30% duty cycle
- LM833 Mic Amp
- 4 SFH4550 IR LEDs
- 750mw output

Transmitter and Receiver



- 555 timer PWM
- 20% duty cycle
- OpAmp Mic Amp
- 12 SFH4550 IR LEDs
- 2 parallel blocks of 6 in series
- 3.5W output
- K7RJ circuit of KA7OEI v3.1 rcvr
- 3D printed lens and transmitter box

IR Transmitter and Receiver



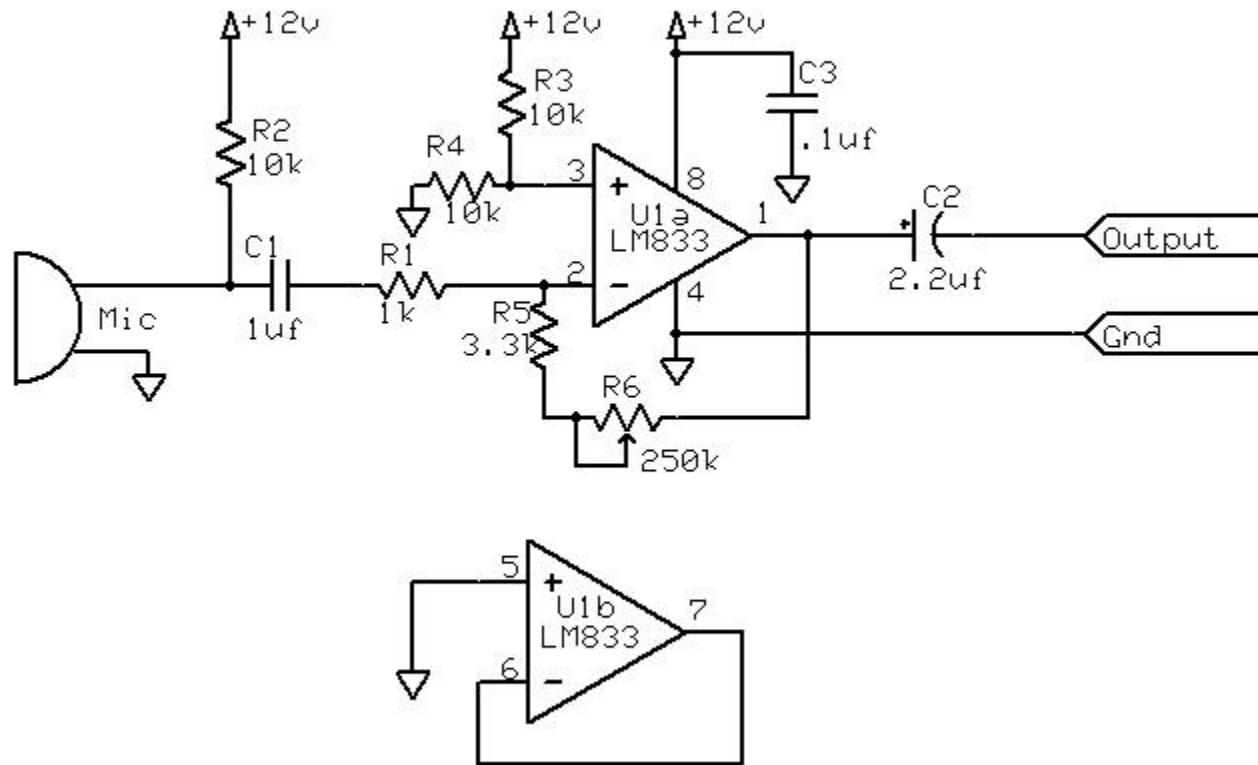
Receiver uses 90cm fresnel lens with a 50.8mm focal point

Beamwidth of 3x4 array

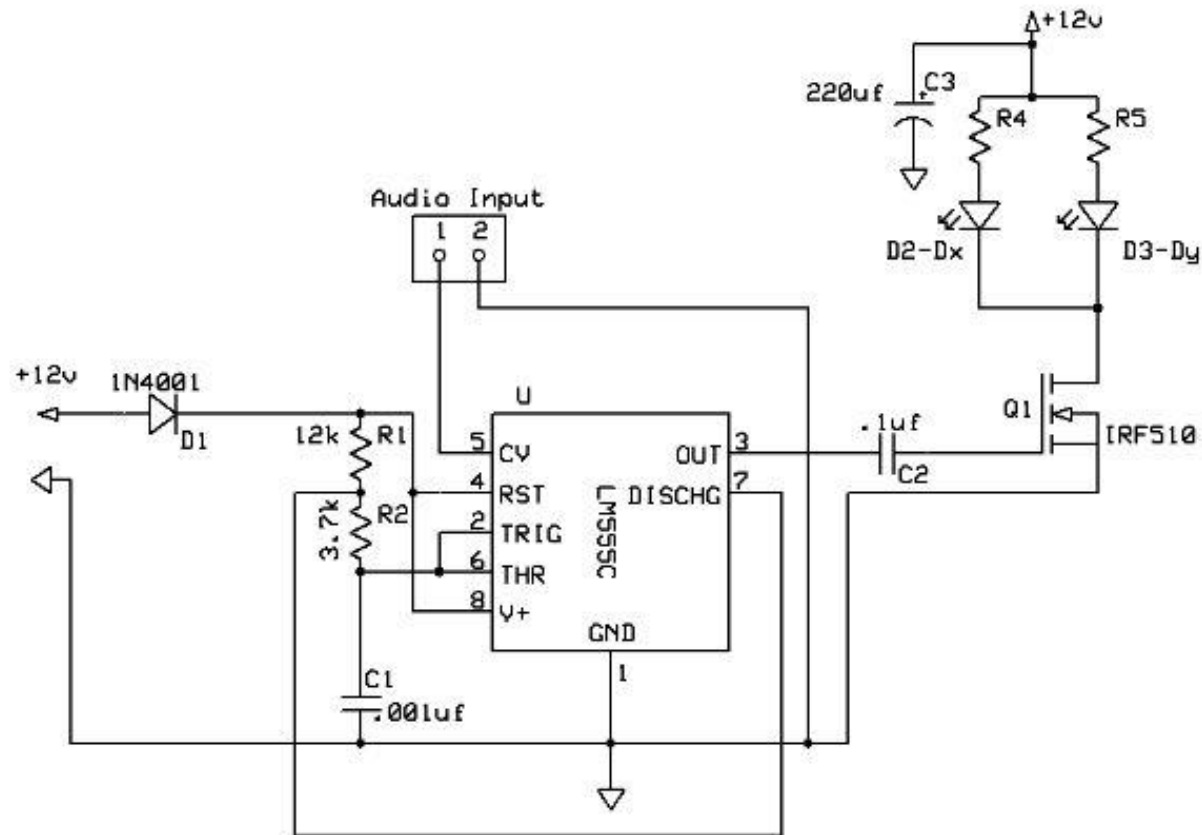


11cm x 13cm

Microphone Amplifier Schematic

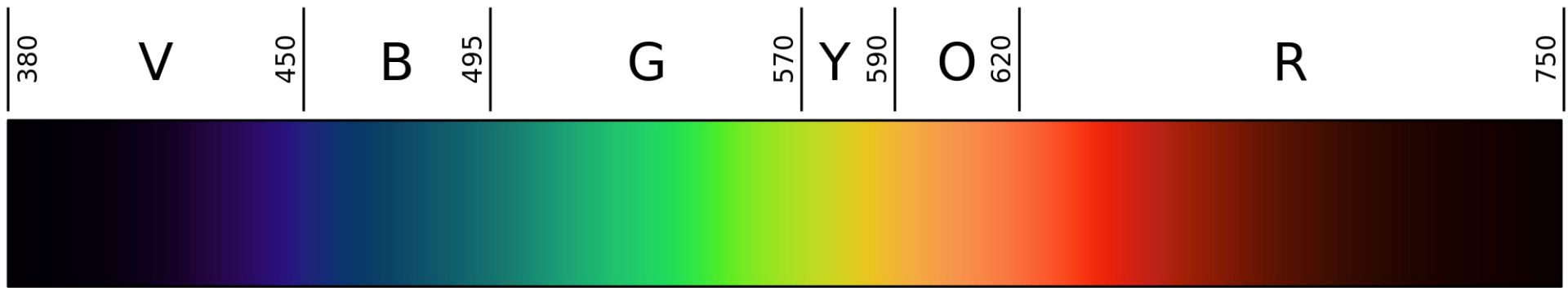


LM555 PWM Modulator Schematic



What's Next

- First contact on January 9th with Donn, WA2VOI
 - Near Lake Nokomis
 - Increase distance to beyond 2km
- Continue experiments with cloud bounce and atmospheric scatter
- Build 2 additional units
- Build larger lens boxes
- Have units available for the 10GHz and up August weekend on North Shore

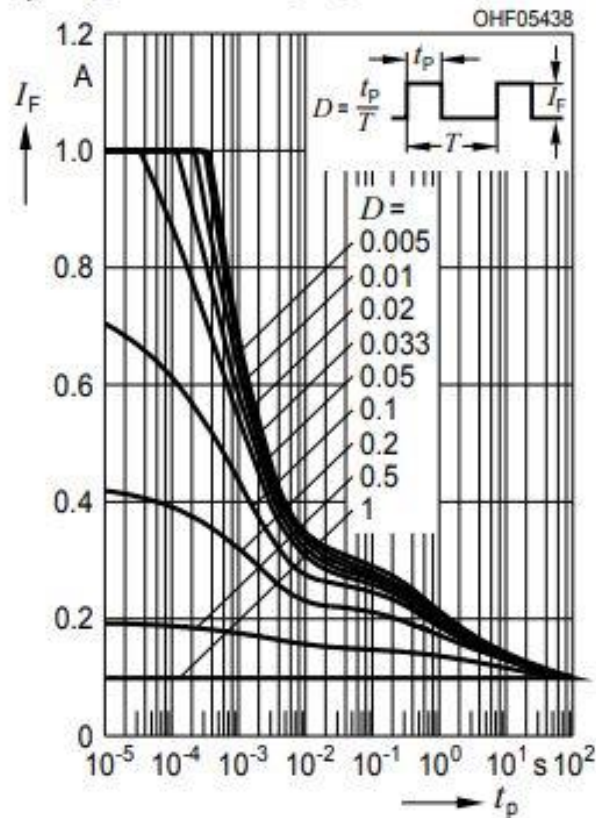


Appendix

SFH4550 Datasheet excerpts

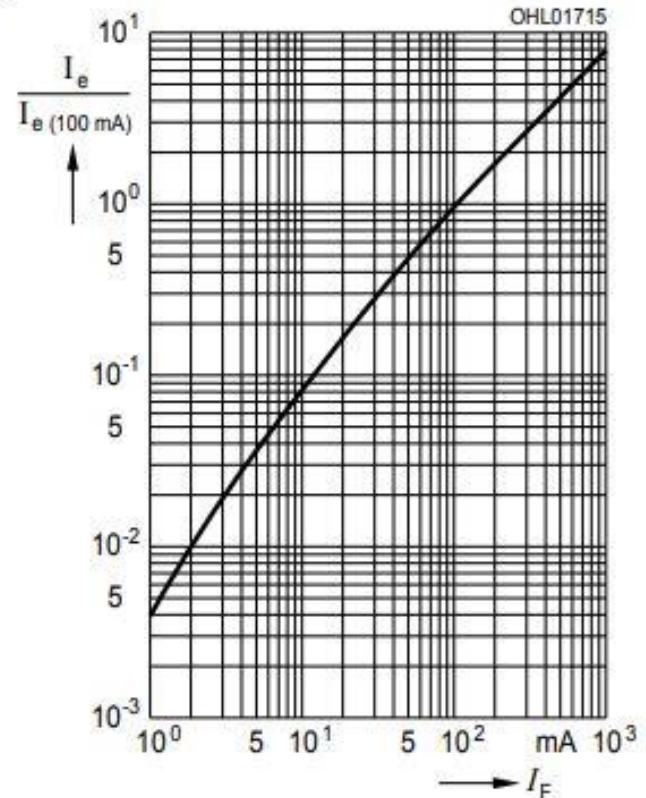
Permissible Pulse Handling Capability

$I_F = f(t_p)$, $T_A = 25^\circ\text{C}$, duty cycle $D = \text{parameter}$

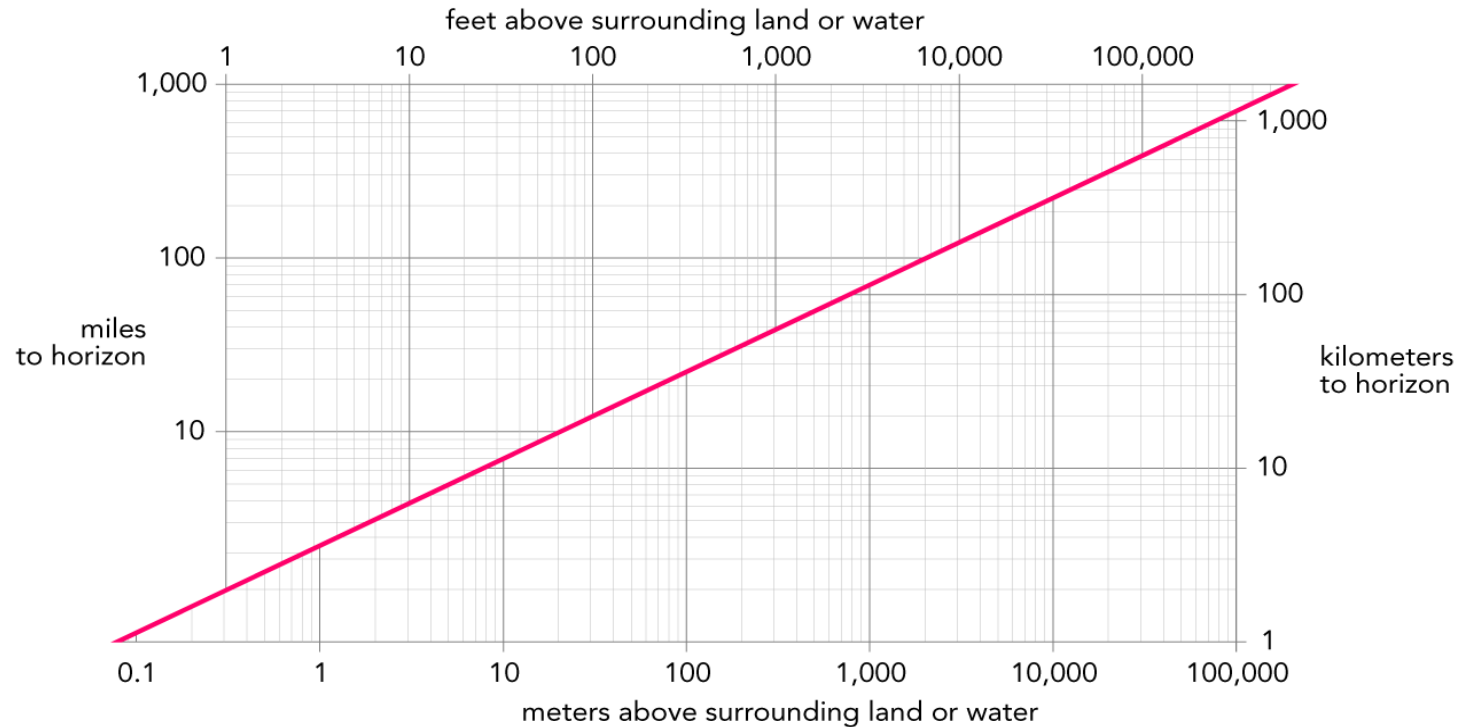


Radiant Intensity ^{2) page 8}

$I_e / I_e(100 \text{ mA}) = f(I_F)$, single pulse, $t_p = 25 \mu\text{s}$, $T_A = 25^\circ\text{C}$



How far away is the horizon?






How to calculate?

First, remember that at 6 feet, the horizon is almost exactly 3 miles away. At 2 meters, it is about 5 km away. Second, if your height increases by a factor of x , the distance to the horizon increases by factor of \sqrt{x} (for any units). So if your eyes are at an elevation of 24 feet, the horizon is 6 miles away. At 200 meters, it is 50 km away. These easy-to-calculate values are accurate to about 1% for all elevations on this chart. (At higher elevations, the straight-through-the-air distance and the along-the-curved-earth distance both begin to diverge from this power-law relationship.)

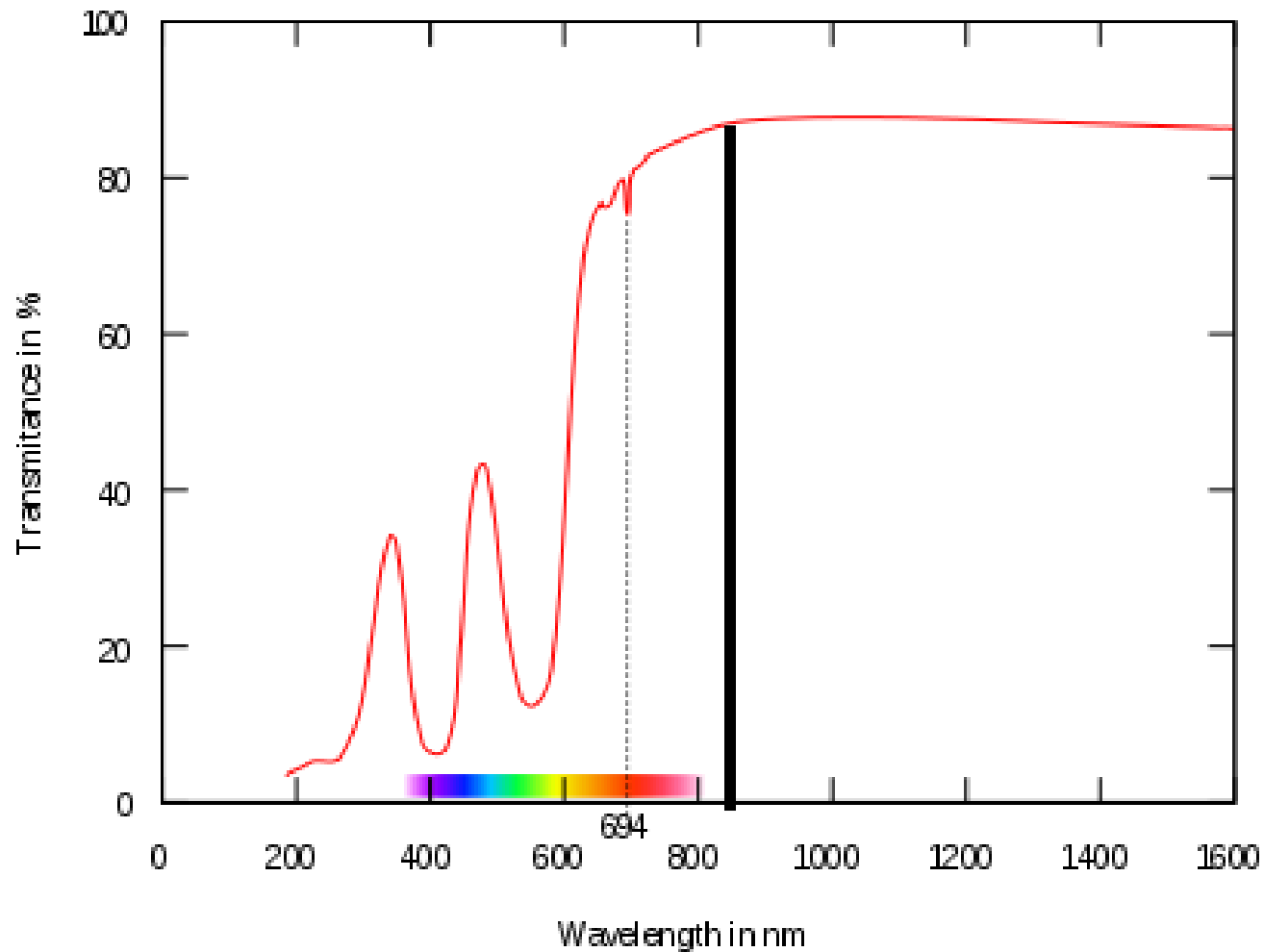
License: CC BY-SA 3.0 8/31/2008

Determining Cloud Cover

Current Weather

| METAR | | Observed |
|--|------------------|--|
| KMSP 180053Z 15007KT 10SM FEW070 BKN110 BKN300 24/09 A3023 | | Mon, Apr 18, 2016 @ 00:53 UTC (1 Hour, 1 Minute ago) |
| Wind | Visibility | Clouds |
| 150° at 7 knots (8 mph) | 10 statute miles |  Few at 7,000 ft AGL  Broken at 11,000 ft AGL  Broken at 30,000 ft AGL |

Source: <http://www.checkwx.com/weather/KMSP>



By FDominec - self-made using Gnuplot, GFDL,
<https://commons.wikimedia.org/w/index.php?curid=3754830>

Resources

- WF0T Blog on Light Communication experiments
 - <http://wf0t.blogspot.com>
- KA7OEI Optical Communications website
 - http://modulatedlight.org/optical_comms/optical_index.html
- G3XBM Blog
 - <http://g3xbm-qrp.blogspot.com/2013/03/k3pgp-optical-receiver-optimised.html>
- DigiKey - MN based electronic parts
 - <http://www.digikey.com>
- Cloud cover reports – Aviation Weather Center & CheckWx.com
 - <https://aviationweather.gov/metar>
 - <http://www.checkwx.com/weather>