10 MHz Receiver

Kosh Yokota, Dick Plambeck 12/23/03
Revision A, 1/9/04
Revision B, 2/13/04
Revision C, 2/25/04

Function: generates 10 MHz reference signal and 1 pps clock tick at the antenna, from 10 MHz pulse train sent from lab via optical fiber.

Brief circuit description: The laser signal is received by a Fermionics FD80FC photodiode. The 10 MHz pulse train from the photodiode is amplified and used to phaselock a 10 MHz crystal oscillator (Frequency Management VC46). The TTL output of the crystal oscillator is amplified, passed through a 10 MHz filter to produce a clean sine wave, then split to provide four 10 MHz outputs. A sample of the incoming 10 MHz pulse train also is sent to a comparator and retriggerable one shot. If a pulse is missing, the one shot generates a 1.5 microsecond wide clock tick, which is available as a positive-going TTL pulse and as an RJ485 differential signal.

Input:

- laser signal (1310 or 1550 nm) on single mode fiber, FC-APC connector. The expected optical intensity is –16 dBm, or 25 microwatts. The acceptable input level is –21 dBm or greater; the circuit functions down to about –27 dBm.

Output:

- Four SMA female connectors with 10 MHz sine wave, +8 dBm; note that crystal oscillator generates 10 MHz output even if it is not phaselocked
- One SMA female connector with 1 pps tick – 1.5 microseconds wide, positive going TTL.
- One RJ45 jack with RJ485 differential signals:

1	10 MHz TTL L
2	10 MHz TTL H
3	1 pps L
4	NC
5	NC
6	1 pps H
7	NC
8	NC

Indicator LEDs:

- optical pwr: green for > -21 dBm (acceptable operation)
  yellow for -27 dBm < pwr < -21 dBm (marginal operation)
  off for pwr < -27 dBm
- 10 MHz lock: green if phaselocked

Power supply/monitor through 9-pin D subminiature connector, male:

1	-15 V, 50 mA
2	DS2401 serial number
3	pwr GND
4	gnd for photocurrent monitor
5	+15 V, 175 mA
6	gnd for DS2401
7	photocurrent OK: 0=no, 1=yes (superfluous indicator)
8	photocurrent monitor, 10V/mA; expected level is 0.2 V
9	10 MHz lock alarm, TTL: low if locked, high if unlocked

1 pps tick as generated by missing pulse

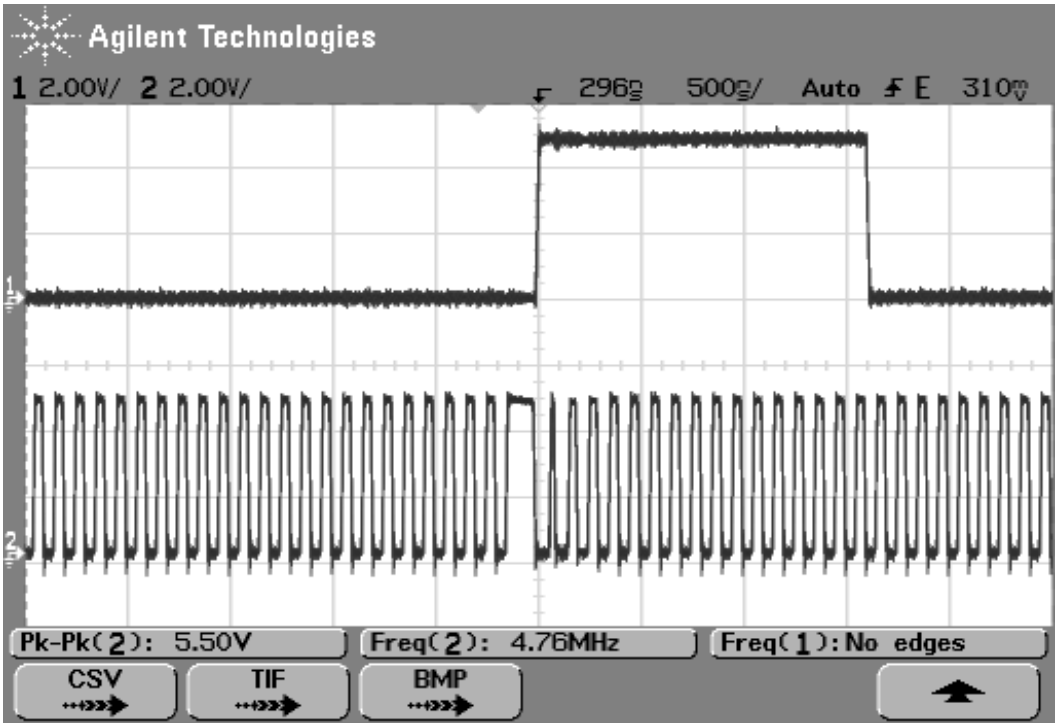


Figure 1. Top trace shows 1 pps clock tick output from SMA connector on 10 MHz receiver box. Bottom trace shows the 10 MHz pulse train received from the lab transmitter over the fiberoptic link; a missing pulse encodes the 1 pps tick.

Thermal behavior

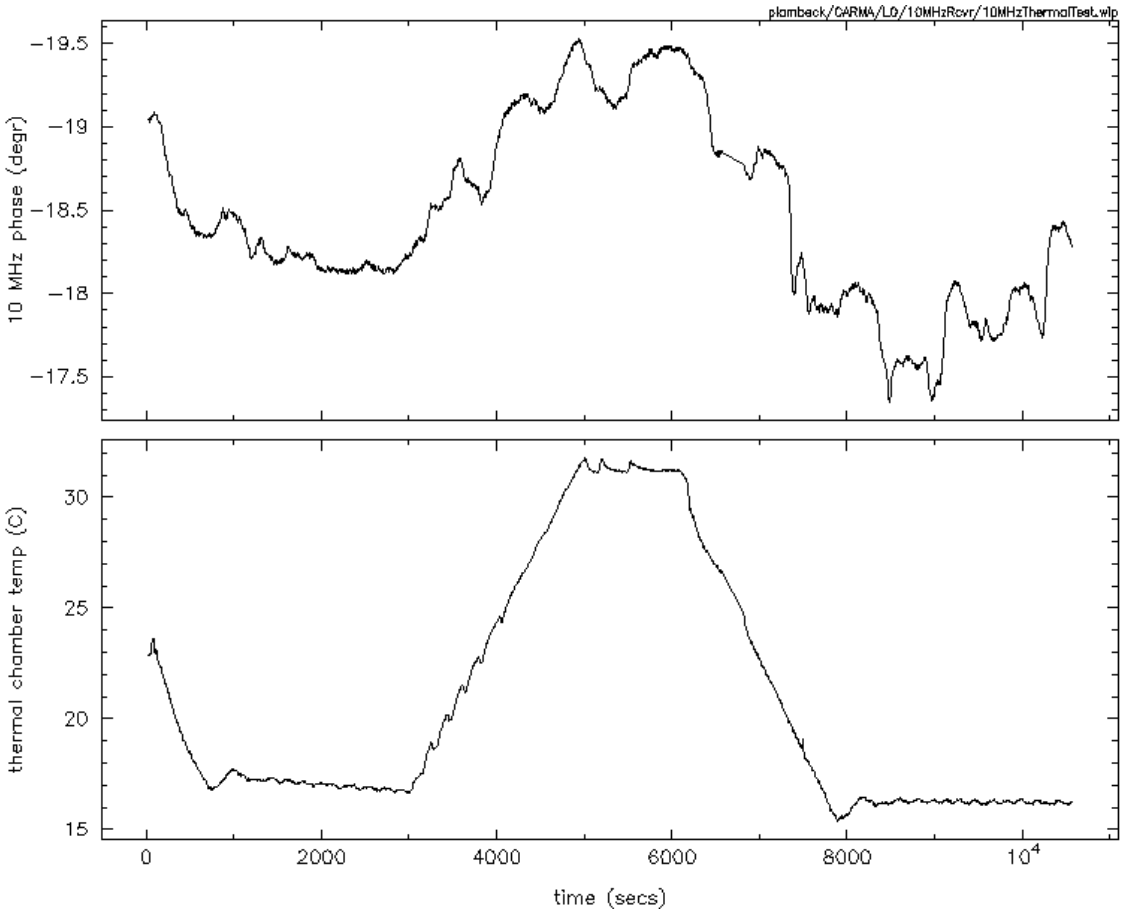


Figure 2. Thermal test of 10 MHz receiver. Top curve is 10 MHz phase, bottom curve is temperature. The thermal coefficient is approximately –0.1 degree/C.

10 MHZ FIBRE (ANT)

MAR-7 +13dB Gain, +5dBm Out, 4.0Vdc @22mA
MAR-6 +20dB Gain, +2dBm Out, 3.5Vdc @16mA

NOTES:
Install either FPD1 or FPD2; NOT both.
FPD1 has an integrated TIA.
FPD2 is a PhotoDiode ONLY.
* Keep FPD1 and FPD2 close together.
* Install either resistor NOT both.
** USE TBD for FPD1, or TBD for FPD2.

1 Anode (Red Wire)
2 Kathode (Blk Wire)
Dialight 559-2201-007

10 MHZ LOCKED
(Digital: 0 = LOCKED)
(Analog: 30V/mA)
(Digital: 0 = NO LIGHT)

~250 mA
~50 mA

+20dB Gain, +16dBm Out, 4.9Vdc @65mA

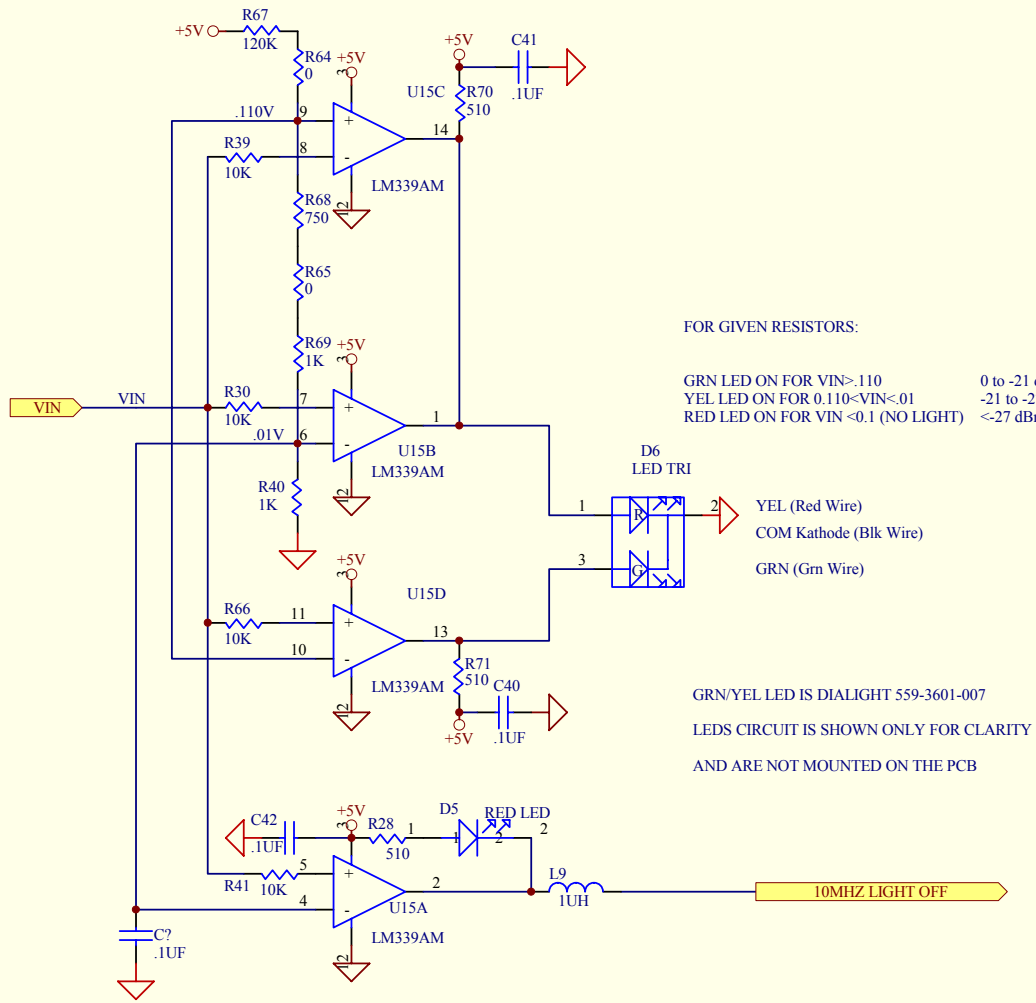
+8dbm ea. Output

Title	10MHZ FIBRE(ANT)		
Size: B	Number D802B	Revision:	
Date: 12-Feb-2004	Time: 15:15:02	Sheet 1 of 1	

Radio Astronomy Lab
University of California
Berkeley, CA 94720 U.S.A.
510-642-4016
http://astron.berkeley.edu/ral/home.html

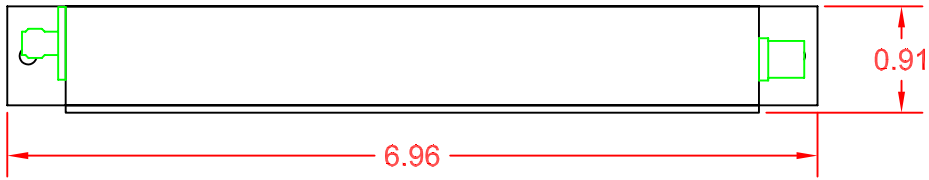
RAL UCB

File: C:\Documents and Settings\Kosh Yokota\Desktop\10 mhz stuff\802ar1\backup\D802ar1.DDB - Documents\802B.sch



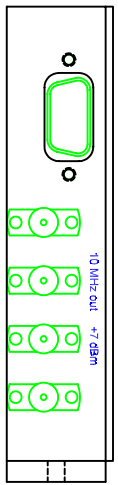
Title: LED Circuitry		
Size: A	Number:	Revision:
Date: 9-Dec-2003		Sheet of
File: C:\Documents and Settings\Kosh Yokota\Desktop\10mhz stuff\802ar1\backup\D802ar1.DDB		

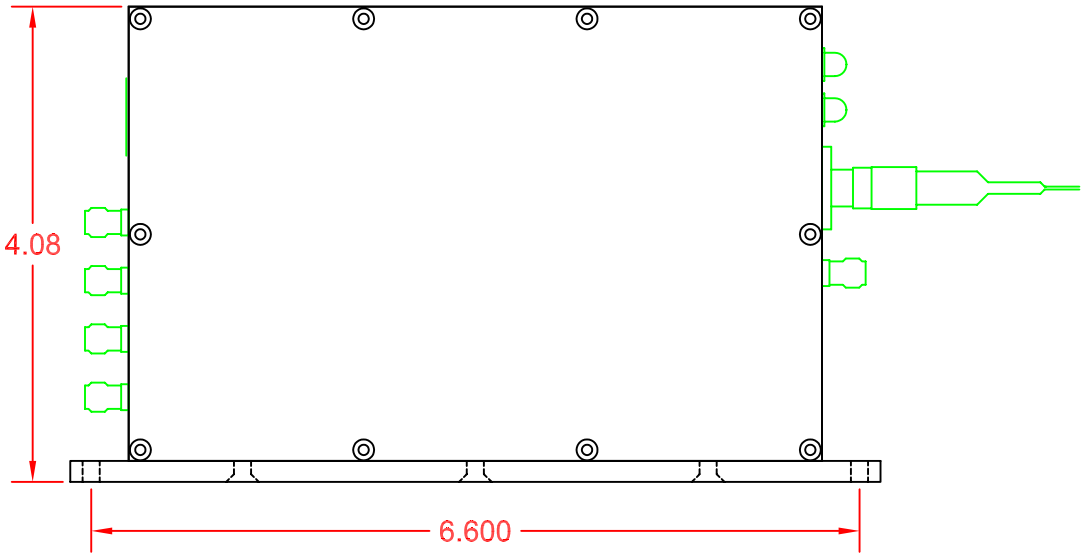
10 MHz Rcvr Outline,
Rev B
5 Jan 04, Dick Plambeck

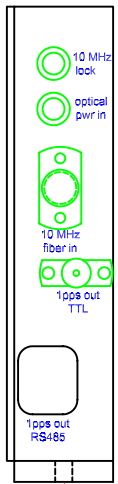


9-pin D male
power in,
monitor out

(4) SMA female,
10 MHz sine
wave out,
+7 dBm







LED, green = 10 MHz phslck OK

LED, green = opt pwr in OK
yellow = opt pwr in marginal

FC/APC singlemode fiber in

SMA female, 1pps tick out,
TTL positive pulse

RJ45, 1pps tick out,
pins 1,2

(2) 6-32 clearance holes
for mounting