BBDEV. MEMO #025

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
HAYSTACK OBSERVATORY

WESTFORD, MASSACHUSETTS 01886

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Telephone: 781-981-5407
Fax: 781-981-0590

To: Broad Band Development Group

From: A.E.E. Rogers

Subject: Check of Symmetricon buffers

The Symmetricon 4036B buffers are made by Timing Solutions (who were acquired by Symmetricon). I checked the specs. at 5 MHz using the Timing Solutions TSC 5115A and a spectrum analyzer. All the specs. on the 4036B data sheet were verified and are O.K. The unit looks very nice and has nice status display LEDs. I did not try the Network interface. Tests of items NOT on the datasheet:

1] Noise figure ~ 20 dB at 5 MHz However the noise and gain peaks by about 18 dB around 130 MHz with a 20 MHz 3dB width. This gain peaking varies somewhat from one output to another. This is a slight problem for the VLBI2010 phase cal. as the noise will results in about 16 ps wideband phase noise or about 0.15 radians at 10 GHz. This should NOT be a problem for mmvlbi as the buffer outputs are used as a reference for a synthesizer where high frequency phase noise (i.e. noise above 100 MHz) will be well filtered out. For the phase cal. I suggest placing a 50 MHz LPF (Minicircuits SLP-70+) in the 5 MHz (or 10 MHz) to the phase cal. to filter out the high frequency noise in the buffer. This filter has a temperature coefficient of $+0.5 \pm 0.2\,\mathrm{ps}/K$. Tests of adding this filter to the 5 MHz line of a phase calibrator resulted in no appreciable change in signals levels in the rails up to 10 GHz. However the filter may be required if the input to the buffer has higher than normal noise around 130 MHz.

2] Temperature coefficient. Heating the buffer increases the delay through the buffer by

+0.6 +/- 0.3 ps/K

as measured with the TSC 5115A. This agrees with the e-mail from Symmetricon say the tempCo is under 1ps/K. A very impressive result. The old MK3 buffers were about 2 ps/K.

3] 60 and 120 Hz. I could not detect any significant 60 or 120 Hz phase noise introduced by the buffer. The TSC 5115A seems to be limited to about -130 dBc at 60 Hz (i.e. about -35 dBc at 300 GHz from 5 MHz) with the same signal on the signal and reference ports. I also looked for sidebands which might be generated by the digital monitoring hardware in the unit and saw nothing but I was not using the ethernet interface.

4036B Specifications

ELECTRICAL SPECIFICATIONS

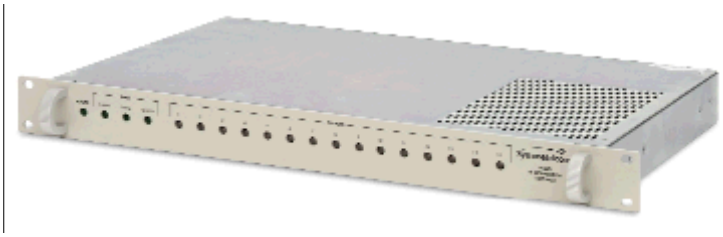
- RF Output (15)
  - Frequency: 1 MHz – 20 MHz
  - Input level: 0 to 1 V rms (13 dBm)
  - Gain: 0dB, jumper selectable -1dB, 1dB or 2dB
  - Input/output impedance: 50Ω
  - Isolation: >100 dB
  - Spurious distortion: <-80 dBc
  - Harmonic distortion: <-40 dBc
  - Connectors: BNC female
- SSB Phase noise
  - 1Hz -135 dBc
  - 10Hz -145 dBc
  - 100Hz -155 dBc
  - 1kHz -163 dBc
  - 10kHz+ -163 dBc
- Status
  - Senses signal presence on all inputs and outputs
  - Green/Red LEDs on Front Panel
  - LED Indicators for 5 MHz, 10 MHz, and Other
  - Network interface
    - Ethernet 10/100 Base T
    - RJ 45 Connector
    - Protocols: TCP/IP, UDP/IP, ARP, Telnet, DHCP, BOOTP, HTTP and AutoIP

ENVIRONMENTAL & PHYSICAL SPECIFICATIONS

- Temperature: 0°C to 50°C
- Humidity: 0 to 95% non-condensing
- Power requirements (AC Input): 90 – 264 V AC, 10W, 47 – 63 Hz
- Dimensions: 1U (~1.75" / 4.44cm) x 19" (48.26cm) x 12" (30.48cm)
- Weight: 9 lbs (4.10 Kg)

OPTIONS

- Low Alarm Threshold



4036B 1x15 RF Distribution Amplifier

Rear view