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To: *VLBA Data Acquisition Group*

From: *Alan E.E. Rogers*

Subject: *Computers, Software, and Procedures for Check-Out of DAR Modules*

Various computers (TRS-80 Model 100, AT&T 6300, COMPAQ, Motorola) using various languages (BASIC, PASCAL and C) have been used to communicate with DAR modules via the MCB. VLBA Acquisition Memo #76 lists some simple BASIC programs used to test Baseband converters. VLBA Acquisition Memos 69 and 74 show some sample plots generated using simple BASIC programs and the DAR manual describes the test set-up. These BASIC programs are not documented and have been changed often to suit the immediate need at hand. The programs written for the TRS-80 are on audio tape which cannot be read into an MS-DOS machine. However there are versions which exist in MS-DOS files and will run under COMPILED QUICK-BASIC or GWBASIC. Before discussions with Barry Clark, I intended to further develop and document these BASIC programs. After discussions with Barry, I have decided to follow his direction. His suggestion for using the station computer software tools has the following advantages:

1. *Engineering test routines can be run remotely via modem or network link to site.*
2. *MCB cables do not have to be disconnected to allow connection of a pc. (Disturbing these cables is strongly discouraged by station personnel.)*
3. *The station printer can be used for plots or data can be stored in a file for subsequent plotting.*
4. *High level MCB access routines can be easily called from the engineering test program.*
5. *Other modules needed in the test can be set up via the station SCREENS or INIASTR and NEWD.*

For the present, engineering tests have to be scheduled so that they don't interfere with other station operations. In the future, however, the station MCB access might be able to set up a protective "fence" to prevent test programs from making MCB writes to addresses being used in the operational program.

I have written a sample program to perform some tests on the BBCs in a DAR. The source and executable files are in user number 500 (an area assigned to me by Barry).

This program assumes that the L.O. output of BBC #1 is connected via a 3dB pad to the alternate IF2 input of the adjacent IFD. Further, it assumes that IFD 2 has been commanded to external input on the D channel either via IFDIST (or SCREEN) or through NEWD. At present this program checks bandpasses (and image rejection), bandwidth compensation attenuator, AGC and L.O. lock range. It loops through bandwidth, sideband, frequency and module number as shown in the following pseudo code:

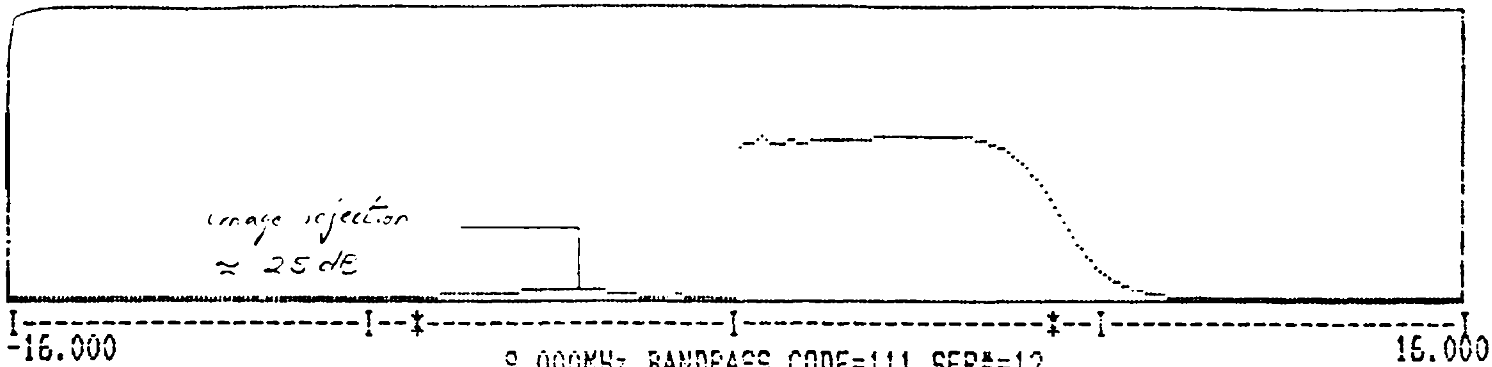
```
for (module = first to last)
 for (center frequency of test = first to last)
  for (USB then LSB)
   for (bandwidth = first to last, then do attenuator test, then do lock test)
    for (320 data points) {set BBC and read total power, Serial # and lock}
    next data point
   next bandwidth
  next sideband
 next frequency
next module
```

The bandpass plots are generated by sweeping the L.O. over a range from -32 to +32 MHz in 200 KHz steps for the 16 MHz bandpass and from -16 to +16 MHz for the 8 MHz bandpass, etc. When the unwanted sideband is being swept the gain is increased by 12dB from 0dB (00H) to 12dB (10H) to make it easier to see the sideband rejection.

The attenuator test is performed by setting the L.O. so that the test signal is at 100 KHz in the baseband and bandwidth is set to 125 KHz. The gain of the 8-bit AGC attenuator is then decreased from the initial setting of 128 down to 0 and then back up to 128. When the AGC attenuator drops to 90 the bandwidth compensation gain is increased from its initial value of 0dB (00H) to 3dB (80H) and another 3dB step (to 6dB=40H) is made after the AGC has dropped another 3dB and so on until the bandwidth compensation reaches 24dB (1H). Any missing, stuck or shorted bits in either the AGC or bandwidth compensation should be evident in this plot.

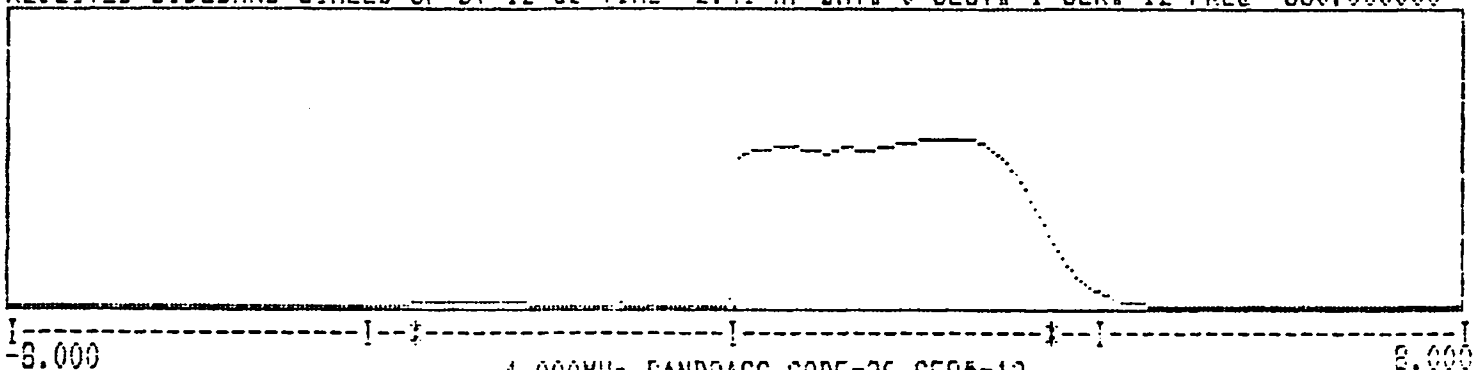
The lock range and phase noise test is performed by sweeping both of L.O. and the test signal from 430 to 1070 MHz. When the converter is not locked the full scale value is plotted. When the converter is locked the total power is plotted with AGC at 128 and bandwidth compensation at 24dB. A problem with the lock range or the presence of excessive phase noise should be evident in this plot. The attached Figure shows sample plots of the bandpass, attenuator test and lock range tests. [These plots were obtained using the station computer (source code MCBT.C) but identical plots can be obtained using a PC (source code MCB3.BAS).]

In the future, additional tests to check phase stability, attenuator phase shift and filter phase response could be measured using the phase calibration detector in the formatter decoder module. Some rudimentary software has already been started, but more work is needed.



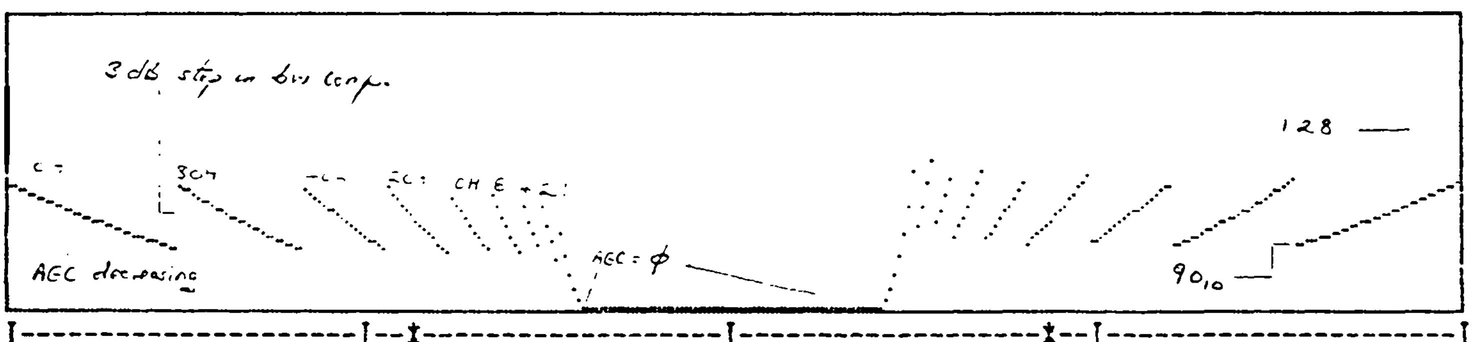
8.000MHz BANDPASS CODE=111 SER#=12

REJECTED SIDEBAND SCALED UP BY 12 dB TIME= 2.41 hr DAY#=0 SLOT# 1 SER# 12 FREQ= 650.000000



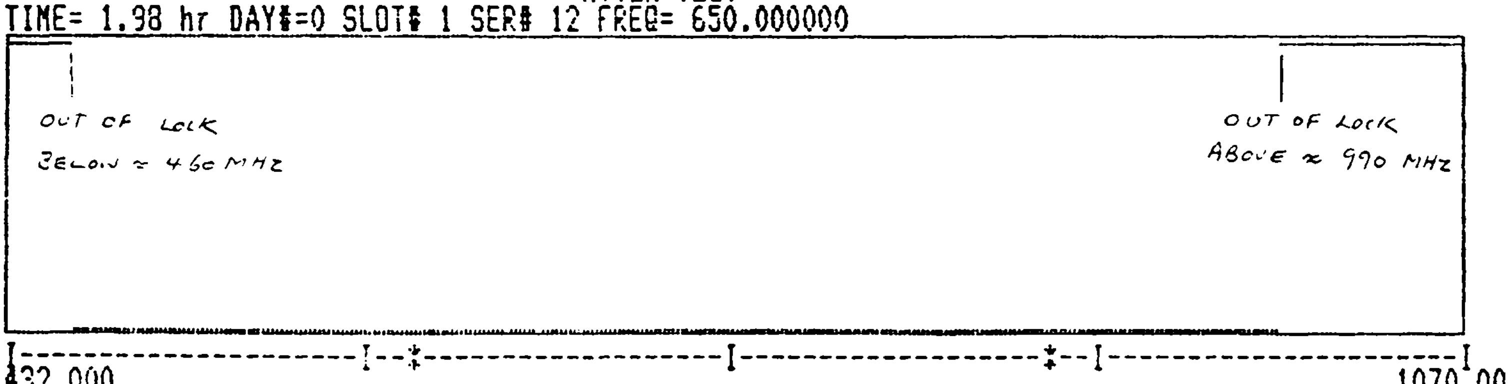
4.000MHz BANDPASS CODE=36 SER#=12

REJECTED SIDEBAND SCALED UP BY 12 dB TIME= 2.42 hr DAY#=0 SLOT# 1 SER# 12 FREQ= 650.000000



ATTEN TEST

TIME= 1.98 hr DAY#=0 SLOT# 1 SER# 12 FREQ= 650.000000



LOCK RANGE and PHASE NOISE

BANDPASS, ATTENUATOR AND LOCK RANGE
USED TESTS FOR BBC CHECKOUT