



TELEDYNE BENTHOS
A Teledyne Technologies Company

How to Tune your Teledyne Benthos Acoustic Telemetry Modem

Revised for 4th Generation Modem Electronics

Section 1

What a good signal should look like.

To determine if you have a good signal or not you will need to know a few things.

1. You will need to know the signal to noise ratio, or SNR, of the communications between the modems.
2. You will need to know your automatic gain control, or AGC, value of the communications between the modems.
3. You will need to know what your expected multipath delay, or MPD, is for the communications between the modems.

To determine these values you will need to run the ATXn command and obtain a test packet response. To do this enter command mode, +++, and type ATXn, where n is the address if the modem you are trying to communicate with.

You should receive a response that resembles what is seen below:

\$00800 bits/sec 1 of 4, Rate 1/2 CC, 12.5ms MGP

Test Packet: 01234567

Acquisition stats SNR:03.3 MPD:06.0 SPD:+00.0

Header stats CRC:Pass SNR:21.1 CCERR:013

MOD:05 ERR:000 SNR:20.3 AGC:18 SPD:+00.0 CCERR:013

The data of interest will be on the bottom line that begins with MOD and the MPD value.

Here is a summary of what is shown:

MOD = Modulation Scheme

ERR = Error Count

SNR = SNR of the received data from the remote modem

AGC = AGC level for that transmission

CCERR = Corrected Channel Errors

MPD = Multipath Delay

Section 2

Signal to Noise Ratio - SNR

Now that you have the MOD, SNR, AGC, CCERR and MPD values you can determine if you are looking at a good signal. The MOD is a decimal number and simply indicated the bit rate being used. This will only change if you change the bit rate and corresponds to the setting of S register 4.

The SNR value is a signal strength indicator and will determine what power level you should be using. For long range applications a higher power level setting, such as full power or -3dB , should be used. For short range applications, less then 1000M, a low power level, such as -12dB to -21dB , should be selected, unless noise is a factor. The modems function well in high noise areas as long as the noise is not in the same operating frequency band. The internal band pass filter will filter out any out of band noise being received by the modem and increase the signal quality. Based on the chart below adjust the power level accordingly:

SNR Value	Action Required
20+	Signal quality high, or try a lower power level
19-15	Signal quality good or try a lower power level
14-12	Signal quality acceptable, for safety sake try a higher and lower power level if available
11-10	Signal quality low, use a higher or lower power level, try lower acoustic bit rate at all power levels
10>	Signal quality poor, use higher or lower power level, try lower acoustic bit rate at all power levels

Section 3

Automatic Gain Control - AGC

The AGC value is how much gain the modem is putting behind the signal coming into the DSP. The higher the AGC value the higher the gain control of the incoming signal. In most cases a value in the high 40's to 50's will be prevalent but higher numbers can be acceptable in some cases. This value is explained below:

AGC Value	Action Required
00-25	Extremely strong incoming signal, try a lower power level or higher bit rate
26-45	Strong signal, try a lower power level or higher bit rate
46-60	Average incoming signal, some noise exists in channel
61-70	Weak incoming signal, try a higher power level or lower bit rate
>70	Extremely weak incoming signal, try higher power level or lower bit rate

Section 4

Corrected Channel Errors - CCERR

The CCERR value needs to be between 11 and 14. This is an overall confidence level given by the modem to determine the accuracy of the transmitted data. The higher the value the more likely the data is to be correct. If this value starts to fall to lower levels you will see errors in the error count field. If you have errors you will need to try a lower acoustic bit.

Section 5

Multipath Delay - MPD

The multipath duration measured by the modem will give you a good indicator of how much self created noise is being generated. The higher the power level of the modem the more multipath that is likely to be measured. This is especially true in shallow water environments where the surface and sea floor are in close proximity. If this number is around or above 25 try lowering the power level. There is no idea number other than 0, so getting as close to 0 as possible will help eliminate noise. The MPD is in milliseconds.

Section 6

What do I do?

When the channel test is run and the required information was obtained use the charts to determine the next course of action. The desired measurements are as follows:

- High SNR
- Low AGC
- CCERR between 12-14
- MPD as close to 0ms as possible in given environment

With the CCERR around 12-14 the highest SNR and lowest AGC are desired values and by adjusting the power level, and bit rate you can raise and lower these values. Try different rates and different power levels. If you wish to save time use the ATYn command and adjust the power levels accordingly.