

IT327: Lab 12

Digital Channel Testing: QAM Constellations, Eye Patterns

Objectives

There are two main objectives for this lab:

1. Gain an understanding of QAM and PSK constellation diagrams using M-Level encoding and decoding.
2. Create an eye pattern using a 'regular' oscilloscope.

Equipment Used

TIMS-301 Modeling System	Audio Oscillator Module
Sequence Generator Module	Oscilloscope Tektronix TDS 210
M-Level Encoder Module	Cables
M-Level Decoder Module	TIMS Manual: Signal Constellations
Tunable LPF Module (x2)	

Procedures

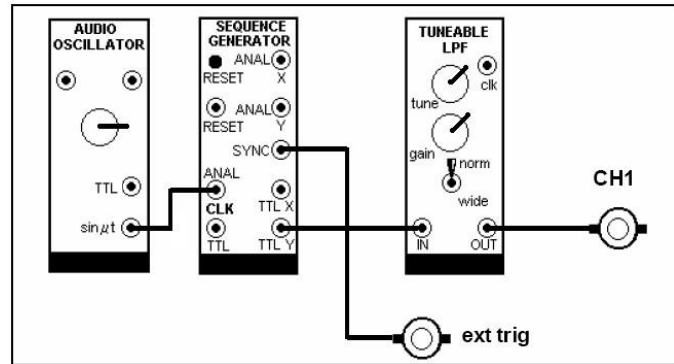
Be sure to take plenty of pictures and include them in your write-up with an appropriate caption.

QAM and PSK Constellation Plots

1. You will need the Signal Constellations section of the TIMS manual. This can be found on the lab website under Lab 9 "Aids" as a pdf or pages 79-88 in Volume D-1 in the lab. Briefly review the first few pages before moving onto the "Experiment Section."
2. Complete steps **T1**, **T2**, and **T3**. Be sure to predict the appearance of the constellation diagrams. In step **T3**, connect the "Q" and "I" outputs to "A" on the scope selector.
NOTE: You will need to switch the oscilloscope display format from "YT" to "XY."
3. Now complete step **T5**. Take a picture of the actual results (step T5) and show your predictions side-by-side in your write-up. (Six predictions and six actuals, twelve total).
4. Go back and do step **T4**. You will want to switch the oscilloscope display back to "YT" format. Compare the *I* and *Q* channels against the un-encoded data. (In your write-up, show the delay between the original and encoded signal).
5. Skip to step **T8**, (Switch back to "XY" format) and take a picture of the results of the six different constellation patterns. **NOTE:** In *Figure 5*, rather than having a "serial data OUT" connect the *Q* and *I* to the "B" on the scope selector. Switch between "A" and "B" on the scope selector and note the difference in your write-up.

Eye Patterns

1. Use the diagram on the right to see an eye diagram on a 'regular' oscilloscope. For best results, turn "persist" on the oscilloscope display menu to at least 2 seconds. Take pictures of your results and include them in your write-up.



Conclusions

Discuss what you learned in this lab along with some real-world applications for using constellation plots and eye patterns. Also discuss any unexpected or differences in the results, such as some of the constellation points not appearing, and why the results occurred. Answer the following questions:

Why is the 16-point QAM and PSK not what you expected?

On the 8-point QAM, why are there more than 8 points?

Why is the eye pattern inconsistent in the middle?

And why is step T4 delayed?