**TIMs Calibration Procedure**

TX Calibration

1. Cos 100k to Y input on left Multiplier 1
2. Sin 100k to Y input on left Multiplier 2
3. AWG Channel 1 to X input on left Multiplier 1
4. AWG Channel 2 to X input on left Multiplier 2
5. Multiplier 1 kXY output to left Adder input A
6. Multipler 2 kXY output to left Adder input B
7. Output of Adder to input of bottom buffer amp
8. Output of bottom buffer amp to A2 on instrument inputs
9. Instrument Input selector switch to A2
10. ChA of Instrument Inputs to Ch1 of DSO
11. Run Tx Calibration

Analog LPF Filter Calibration

1. AWG Channel 1 to input of both Tuneable LPFs
2. Right LPF output to A1 on Instrument Inputs
3. Left LPF out to B1 on Instruments Inputs
4. Channel B to DSO Channel 2
5. Instrument Input selector switches to A1 and B1
6. Run Analog Rx Filter Tuning
7. Tune Filters using the Tune/Gain knobs
8. Filters are tuned when the two impulse responses are identical

RX Calibration

1. Perform TX Calibration First
2. Output of bottom buffer amp to B input of right adder
3. Output of right adder to X inputs of right Multipliers 1 and 2
4. Cos 100k to Y input of right Multiplier 1
5. Sin 100k to Y input of right Multiplier 2
6. Output of Multiplier 1 to right LPF
7. Output of Multiplier 2 to left LPF
8. Right LPF output to A1 on Instrument Inputs
9. Left LPF out to B1 on Instruments Inputs
10. Channel B to DSO Channel 2
11. Instrument Input selector switches to A1 and B1
12. Run Rx Calibration

**M-QAM Transmitter and Receiver Setup**

Transmitter:

1. Cos 100k to Y input on Multiplier 1
2. Sin 100k to Y input on Multiplier 2
3. AWG Channel 1 to X input Multiplier 1
4. AWG Channel 2 to X input Multiplier 2
5. Multiplier 1 kXY output to Adder input A
6. Multipler 2 kXY output to Adder input B
7. Output of Adder to input of bottom buffer amp

Receiver:

1. Output of bottom buffer amp to B input of right added
2. Output of adder to X inputs of Multiplier 1 and 2
3. Cos 100k to Y input of Multiplier 1
4. Sin 100k to Y input of Multiplier 2
5. Output of Multiplier 1 to right LPF
6. Output of Multiplier 2 to left LPF
7. Right LPF output to A1 on Instrument Inputs
8. Left LPF out to B1 on Instruments Inputs
9. Channel B to DSO Channel 2
10. Instrument Input selector switches to A1 and B1

**Troubleshooting**

AWG/DSO isn’t connecting:

* Make sure Keysight IO MATLAB add-on is installed: “Instrument Control Toolbox Support Package for Keysight IO Libraries and VISA Interface by MathWorks”
* If using the ruggedized laptop, only the rear USB Port works. A USB hub is required.

Tx or Rx Calibration not working as expected

* Check signal levels. DSO won’t trigger if they are too low. Increase gain on the buffer amp
* Make sure no noise is being added
* Make sure Instrument Input selectors are in the proper position

Stuck