

24 GHz PA0HME checklist for testing PCB. Modifications by KM5PO .

How I did a first time test and measured a new Wavelab 24GHz add-on module.

I use a step by step approach:

- The pinstrips J2, J3 and J4 I only mount afterwards.
- Optically check if everything is present and well soldered.

Supply: (KM5PO- My supply was set to 6.8v)

In RX, PTT open, high on pin 1 J32

- +5V on C42
- +5V on C43
- +3V3 on C57
- -5V on C45

in TX mode, PTT short to ground, and pin 9 and 10 of J2 temporarily short circuited to simulate the RF module .

- +6V on C41
- +5V on C44

PTT switching:

In RX:

C12 and C22: 0V

C11 and C23: 5V

In TX:

C12 and C22: 5V

C11 and C23: 0V

In circuit programming U51:

Or directly upload HEX files or compile and upload.

Arduino IDE setting for compiling: Board "ATtiny25/45/85", Processor "ATtiny85", Clock "internal 1MHz"

Connect AVRISP MKII to J52

Ensure both U53 and U54 are powered: JP51 and JP52 closed. (KM5PO: measure current across these two jumpers first – see below – then close jumpers)

Leave JP53 and JP54 always open

Test ADF4351's U53 and U54:

- Test with a multimeter in ohms if U53 and U54 are soldered correctly:
 - Open pins: With a multimeter in the diode range, the plus terminal to ground and the other to a connected component: e.g. C or R you can measure if the pin is connected. Example: on C64 and C66, connected to pin 23 U54, you should measure $\sim 0.2V$.
 - Check also short circuits: e.g. no short circuit between pin 23 C64 and pin 24 C68.
 - Measure currents of U53 and U54 on JP51 and JP52, if OK short both jumpers JP51 and JP52 you can expect 71mA no code loaded 88mA code loaded (KM5PO: all units have measured 73-75 mA code loaded)
- with a DC voltmeter I usually check all DC values on all pins of U53 and U54, tapping on connected components. But perhaps this step is only needed to find fault.
- Ensure U51 is programmed

- Ensure 10MHz reference is connected and arrives at inputs of U53 and U54. (KM5PO: I use a shop GPSDO at 13.5 dBm input to the PCB board, less power will work)
- Connect supply; after 1 second first lock indication should switch on 500ms later also the other.
- 1807MHz should be present at pin 17-18 J2 (KM5PO: for U.S. Terrestrial use this should be 1819 MHz)
- Check U1: connect a current meter between pins 1 and 2 from JP1: you should expect a current of ~55 mA, if OK short JP1 (KM5PO: expect ~ 80 mA due to substituted part unless you replaced bias resistors or have NTMS build#4 in which case measure ~ 57 mA)
- 1932MHz (case IF 432MHz) should be present on C6 (KM5PO: 2220 MHz case IF 144 MHz, 1932 MHz case 432 MHz in USA also)

Test 2364MHz TX:

- Place module in TX, PTT short to ground [does not require pins 9/10 shorted on J2] (KM5PO: apply <= 1 watt 144 MHz IF drive at J1 or inject +5 dBm at C8 note: TX IF attenuation pot RV1 is at minimum value fully CCW and placed resistors on pad make up 20 dB of attenuation from J1)
- Check U5: connect a current meter between pins 1 and 2 from JP3: you should expect a current of ~55 mA, if OK short JP3 (KM5PO: expect ~ 80 mA due to substituted part unless you replaced bias resistors or have NTMS build#4 in which case measure ~ 57 mA)
 - 2364MHz should be present on pin 3-4 J3 (As test stimulus I usually connect +2dBm 432MHz on C8, and measure +1dBm on 2364MHz) (KM5PO: with drive supplied as noted above, expect ~+5 to +8 dBm 2364 MHz on pin 3-4 J3)

Test RX:

Place module in RX, PTT open

- Check U6: connect a current meter between pins 1 and 2 from JP4: you should expect a current of ~15 mA (case MGA-86576), if OK short JP3 (KM5PO: expect ~85-90 mA due to substituted part unless you replaced bias resistors or have NTMS build#4 in which case measure ~ 57 mA)
- As test stimulus I insert -20dBm 2364MHz (e.g. from a Pluto) on pin 13-14 J4 and I measure RX gain ~4dB 432MHz on J1 (KM5PO: inject -20 dBm 2364 MHz on C20 and measure RX 144 MHz output -28dBm at J1 also 2nd test: inject DigiLO 24192.1 harmonic into wavelab module RX port and measure -46 dBm 2364 MHz on C20 and measure -40 dBm 144 MHz at C8)

Add-on module current consumption:

- RX mode: ~300mA
- TX mode: ~335mA

Finally I mount the pinstrips and mate with the RF module.

Then step by step I verify the currents via the solder jumpers and close them.

KM5PO: Example current values across jumpers

Jumper	Current	
JP5	1.2 A with no drive/1.7 A with IF drive	In TX
JP6	442-453 mA	In RX
JP7	236-239 mA	In RX
JP8	Same as JP5/Don't need to close jumper	
JP9	246-264 mA	Only seen in RX

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