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 ~~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: Current values across jumpers

Jumper	mode	Typical	Current
JP5	In TX	1.2-1.7	
JP6	In RX	434-453 mA	
JP7	In RX	231-249 mA	
JP8			
JP9	Only seen in RX	246-264 mA	

Close jumpers JP5, JP6, JP7, JP9
Current readings with board mounted to module:

In RX			
In TX / no IF drive			
In TX / with drive			

RF testing power output in Transmit

IF drive	144 – 432	
24 GHz Power output		
PTT but no drive		
PTT/with drive		TX pot full CCW
Attenuation		
Output in dBm		

Minimum 10 MHz reference input power to achieve lock on synthesizers:

Minimum	
Maximum tested	

The expected behavior when sufficient 10 MHz ref is available is the left hand synth will show lock first at LED D52 followed one second later with right hand synth showing lock at LED D51. If ref input levels are changed then always power cycle the board.

If right hand synth LED D51 flickers while left hand synth LED D52 is steady then you need more 10 MHz ref input.