2. - MFJ **269 TEST & CALIBRATION** PROCEDURE

2.1. Introduction

The box can be tested completely after assembling with the battery holder initially unassembled. An initial PCB pre calibration procedure is assumed.
The operations indicated in the procedure can be followed under normal conditions (getting oscillations impedance and SWR meter working), otherwise some troubleshooting may be required.
A multimeter, a spectrum analyzer, a scope (optional), a calibrated frequency counter, a

2.2 Procedure

- Check appearance of box, if any defects inform to the assembly persons.

- Set the unit in test mode by pressing the mode and the gate time switches buttons in the order previously indicated.

2.2.1 Checking the RF amplifier bias and the AGC

Hook up the available spectrum analyzer to the N connector.
Set the unit at the **HF/VHF** mode. Tune to 156 MHz. Check that **T1** gets 2.5 Vdc.
Set the unit at 468 MHz by pressing the **UHF** selection switch. Check that **T1** gets 2.5 Vdc (spectrum analyzer showing a 6 dBm reading at that frequency).
Track on the spectrum analyzer for any harmonic with amplitude higher than -30 dB below the reference frequency.
Adjust the frequency down to 415 MHz, and analyze the harmonics amplitude. Check a **T1** 2.5 Vdc reading.
Release the **UHF** switch (HF/VHF mode).
Set the maximum frequency (rotary switch all the way at the left and plates of the capacitor completely open). Check a **T1** 2.5 Vdc reading.
Turn the power **OFF** and disconnect the spectrum analyzer.

2.2.2 Band Overlapping

- Set the TEST mode (read 1.I if it is necessary to remind the procedure).

- Set the 4th TEST mode step where the internal oscillator frequency will be displayed and the sixteen bit AD conversion from Vr, Vs and Vz too (" Rxxx Sxxx Zxxx").

The unit at the HF/VHF mode has to cover continuously from 170 to 1.8 MHz. Check that the band overlapping realized in the PCB precalibration is still correct.

- Using the variable capacitor, slowly cover the band looking for a consistent frequency reading in the counter module. Notify, if erratic behavior is observed.
- Repeat the previous operation to cover all the bands. Readjust the setting where necessary.

2.2.3 Voltage calibration.

The unit at the UHF mode measures only SWR, coax loss, return loss, match efficiency, line length in degrees and line length in feet.

- Apply a 100 ohms load and set the SWR needle meter over 2 by adjusting R56.
- The trimmer resistors R28, R108 and R109 for the Vr, Vs and Vr compensation circuits are assumed to be in the default position ("centered" around 250K).
- Set the unit in the 10 - 27 MHz band (b3) to 10 MHz.
- Apply open load, and set Vz gain (R72) to get Vz=FFx if it necessary.
- Apply short load, and set Vs gain (R73) to get Vs=FFx if it is necessary.
- Apply 12.5 ohm load and adjust the trimmer R109 to get Vz =333h (adjusting the gain in the Vz compensation circuit). Adjust R53 to get Vr=999h
- Apply 200 ohm load:
    - Adjust the trimmer R108 to set Vs = 333h (adjusting the gain in the Vs compensation circuit).
    - Adjust the trimmer R72 to set Vz = CCCh (adjusting the gain in the Vz amplifier)
- Apply 75 ohm load. Adjust the trimmer R28 to get Vr=333h
- Apply 12.5 ohm load again:
    - Readjust the trimmer R109 again to set Vz =333h.
    - Adjust the trimmer R73 to set Vs = CCCh (adjusting the gain in the Vs amplifier)
    - Readjust R53 to get Vr=999h again.
- Apply 200 ohm load again:
    - Readjust the trimmer R108 to set Vs = 333h.
    - Verify a Vz = CCCh reading.
- Apply 75 ohm load. Adjust the trimmer R28 to get Vr=333h

It may me necessary to repeat the previous interactively to get the desired settings.

- Apply 50 ohm load and check for Vs = Vz = 7Fx/80x hexadecimal, Vr=0.

-Set the unit in impedance mode.

- Adjust the trimmer R67 to read 50 ohms on the 7 needle meter.

- Set the unit around 430 Hz and verif an SWR reading close to one and a zero ohm impedance needle meter reading. 145 MHz

2.24 Inductance and capacitance modes

- Set the unit in the capacitance mode. Verify a zero ohms impedance needle meter reading (C (X<7) or C (X=0) on the LCD).
- Remove the load and verify a higher than 400 ohms impedance needle meter reading for all the modes.

- Set the unit to a frequency higher than 60 MHz and verify a close to 4 pF reading.

2.2.5 **Frequency counter mode.**
- Select **frequency counter** mode.
- Connect the cable running from the test station analyzer to the frequency input of the unit being tested.
- Verify the frequency reading for the three different gate times available.
- Disconnect cable from unit
- Turn the power OFF.

2.2.6 Advanced modes.

- Press the **mode** and the **gate time** switch buttons simultaneously and release them when the **Advanced 1** messages is displayed.
- Remove the load and set up the unit at a frequency higher then 40 MHz in **HF/VHF** frequency range, where **Z** is lower than **1500Ω**. A certain magnitude of the impedance and a **90°** phase should be displayed.
- Connect a 3 feet RG58A load. Trace for a short reading (Z=0-2) at VHF (a freq. around 150 MHz).
- Connect the 50 ohm "dummy load" over the antenna output and set a low frequency. Verify the **LCD (Z=50 θ=0°, SWR=1)** and **impedance needle meter** readings in the **impedance mode.**
- Set the next **mode.** With the 50 ohm load hooked up a **return loss (RL)** higher than 42dB, a **reflectance coefficient (ρ)** of zero and a 1 **SWR** should be displayed. Press Mode
- Read unity SWR and a zero Xs or infinite Xp for Rs or Rp equal to 50 ohms in the **resonance mode.** Verify a zero ohm reactance reading on the impedance needle meter.
- Read a close to **100% match efficiency** in the last **advanced mode 1.**

-Press and hold the mode and the gate time switch buttons. As soon the Advanced 2 message is displayed, release both switches.

Decrease the **velocity factor (VF)** to the allow minimum 0.5 and increase it back to 0.56. Accept the selected value by simultaneously pressing both push-button switches. Press gate & Mode switches to move them

Over pass the **DTF** mode by pressing the mode push button to get the **line length in degrees** mode.

Press the **gate switch button** and increase and decrease the feet length.

Select any value by simultaneously pressing both push button switches.

Watch the **length in feet** mode and Press and hold the **mode** and the **gate time** switch buttons. As soon the **Advanced 3** message is displayed, release both switches.

Increase and decrease the characteristic frequency accepting any selected value by simultaneously pressing both push button switches.

- Remove the load, set to the minimum frequency and verify the Z>1500 LCD reading. Watch the SWR label blinking.

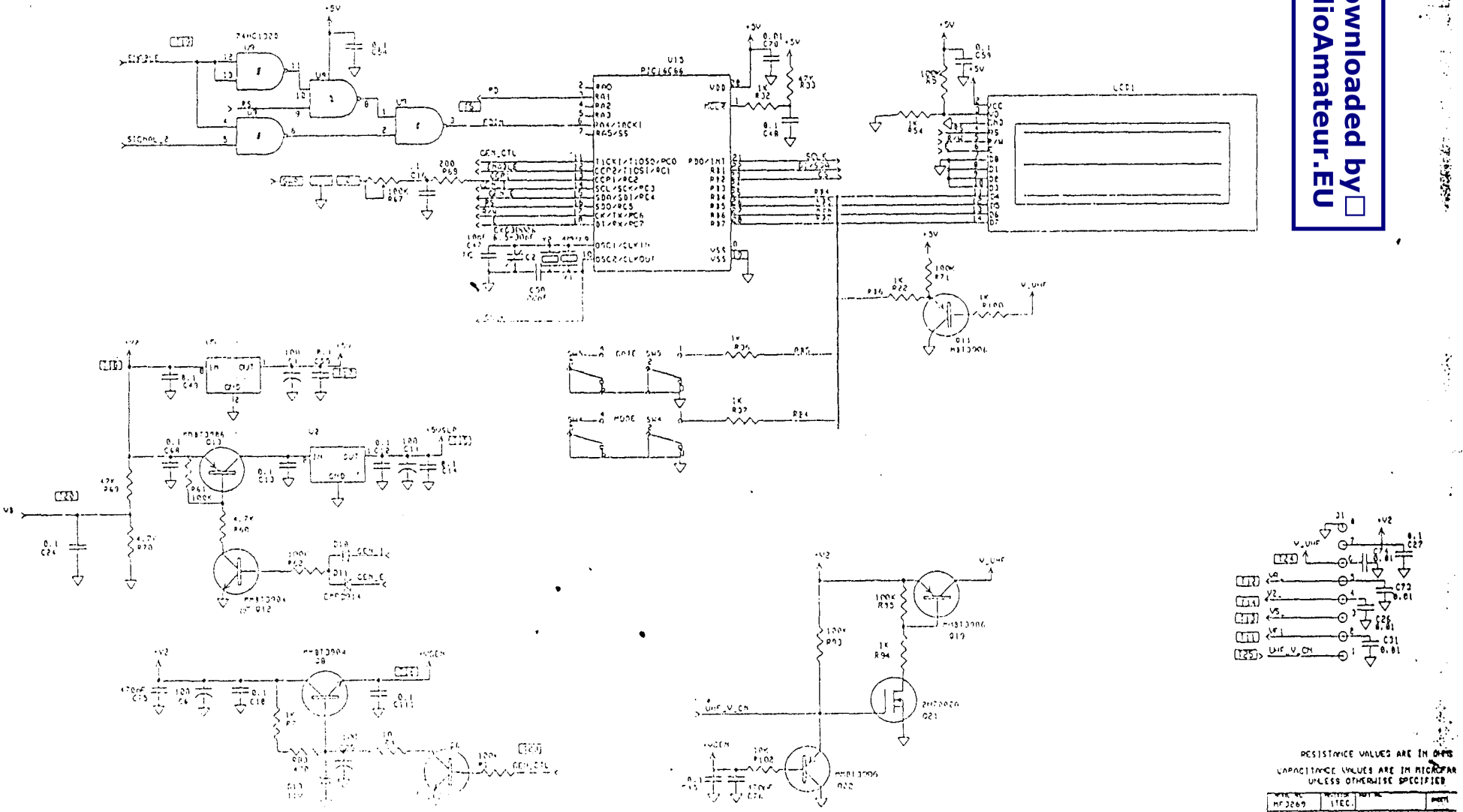
2.2.1.6 Battery leads test.

- Install the battery charger jumper in the OFF position.
- Assembly the battery holder.
- Apply 12 Vdc to the battery leads considering the polarity and turn ON the power.

3.1.) Test point definition

These test point are labeled on the PCB as follow (numbers and test points could be revised and they will be print out in the solder side)

T1 : Forward voltage - amplified - (Vf)
T2 : Reflected voltage - amplified - (Vr)
T3 : Voltage dropped over Rs in series with the load - amplified - (Vs)
T4 : Voltage dropped over the load - amplified - (Vz)
T5: Signal from conditioner to microcontroller.
T6: Buffer Oscillator signal to prescaler
T7: Internal generator selection (GEN_I)
T8 : External signal selection signal (GEN_E)
T9: Osc. amplifier output (osc. signal and + 5.x V)
T10 : AGC control voltage in Q3 gate
T11,T31 : Forward voltage - detector - (Vf-)
T12,T32 : Reflected voltage - detector - (Vr-)
T13,T33 : Voltage dropped over Rs in series with the load - detector - (Vs-)
T14,T34 : Voltage dropped over the load - detector - (Vz-)
T15 : +5 V power supply for prescaler and op-amps. (+5VSLP).
T16 : + Vdd for oscillator
T17 : +5 V digital
T18 : External voltage supply
T19 : Enable counter
T20 : Testing voltage for battery level checking
T21 : Signal from prescaler amplified
T22: Input signal for prescaler
T23: Control for the internal oscillator supply
T24: Supply voltage for UHF tripler and MMICs.
T25: UHF selection control signal (LOW:
T26: Q25 collector
T27: U11 MMIC output (bias to 4.7 Vdc)
T28: U12 MMIC output (bias to 5.4 Vdc)
T29: Q25 base
T41 : Forward voltage from diode compensation circuit (VF2)
T42 : Reflected voltage from diode compensation circuit (VR2)
T43 : Voltage dropped over Rs in series with the load from diode compensation circuit (VS2)
T44 : Voltage dropped over the load from diode compensation circuit (VZ2)



RESISTANCE VALUES ARE IN OHMS
CAPACITANCE VALUES ARE IN MICROFAR
UNLESS OTHERWISE SPECIFIED

MFJ 2269	LTEC.		SHEET
PCB411 M3 MICROCONTROLLER/ SWITCHES			
/13/2000		MFJ ENTERPRISES 300 INDUSTRIAL PA STARKVILLE MS 397	