

# How to Use M-PA Radios on 902-928 MHz Amateur Band

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Recently there has been a lot of discussion on the GE-Mpa list and elsewhere about the 900 MHz MTL radios appearing on eBay, and their potential usefulness on the 902 to 928 MHz amateur bands, and if any hardware modifications were required.

I hope to answer some of these questions with this short document, which is a compellation of long-term efforts by several hams, including: **Doug Bade** KD8B (Creator of the modified software to support 902-928 MHz and dozens of hours of testing), **Gary Peterson** NZ5V (Reviewing the data and testing methods) and of course **John Belstner** W9EN (The "father" of HamFlash).

The information contained within this document applies equally to the following radios: M-PA, MTL & P400. The **GeNet 900** model of the MTL is not supported due to the modem/clock differences.

## OPTIONS:

As of today, there are three different options that can be taken to migrate this radio into the amateur bands.

### Original ARRL 921/909 repeater plan:

In this older ARRL plan, repeater outputs were in the 920-922 MHz region with their inputs being 12 MHz lower in the 908-910 MHz area. In this earlier version, the radio's firmware was replaced with the special **Hamflash** code file, and extensive hardware mods were required. Consequently, only a very few ( < 6 ) hand-built radios exist in the world today.

### Current generation 927/902 repeater plan:

In this newer scheme, repeater outputs were in the 927-928 MHz region with their inputs being 25 MHz lower in the 902-903 MHz area.

This variant offers a much greater equipment selection amongst the popular brands of two-way radios available today. Most models will handle the 902 MHz inputs and 927 MHz outputs with only minor modifications, IF ANY AT ALL. Often times only a modified programming software application is required to load amateur frequency pairs into the radio.

### 927 MHz simplex only:

This is the simplest of all three options, and uses one or more simplex frequencies in the 927-928 MHz band. Installation of the **HamFlash** firmware into the radio is all that is required to allow the programming of amateur frequencies into the radio.

## PRACTICAL IMPLEMENTATION:

For my testing, I used the below equipment which is shown in Photo#1:

- IFR Com-120b service monitor
- Calibrated 3-foot RG-58 coaxial jumper (0.4 dB loss)
- P400 portable with Ø81 logic board
- Unmodified 896-902 / 935-941 rear cover assembly



**PHOTO #1**

**TEST #1**

- UNMODIFIED HARDWARE RADIO; P400 model (Euro version of the M-PA)
- HAMFLASHED
- DEFAULT (hamflash supplied) TRACKING DATA FOR TX PWR/DEVIATION/SQUELCH

In this first test, I simply tested the receiver's performance on 927.500 MHz using the hamflash's default squelch setting tracking data.

**0.240  $\mu$ V for 12 dB SINAD**

**TEST #2**

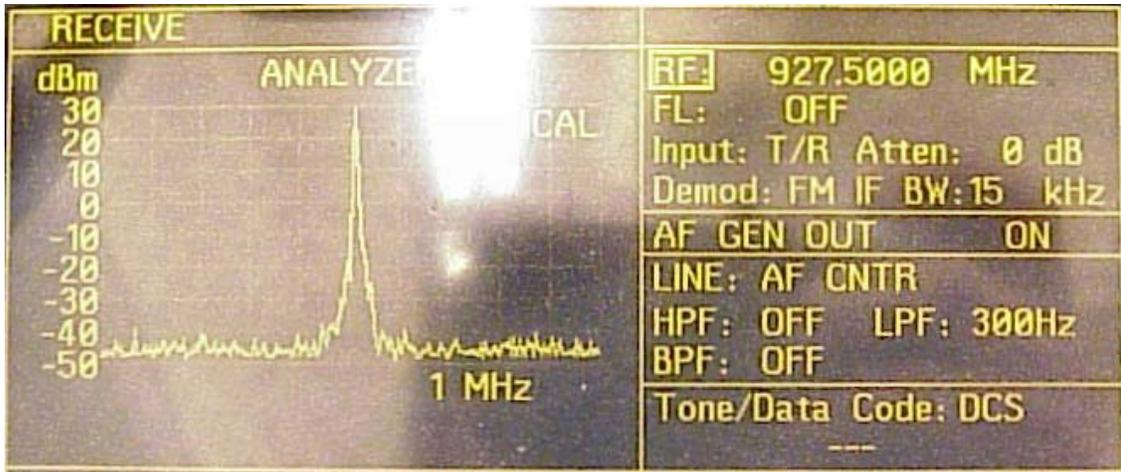
- UNMODIFIED HARDWARE RADIO; P400 model (Euro version of the M-PA)
- HAMFLASHED
- DEFAULT (hamflash supplied) TRACKING DATA FOR TX PWR/DEVIATION/SQUELCH

In this second test, I transmitted with the radio on 927.500 MHz using the hamflash's default tracking data (Hi PWR setting). Then adjusting to reach 2 watts +/- output power. A good stable RF output was produced by the radio. The table below lists my changes and their results:

<u>HEX.....DEC.....POWER (w)</u>
80.....128.....0.862 (HamFlash default)
96.....150.....1.290
AA.....170.....1.660
<b>BE.....190.....2.160 (See Note #1)</b>

**NOTE #1:** It is strongly discouraged to greatly exceed the two (2) watt maximum RF output of the 900 MHz board.

In PHOTO #2 you can see a close-up of service monitor's display showing a live signal on 927.500 MHz, checking for presence of unwanted spurs. The closest spur is -70 dB below the fundamental.



**PHOTO #2**

### **TEST #3**

- UNMODIFIED HARDWARE RADIO; P400 model (Euro version of the M-PA)
- HAMFLASHED
- DEFAULT (hamflash supplied) TRACKING DATA FOR TX PWR/DEVIATION/SQUELCH

In this third test, I transmitted with the radio on 902.500 MHz and the “normal” Part-90 frequencies association with the bandsplit of radio: 896.000, 935.000 & 941.000.

When I transmitted on 902.500 MHz, no signal was seen on the service monitor programmed for that frequency, however I was observing 2 watts of output power on the watt meter. In searching, I found the radio was actually transmitting on 948.100 MHz with a very distorted signal.

Below are my test results in transmission on 902.500 and the other frequencies:

FREQ.....POWER....COMMENTS.....

**[Amateur Frequencies:]**

902.500....2.00.....actually on 948.100, distorted

[Original Part-90 Frequencies for reference:]

896.000....2.00.....actually on 947.900, distorted

935.000....1.91.....clean signal, good audio

941.000....2.06.....clean signal, good audio

From the above, it appears that the hamflash is loading the synthesizer, but due to the 896/902 frequency not being in the intended (hamflash's) 908-910 input frequency range, incorrect data is getting loading to synthesizer, resulting in an incorrect transmit frequency very high up in the band. The 935 & 941 MHz frequencies are within the radio's 'normal' bandsplit, and outside the hamband, and are apparently not affected by the hamflash.

## TEST #4

- UNMODIFIED HARDWARE RADIO; P400 model (Euro version of the M-PA)
- FLASHED WITH EDACS FLASHCODE ([ver\\_107e.bpd](#))
- TRACKING DATA LOADED BY AUTHOR
- PROGRAMMED USING 3<sup>rd</sup> GENERATION OF THE MODIFIED VERSION OF EDACS-1 TO ALLOW 902-927 MHz FREQUENCIES

In this fourth test, I again transmitted with the radio on 902.500 and 927.500 MHz and the “normal” Part-90 frequencies association with the bandsplit of radio: 896.000, 935.000 & 941.000.

When I transmitted on 927.500 MHz, a good stable RF output was produced by the radio, identical to that shown in PHOTO#2. Below are my test results in transmission on 902.500 and the other frequencies. PHOTO #3 shows the emission mask on 902.500 MHz.

FREQ.....POWER....COMMENTS.....

### [Amateur Frequencies:]

902.500....1.90....clean signal, good audio

927.500....2.16....clean signal, good audio

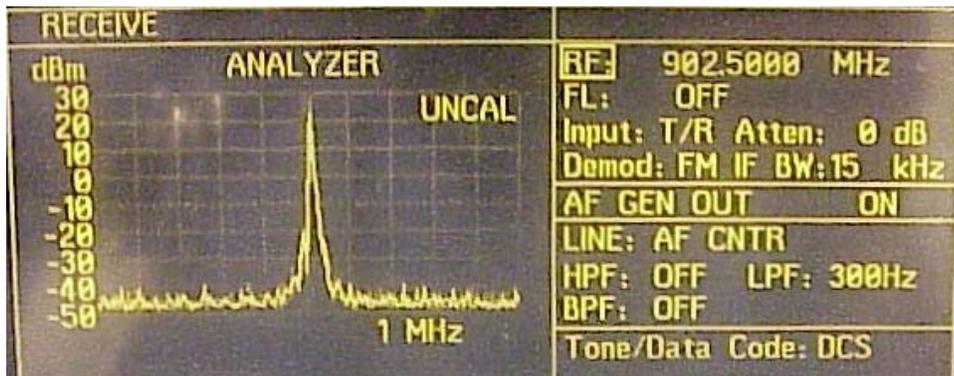
[Original Part-90 Frequencies for reference:]

896.000....2.00....clean signal, good audio

902.000....1.90....clean signal, good audio

935.000....1.91....clean signal, good audio

941.000....2.06....clean signal, good audio



**PHOTO #3**

## FINAL COMMENTS:

If you intend to only use this radio for 927 MHz simplex operation in your local area, simply using an unmodified radio and Hamflash is the simplest route to take.

If you desire to use the 927/902 repeater pairs and ability of simplex operation, flashing the radio with normal flashcode and using the 3<sup>rd</sup> generation (or later) of the modified version of software will allow you the desired operation without any internal hardware modifications.

So with very little effort on the part of the user, a high quality 900 MHz amateur radio can be available to the amateur community. 73.