Icom IC781 ALC Power Spike (also see follow-up **K1VF UPDATE**, Below)

13 Nov 2002 From: **Vince, K1VF**
IC-781 ALC Info

I also noticed a severe power spike on transmit at the leading edge with serial # 03156 (late production purchased 11/20/2000) versus early production serial #01285, which performed flawlessly. Any amplifier using 3CX800A7's, and equipped with a properly working Grid Trip system, simply will not allow operation with such an exciter fault. It will (or should) trip/fault immediately.

Close inspection showed virtually no changes in the IF unit PC board version and schematic between the two date code units, but the later unit experienced unusable transmit power spikes upon start of PTT in all modes.

The problem turned out to be the following:

1. C47 and C48 were reversed on the later unit.
2. R108 was populated as 4.7K versus 100 ohms.
3. R112 (4.7K) and R109 (4.7K) were both populated as 1K.

In all five cases, the early unit was populated per the schematic in the Service Manual, and the new unit, after changes to agree with the schematic, performed flawlessly.

In summary, final values for these components per the schematic should be:

C47 = 2.2µF, be sure to observe polarity
C48 = 0.47µF, be sure to observe polarity
R108 = 100 ohms
R109 = 4.7K
R112 = 4.7K

These changes (to originally designed) values result in identical, flawless performance of the ALC system.

(Proceed to UPDATED post, which follows)

05 Apr 2003 From: Vince, **K1VF**

Icom 781 ALC Power Spike UPDATED w/SUMMARY
UPDATED: April 5, 2003

Although the above changes (from my initial post of 13 Nov, 2002) improved the ALC behavior, reducing a 200+ watt spike, there was still a persistent 1-2msec spike of 10-15% at the leading edge of SSB and CW operation, at all combinations of power and drive level settings. Although this was not enough of a problem to bother the grid trip protection of 3CX800-type amplifiers, it did create problems when attempting to use ALC generated by an external amplifier to the ALC input of the 781. The external linear amplifier ALC would provide a sharp negative-going spike (1-2msec following the input power spike), that in turn would saturate the 781 ALC, reducing its output to zero for the 2-second time constant, before it recovered.

The following changes (including an amended change to R109 from my initial post) cured the problem completely, and power on SSB (tone injected) and CW now rises cleanly from 0-100% with ZERO overshoot.

1. The -9.0Vdc supply to the ALC system was low, at -7.5Vdc. The problem was traced to the PI Unit; R8 was changed from 5.6K to 4.7K, 1/2W. (Alternatively, you can place a 30K in parallel on the back side of the board).

2. The ALC timing transistor, Q35, was not saturating on fast attacks, meaning that it was not able to charge timing capacitor C47 fast enough to properly control the leading-edge attack time. Given the typical DC Gain spec of Q35, R109 must be reduced from 4.7K to 1K to allow this transistor to fully saturate.

3. Diode D15 was changed to a high-speed Schottky diode, type 1N5711.

Note: This diode was either missing or intentionally depopulated on the later, serial 3156 unit; however it is needed for the leading edge attack, and provides an additional current source to charge C47 directly via the primary FWD-PWR difference op-amp IC4-p7.

These changes were made to both units (Serial #01285, #03156) with identical results. They provide clean rise times (from 0-100% in 3msec CW) output with no overshoot or ringing at all combinations of Drive and PWR levels.

In summary, the following components are either incorrectly installed, or should be changed as follows:

IF Unit PC Board:

C47: 2.2 µF
C48: 0.47 µF
R108: 100 ohms
R109: 1K
R112: 4.7K
D15: 1N5711

PI Unit PC Board:

R8: 4.7K

Reader Comments and Feedback to K1VF IC781 ALC Circuit Fix

Date: 14 Nov 2003
From: VE2DC (Mel)
Subj: VE2DC mod superseded by K1VF mod

I have changed my 781 ALC circuit to the improved circuit as suggested by K1VF and there is an small and worthwhile improvement in ALC performance. The slight remaining leading edge overshoot has been eliminated. Therefore: my original fix has been superseded!!! Thanks Vince...

Date: 11 Aug 2003
From: Fred VE3FG
Subj: This mod fixes what Icom Canada could not

This modification really works!! Thanks to K1VF's ALC circuit modification, I finally have an IC781 that has a properly functioning ALC circuit. Output from the IC781 and IC4KL now responds as it should when the 781 is keyed using PTT in the SSB mode. There is no longer and occasional momentary delay. Since day one my 781, intermittently, behaved just as K1VF described .. "would saturate the 781 ALC, reducing its output to zero for the 2 second time constant, before it recovered". K1VF reported that he measured the -9.0 Vdc supply voltage to the ALC system in his 781 and found it to be low at -7.5 Vdc. After measuring, I discovered the same voltage readings in my 781. Changing R8 as per K1VF's modification, I obtained the correct -9.0 Vdc reading.

Many thanks to K1VF for providing this excellent modification.
VE3FG Fred

Date: **29 Feb 2004**
From: Steve, K0SF
Subject: **K1VF Update to ALC Fix**

With the new formatting of www.mods.dk, K1VF's 2003 update to the IC-781 ALC problem is missing. As I had applied K1VF's fix to my IC-781 (SN 2739) and found it to completely eliminate the overshoot, I want to list it here again in its entirety:

The following components are either incorrectly installed, or should be changed in accordance with K1VF's recommendation.

IF Board:

C47: 2.2 µF
C48: .47 µF
R108: 100 ohms
R109: 1K
R112: 4.7K
D15: 1N5711

PI Board:

R8: 4.7K

The IF board changes required about 2 hours, the PI board about 1 hour. It is an evening project.

I used a 1N4148 diode for D15; since it's reverse bias transit time was nearly that of the 1N5711 Schottky.

Also, I left R109 alone. The factory had installed an 820-ohm resistor in this position.

Note that the user will also need to check the -9V supply coming from the PI board. Before modification, my -9V line was low, -7.4 VDC. K1VF recommends changing R8 on the PI board to 4.7K to achieve -9V. When I changed R8 to 4.7K, my -9V line lifted to -9.4 VDC, but I left it that way. A 5.1K might be a better choice for R8. The circuit is Beta dependent, and does not use true voltage referencing.

Before modification, my QRO HF-2500DX amplifier's grid over-current reset would trip constantly. The problem was extremely annoying, making it almost impossible to run the amplifier in a contest. I have not had to reset the QRO once since the modification.

I will try to get a digitizing scope from work and take screen dumps of the modulation envelopes from IC-781's with and without the fix to demonstrate the difference. I have 2 more IC-781s that I will be modifying for friends; I should have an opportunity to do this.

Thanks to Vince, K1VF for really digging into this elusive problem and coming up with the "silver bullet" fix.

Steve, K0SF

KG4LRU Rating: 5/5
Date: Apr 9, 2005 16:32
Subject: IC781 ALC fix for good
Time owned: months

I too have been suffering with the dreaded ALC spike I have several 781s; 1402, 2209, 2700. Two of these had the components reversed and or missing, this helped but did not fix the radio. My radio has not been in for alignment and was needed voltages were off so I packed it up and sent to Burghardt's in SD. Dave in service there is a great 781 Tech; he was impressed by Mel's work and I am very grateful to K1VF for all his work put into to the research on the mod . I run the Acom 2000a and now can set it at 600 watts and it will not budge over 600 watts no matter how loud I shout. 73 to all you can safely invest just a little more money in your 781 to make it perfect.

If you have a 781 with the dreaded ALC spike, it can be tamed . Try this mod; it works!

Proper alignment, and this mod, put the 781 back into the contest fray.

73
Phil
