

From: http://www.amalgamate2000.com/radio-hobbies/radio/ne567_tone_decoder_as_am_fm_de.htm

NE567 Tone Decoder as AM FM demodulator at 455 KHz

The Ne567 tone decoder IC is a phase lock loop designed for detection of audio tones , it is very useful and has been around almost as long as the NE555 . in order to detect tones within its adjustable capture range ,it uses a synchronous demodulation technique where the VCO output is fed to the second on board balanced mixer in quadrature (actually 80 degrees) but that minor error doesnt prevent it from performing its desired function very well . Thus it has a Synchronous detector for AM ! The ic is rated up to 500 KHz . and being a synchronous demodulator and a PLL there is no reason why it shouldn't demodulate Frequency modulated signals and Amplitude modulated signals .

In order to work at 455 KHz, the Correct resistor and capacitor need to be chosen , 470 pf and a 4.7 K ohm variable enable tuning either side of the wanted VCO frequency , the only two other variables to choose are the filter capacitors for the FM loop and the output of the synchronous demodulator. Because we are not interested in the Lock function of the ic at the moment, the values will be somewhat different than those suggested by the I.C designer . For a dedicated FM only demodulator , there is no reason why the correct lock range capacitor be used on the synchronous detector to enable an Audio mute function simultaneously to Frequency demodulation . I built up a simple double sided etch PC board and made an operational circuit , the FM loop capacitor was a 470 pf bypass and the AM detector was .01 uf , the v+ rail was 6 volts via a 3 terminal regulator . The VCO was set to 455 KHz and the fm audio output was connected to my usual amplified computer speakers , these are not the most sensitive audio amp but 10's of millivolts of audio input yield audio loud enough to hear on the work bench .

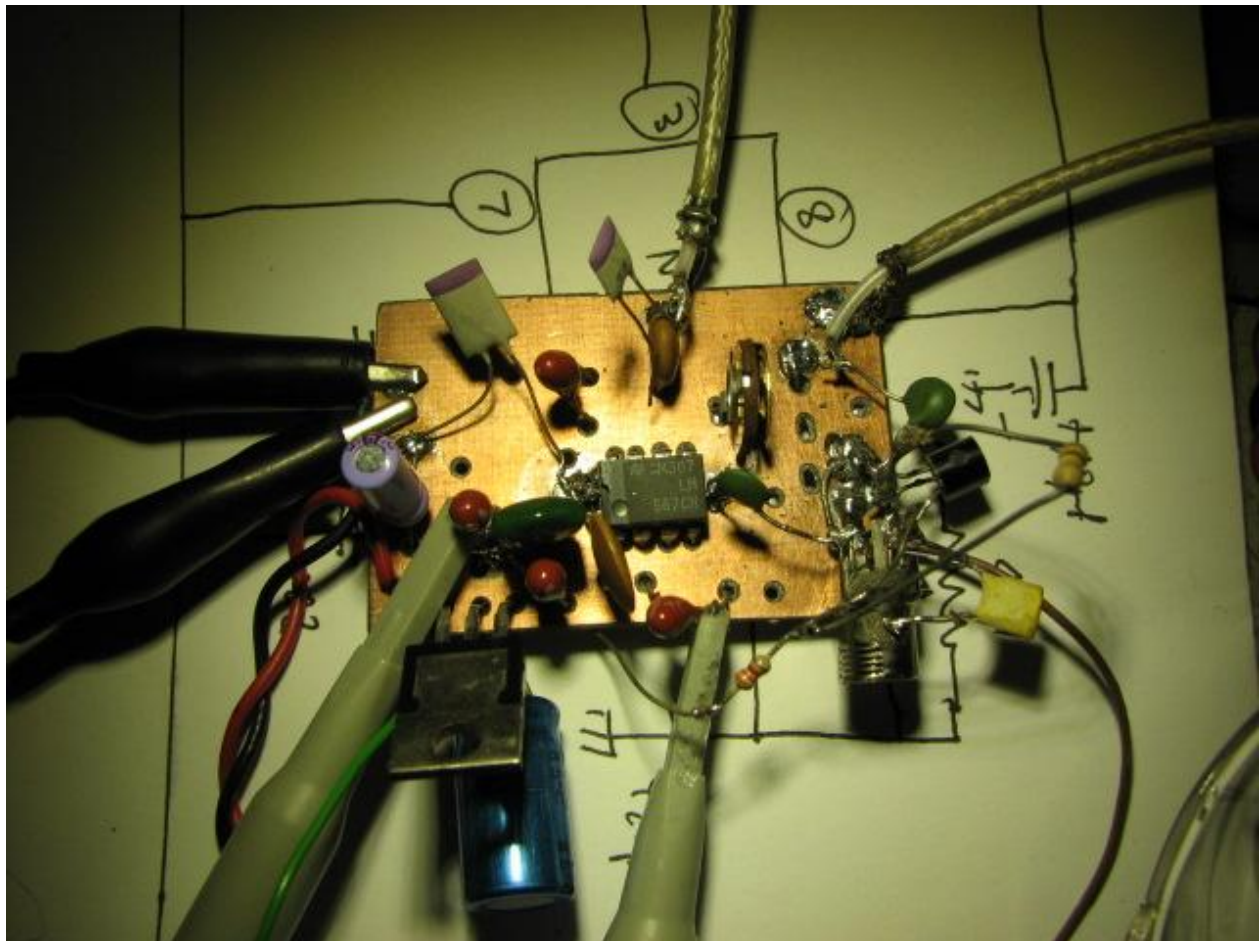
I connected the 50 ohm source from the signal generator directly to the capacitor input of the NE567 , this is a rather large mismatch as the input impedance of the 567 is 25 k ohms (more about this later) I connected the audio amp input to the Demodulated fm output pin 1 , and punched up 455 KHz , FM , 2.5KHz Dev at 1 KHz tone , and then ramped the RF output amplitude up from -100 dbm until I heard sound from the speakers ..

maximum frequency and looked at the flat plateau (lock range) on the screen this NE567 at +6v rail would go to a centre frequency of 1200Khz and sweep +/- 350 Khz . considerably higher than the 500 Khz advertised in the data sheet !

The next test was 455 Khz ,1 Khz tone , AM 80% modulation over a range of input levels and look at the audio output level from the synchronous demodulator (pin 1)

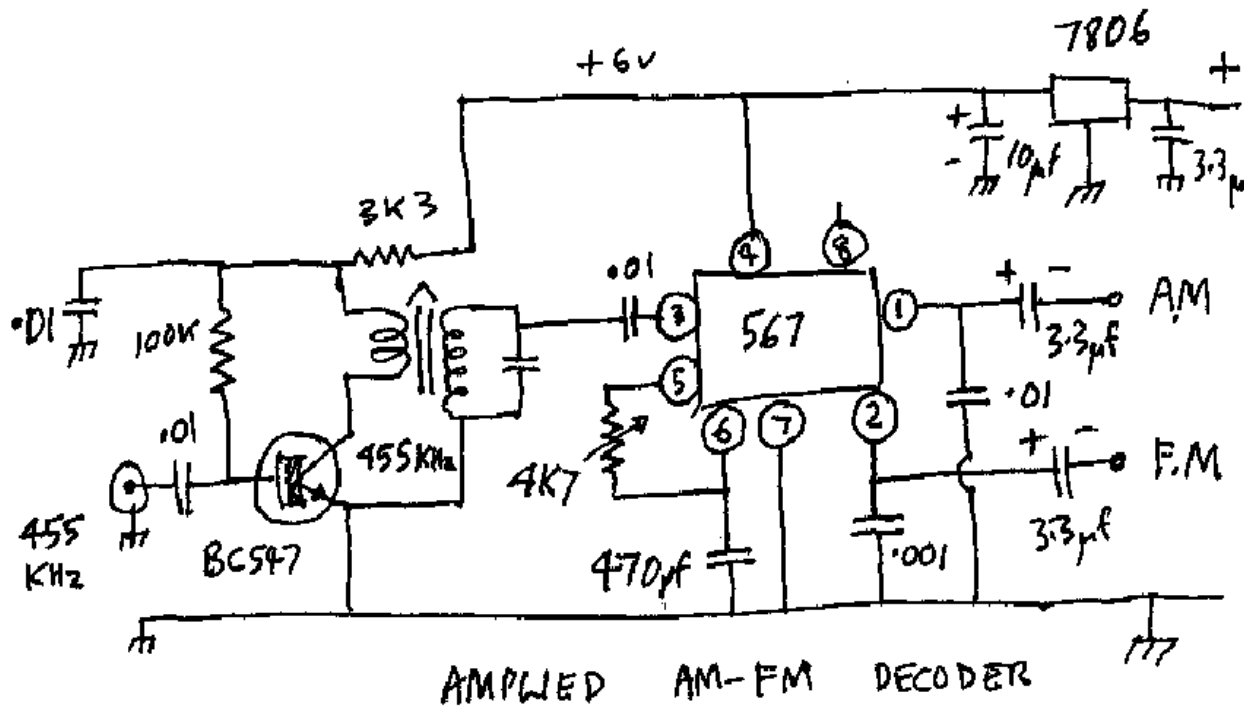
-40 dBm	44 mV	
-35	77	Clean sounding and looks correct on scope
-30	130	
-25	233	
-20	320	
-15	350	1 Khz tone starting to sound slightly distorted
-10	305	sine wave shows distortion and sounds it
-5	195	sine wave shows more distortion and sounds worse

There is quite a wide dynamic range over which the synch demodulation sounds very clean and in a normal radio receiver the levels would be chosen to be held by the AGC in the receiver



There is a large mismatch between the 50 ohm signal source at 455 KHz and the 25Kohm input impedance of the ne567 , I placed an interstage transformer in the circuit with the low impedance ends

connected and the top of the tuned circuit to the capacitively coupled pin 3, this enables a more sensitive PLL and it will lock at lower levels due to the increase in voltage derived via the 455 KHz tuned circuit input. However when connected to the 455 KHz IF tap out of the scanner, I found I required more voltage gain than the tuned interstage coupling transformer could provide, so a single transistor BC547, class A stage was lashed up and connected to the transformer input. This enabled good reliable clear demodulation of both modes at the -70 dBm scanner 455 KHz output.



Listening test ;

The 455 KHz of the AOR2001 scanner was connected to the PLL demod and both forms of modulation listened to off air from air traffic control (AM) and local police (nbfm) the demodulated audio of the weather broadcast on 128.800MHz AM was clear and clean sounding , the nbfm was also clear and clean

The NE567 as a tone decoder is a more versatile device than first meets the eye . I have not had a look at the xr2211 PLL chip but I gather that chip is obsolete ..

Hope my findings are of use to someone or promotes some new idea

cheers Mike ZL1BTB