

MODULATED FM CW CONTROLLER NOTES

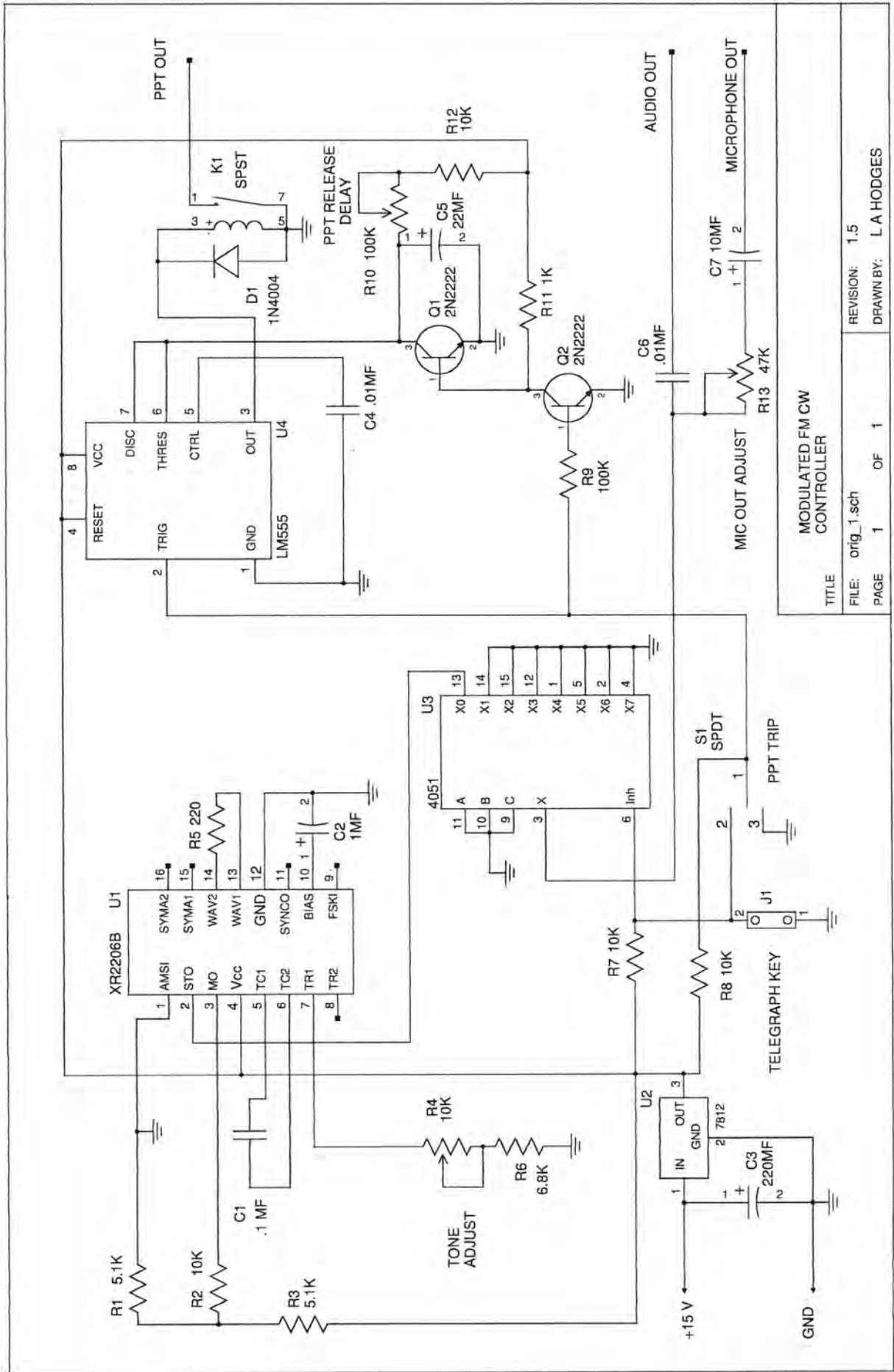
This package contains my original article on building a unit that allows one to send Morse code over a FM transceiver. Since the article was first created around 2001 or so but things have changed. First the schematic program I used to create the diagrams isn't installed on any of the computers I currently have. Plus the hard copy diagram I have had some penciled in changes. So I decided to redo the original schematic using the Linux program gEDA. Page 2 of this package contains the reconstituted schematic diagram. Page 3 and 4 contain the original documentation updated with the new part numbers caused by using a different drawing program. Page 5 is the parts list for the first schematic.

Page 6 contains an updated schematic which has the audio amplifier and speaker added back in. After some research I found a LM386 amp circuit that seem to work well enough. Page 7 is the parts list for this version of the MFM controller. This is the version I am currently using.

The XR3306 function generator chip is getting hard to find so it's getting kind of expensive. Page 8 has a schematic with the XR2206 replaced by a twin-T transistor audio oscillator. The twin-T produces a good sine wave and can be keyed directly so we don't need the CD4051. Other simplifications can be made with this circuit. Although I haven't switched to this version, I have breadboarded this circuit and it functions well. Other members of our club have used this version with good results. Page 9 contains the circuit diagram for this version.

Page 10 has some diagrams for interfacing the MFM controller with a couple of different FM radios. These boxes allow different radios to be used along with the ability to connect the rig's microphone at the flip of a switch. Remember that this unit produces modulated CW not true CW so it must be used in the FM voice portion of the ham bands.

The rest of this package has pictures of my current version. The picture of the front panel shows the amplifier volume control. In the original version this location contained a phono jack for connecting the external audio amplifier. Of course the original unit doesn't have a speaker either. Any controls that aren't on the panels are on the circuit board because they don't require adjustment very often.



TITLE: MODULATED FM CW CONTROLLER

FILE: orig_1.sch
 PAGE 1 OF 1
 REVISION: 1.5
 DRAWN BY: L A HODGES

MODULATED FM CW CONTROLLER

I had the desire to be able to send morse code over my 2 meter radio to help some people in my amateur radio class improve their code skills. To that end I have developed the following circuit. In this day and age most people use programmable PIC controllers to perform this task. I am from the old school and prefer to use discrete components and chips to build my projects. I spend my days at work writing computer code so when I build a project I prefer to use solder and wire instead of bits and bytes.

My goal was to build a unit that would produce a pure sine wave tone and to that end I decided to use a XR2206 function generator chip to produce the tone oscillator. Resistors R1, R2 and R3 set the output level to about 1 volt peak to peak. Capacitor C1 and resistors R4 and R6 set the tone. The fixed value of R6 sets the low end of the tone range to about 500 Hz and the variable resistor R4 varies the tone up to the 2000 Hz range. R5 sets the XR2206 to produce a sine wave. Capacitor C2 sets the filter bias. No attempt was made to turn the XR2206 on or off to key the audio tone.

To key the audio tone I use a CD4051 CMOS 8 channel analog multiplexer. Any of the CD405X series of chips could have been used for this stage. Pin 6 or the INH line is held high by resistor R7. When the code key is taken to ground the INH line is taken to ground and the tone signal that is on pin 13, X0 is passed through to pin 3 the output of the CD4051.

The output of the CD4051 is used to develop two signals. The first output through capacitor C6 is a 1 volt peak to peak signal used to drive an external amplifier. The second output goes through resistor R12 and capacitor C7 and is used to drive the microphone input on the radio you are using. R13 is adjustable to set the level of the signal going to the radio so the radio will not be overdriven and cause distortion.

The next part of the circuit starts out as a conventional one shot monostable multivibrator built around a LM555 timer chip. Capacitor C5 and resistors R10 and R12 set the length of time that the output stays high after the LM555 is triggered. R10 is adjustable to vary this time period. For this circuit to be useful to control the radio's Push To Talk (PPT) line it must stay active high as long as morse code is being sent and should only drop out when we stop sending code via the code key. Resistors R9 and R10 and transistors Q1 and Q2 allow the LM555 to remain triggered as long as the morse code key is being used before the timer expires. So as long as we are sending code the PPT line will stay closed and the radio transmitter will be keyed. We adjust R10 to our keying speed so the transmitter will not drop out between our code elements as we send them. The output of the LM555 drives relay K1 which grounds the PPT for use by the transmitter. I have added switch SW1 to allow the LM555 to trigger the PPT line without letting the tone from the XR2206 to reach the radio. If we allow the PPT line and the audio tone to be triggered at the same time the transmitter will shorten the first morse code character because the transmitter does not become active instantaneously. By hitting this switch first the transmitter will be active before we send our first character.

The last part of the circuit is a LM7812 voltage regulator. The wall wart power supply I was using put out about 15 volts DC with a lot of ripple so I added the voltage regulator and capacitor C3 to supply a stable DC voltage to the project. If you attach this to a good power supply you can probably eliminate this part of the circuit.

The next page of diagrams shows what I call personality modules. Each radio has its own way of connecting the microphone and the push to talk switch. Also, operating modulated FM happens in the Voice portion of the bands so it is nice to have the microphone available with the click of a switch just in case you need to answer someone back when they ask what that strange beeping is.

The first circuit is used with my HTX202. The PPT uses a 2.2K resistor to ground to key the transmitter on the same line as the microphone audio.

The second circuit is used to connect to my Alinco DR150T. Line 1 is the microphone line and is switched between the microphone and the code oscillator. Line 2 is the PPT line and is also switched between the microphone and the code oscillator PPT. All other lines just pass through from the input connector and the output connector.

If you are going to only connect to one radio then this type of switching can be built into the main box.

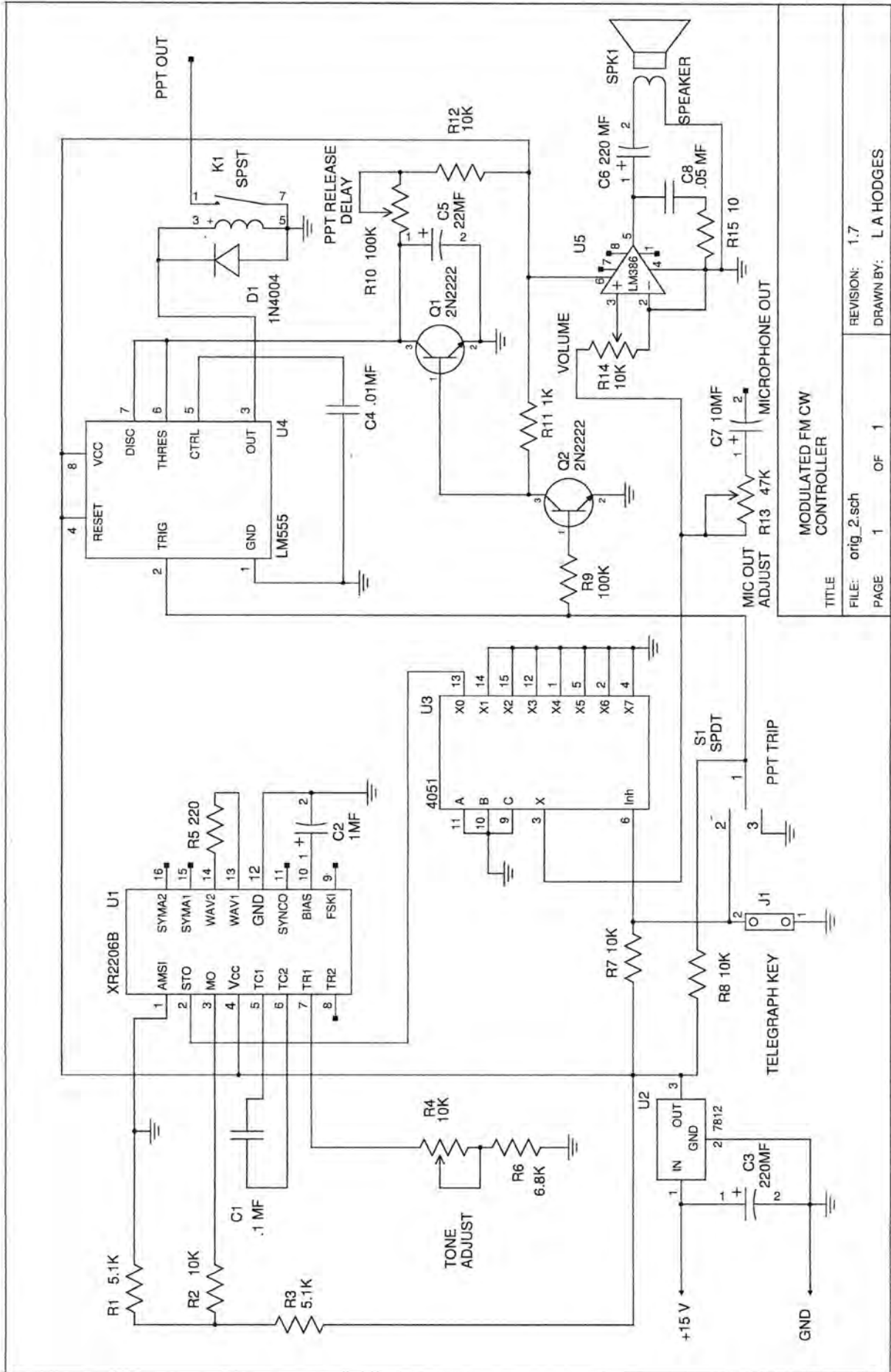
I had a small Radio Shack amplifier that I decided to use as my local monitor. I tried to use a LM386 audio amp chip but was not happy with the way it was working so I decided to go with the external amp.

I have tried this unit on the air and it seems to work well. It also makes a nice code practice oscillator with a nice clean tone. Parts are readily available with a majority of them from Radio Shack and the XR2206 and CD4051 from Arrow Electronics among others. To tell the truth most of the parts including the chips came from my junk box.

Now to give credit where credit is due. The original idea came from the January 1998 issue of QST on page 78 entitled "A MORSE CODE ADAPTOR FOR FM TRANSCEIVERS". The retriggerable LM555 idea came off of the internet from Terry Pinnell published on May 17, 2001. The CD4051 information came from National Semiconductor CMOS data book. The information on the XR2206 chip came from the EXAR Corporation web site data sheet area.

Lee A. Hodges - KC8IT1

INTEGRATED CIRCUITS	
U1	XR2206
U2	LM7812
U3	CD4051
U4	LM555
DIODES	
D1	1N4004
TRANSISTORS	
Q1	2N2222
Q2	2N2222
CAPACITORS	
C1	.1 MF
C2	1MF ELECTROLYTIC
C3	220MF ELECTROLYTIC
C4	.01MF
C5	22MF ELECTROLYTIC
C6	.01MF
C7	10MF ELECTROLYTIC
RESISTORS	
R1	5.1K
R2	10K
R3	5.1K
R4	10K VARIABLE
R5	220 OHMS
R6	6.8K
R7	10K
R8	10K
R9	100K
R10	100K VARIABLE
R11	1K
R12	10K
R13	47K VARIABLE
MISC	
K1	12V SPST RELAY
S1	SWITCH SPDT



TITLE MODULATED FM CW CONTROLLER

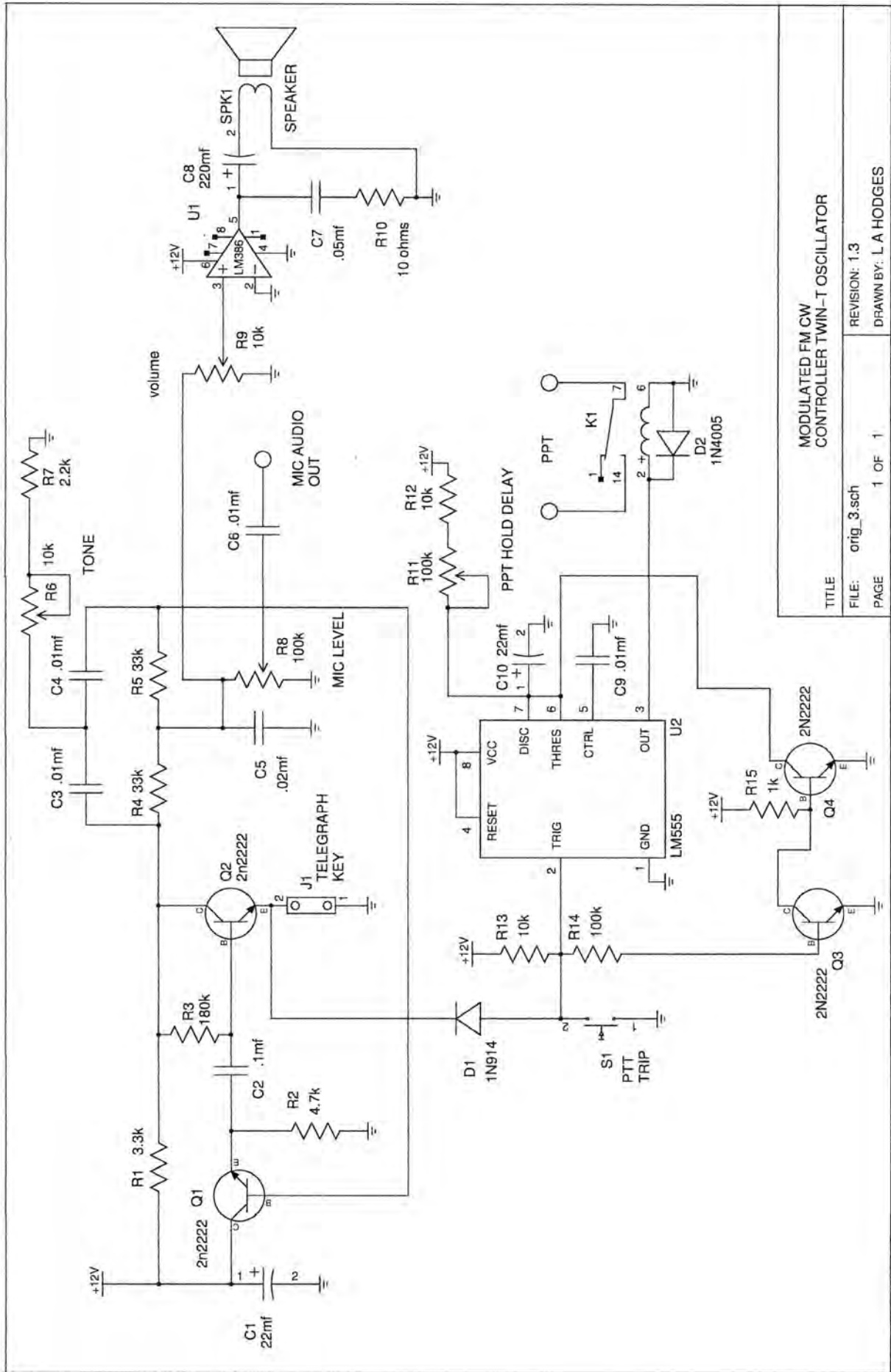
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PAGE 1 OF 1

REVISION: 1.7

DRAWN BY: LA HODGES

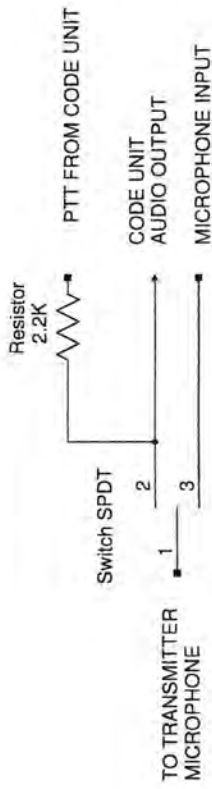
INTEGRATED CIRCUITS	
U1	XR2206
U2	LM7812
U3	CD4051
U4	LM555
U5	LM386
DIODES	
D1	1N4004
TRANSISTORS	
Q1	2N2222
Q2	2N2222
CAPACITORS	
C1	.1 MF
C2	1MF ELECTROLYTIC
C3	220MF ELECTROLYTIC
C4	.01MF
C5	22MF ELECTROLYTIC
C6	220MF ELECTROLYTIC
C7	10MF ELECTROLYTIC
C8	.05 MF
RESISTORS	
R1	5.1K
R2	10K
R3	5.1K
R4	10K VARIABLE
R5	220 OHMS
R6	6.8K
R7	10K
R8	10K
R9	100K
R10	100K VARIABLE
R11	1K
R12	10K
R13	47K VARIABLE
R14	10K
R15	10 OHMS
MISC	
K1	12V SPST RELAY
S1	SWITCH SPDT
SPK1	8 OHM SPEAKER



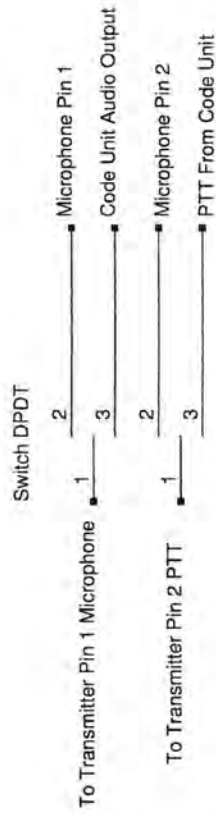
MODULATED FM CW
CONTROLLER TWIN-T OSCILLATOR

TITLE: orig_3.sch
 FILE: 1 OF 1
 REVISION: 1.3
 DRAWN BY: L.A. HODGES

INTEGRATED CIRCUITS	
U1	LM386
U2	LM555
DIODES	
D2	1N914
D2	1N4005
TRANSISTORS	
Q1	2N2222
Q2	2N2222
Q3	2N2222
Q4	2N2222
RESISTORS	
R1	3.3k
R2	4.7k
R3	180k
R4	33k
R5	33k
R6	10k VARIABLE
R7	2.2k
R8	100k VARIABLE
R9	10k VARIABLE
R10	10 ohms
R11	100k VARIABLE
R12	10k
R13	10k
R14	100k
R15	1k
MISC	
K1	12V SPDT RELAY
S1	SWITCH SPST
SPK1	8 OHM SPEAKER
CAPACITORS	
C1	22MF ELECTROLYTIC
C2	.1mf
C3	.01mf
C4	.01mf
C5	.02mf
C6	.01mf
C7	.05mf
C8	220MF ELECTROLYTIC
C9	.01mf
C10	22MF ELECTROLYTIC



SWITCH BOX FOR INTERCONNECTION TO A RADIO SHACK HTX-202



Lines for Pins 3-6 pass through from input to output

SWITCH BOX FOR INTERCONNECTION TO AN ALINCO DR-150T 8 PIN MICROPHONE

DIAGRAMS FOR MAKING SWITCH BOXES FOR DIFFERENT TRANSCEIVERS

TITLE

FILE: orig_4.sch

PAGE

REVISION: 1

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1 OF 1

