

**Rig Summary:** YouKits EK-1 is a 40/30/20M CW QRP rig with plenty of functions and good performance for \$189 (2017). For its simplicity, it has a fairly clever SA602 and DDS based circuit. The receiver is quite sensitive and transmitter delivers a full 5W on 20 and 40M, 4W on 30M. Features include DDS frequency generation, encoder tuning with variable steps, VFO and MEMory modes, RIT, LCD display of frequency and mode information, and supports both CW paddles with internal keyer or a straight-key.

**Mechanical:** The rig is well built at 4.25"x1.8"x 4.25" (WHD) – 5.35" deep including knobs and BNC antenna connector, making it ideal for SOTA or portable use. External DC power required; batteries optional from YouKits.

**Models:** The EK-1A is no longer available, replaced by the nearly identical EK-1C with improved 30M xmit filtering and minor digital display changes.

**Documentation,** specifications, or schematics are scarce, and hence the purpose of this document. See YouKits website for User's Manual.

**On-the-air:** The two EK-1A rigs tested have been used for QSOs and during the 2017 Straight Key Night with good results using tuned antennas.

**Schematics** are not published by YouKits. Those attached are based on a brief initial release version found and by "reverse engineering" the circuit and PCB. It is believed the EK-1C is virtually identical with the addition of the 30M output filters and relay switches. Voltages and waveforms have been added to the schematics to assist in troubleshooting.



Lab tests by NA5N on two YouKits EK-1A belonging to Chuck Adams K7QO and Paul Harden NA5N.

Equipment used:

Tektronix TDS3032B 300MHz oscilloscope (not shown)

Tektronix 7L13 Spectrum Analyzer

H-P 5315B Frequency Counter

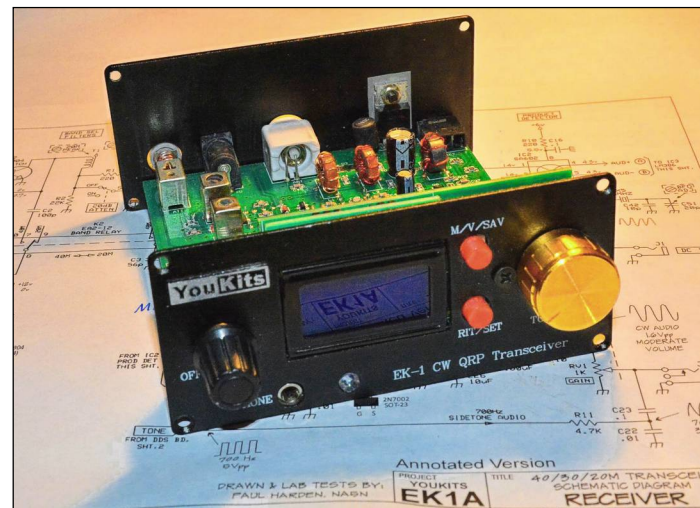
Wavetek 3006 1KHz–520MHz Signal Generator

**NOTE ON 30 Meters:** On the EK-1A, a modification was performed by the user to activate the 30M band. The EK-1A uses the 20M output filter for 30M which reduces the 2nd harmonic by only 26dB. **This is not FCC compliant** and no doubt why YouKit had the user activate 30M as an option. This shortcoming has been corrected in the EK-1C. Harmonic and spurious rejection on 40M and 20M well exceeds the FCC requirement of –43dBc.

This document was prepared since little technical information on the EK-1 is available with all attempts to make it as accurate as possible.

# The Handiman's Guide to YouKits 40/30/20M QRP TRANSCEIVER EK-1A

(Applicable to model EK-1C)



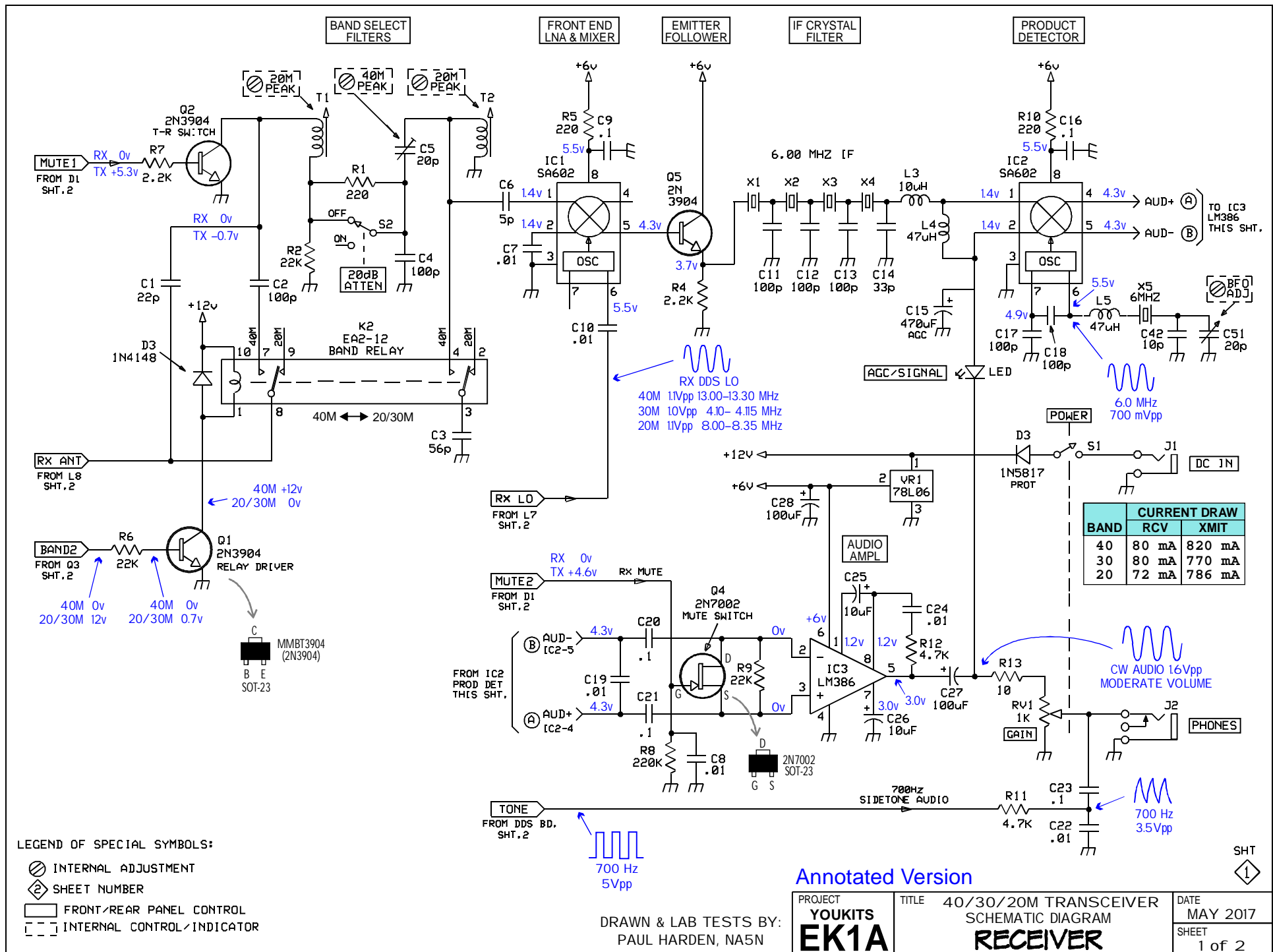
Schematic Diagrams  
*annotated with voltages, waveforms, specifications*

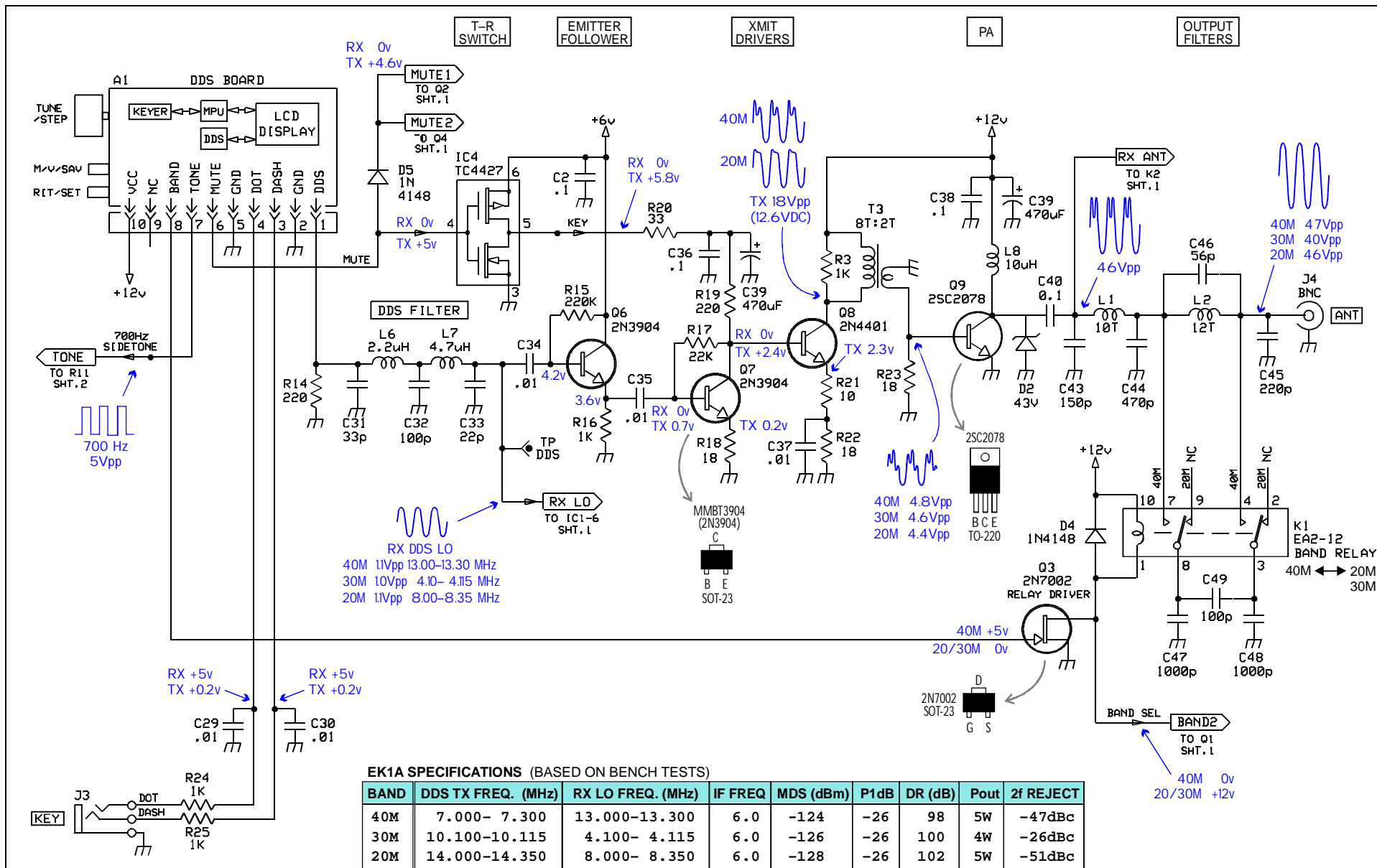
Lab Tests  
*oscope & spectrum analyzer waveforms, measurements*  
Troubleshooting  
*using lab tests data and annotated schematics*

by Paul Harden, NA5N <na5n@zianet.com>  
with assistance from Chuck Adams, K7QO

Revised July 2017

EK1 available from: <https://youkits.com> and <http://www.vibroplex.com>





Annotated Version

DRAWN & LAB TESTS BY:  
PAUL HARDEN, NA5N

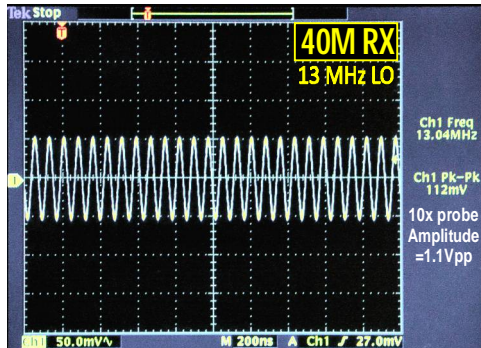
PROJECT <b>YOUKITS</b> <b>EK1A</b>	TITLE 40/30/20M TRANSCEIVER SCHEMATIC DIAGRAM <b>TRANSMITTER</b>	DATE MAY 2017
		SHEET
		2 of 2



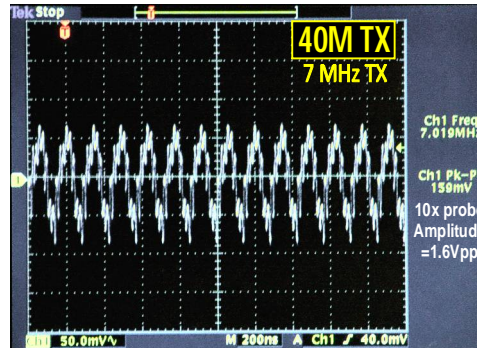
## EK-1A OSCILLOSCOPE WAVEFORMS

### DDS - DIRECT DIGITAL SYNTHESIZER

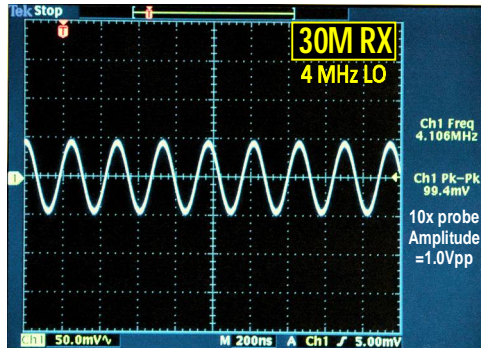
Measured at Test Point "DDS" (near IC4)



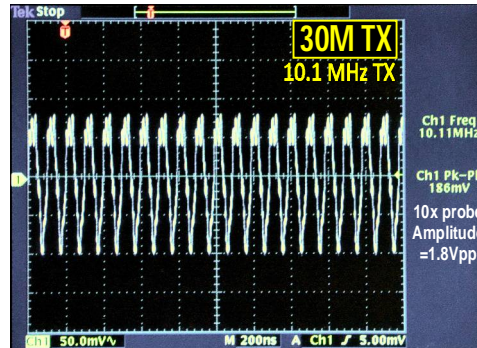
40M DDS RX LO = 13.00–13.30 MHz @ ~1Vpp



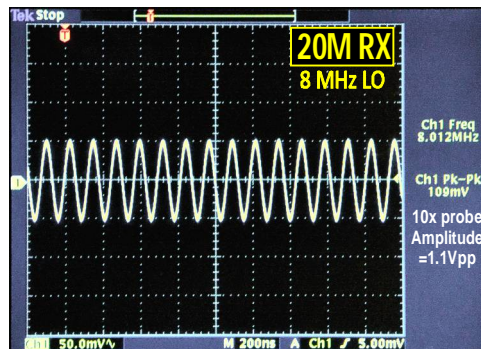
40M DDS TX FREQ. = 7.00–7.30 MHz @ ~1.6Vpp



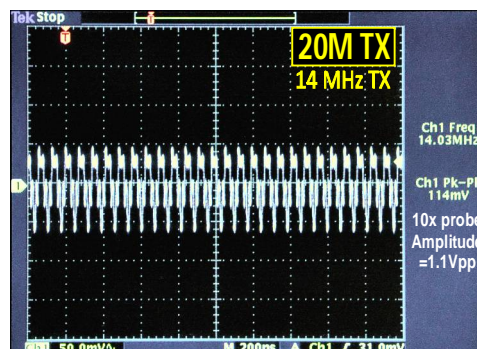
30M DDS RX LO = 4.100–4.115 MHz @ ~1Vpp



30M DDS TX FREQ. = 10.100–10.115 MHz @ ~1.8Vpp



20M DDS RX LO = 8.000–8.350 MHz @ ~1Vpp

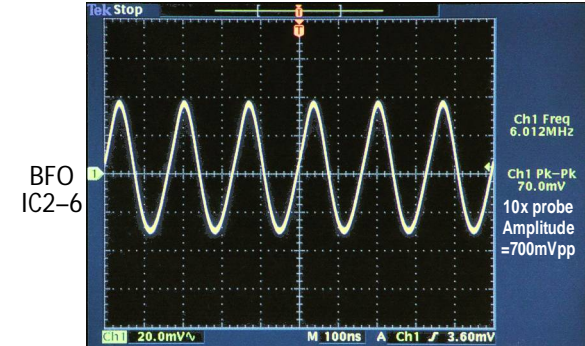


20M DDS TX FREQ. = 14.000–14.350 MHz @ ~1.1Vpp

On each band, the DDS provides the proper local oscillator (LO) frequency to the receiver mixer plus the RIT offset, on **receive**; on key-down, the DDS shifts to the desired **transmit** frequency. DDS output on receive should be about 1Vpp all bands.

### RECEIVER PRODUCT DETECTOR BFO

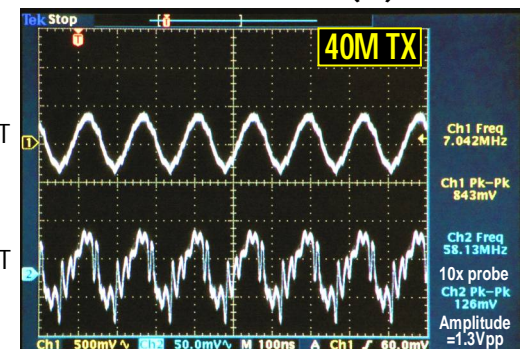
BFO/IF FREQ. = 6.00 MHz (all bands)



BFO  
IC2-6

SA602 mixer IC2 requires ~700mV BFO injection for proper conversion

### XMIT EMITTER FOLLOWER (EF) Q6

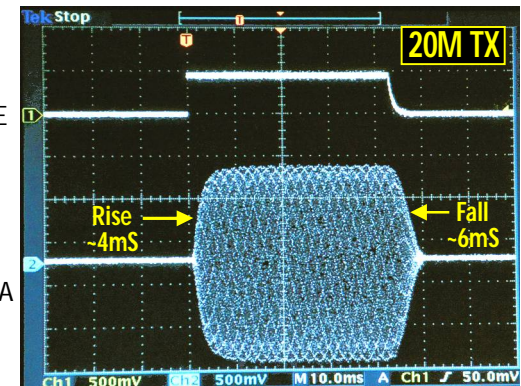


CH. 1  
EF INPUT  
Q6-b

CH. 2  
EF OUTPUT  
Q6-e

EF output Q6-e "cleaned up" by Q8 and T3

### CW KEY SHAPING



CH. 1  
KEYLINE  
IC4-5

CH. 2  
RF OUT  
ANTENNA

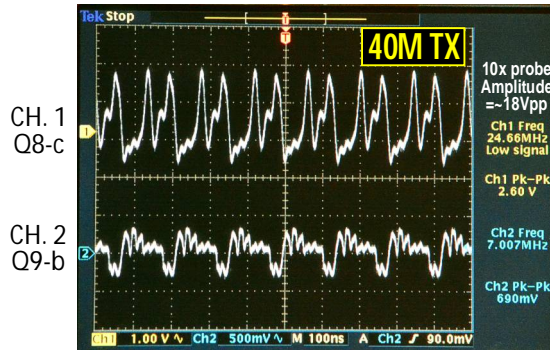
Some rise/fall time prevents "key clicks" on transmit



# EK-1A OSCILLOSCOPE WAVEFORMS — TRANSMITTER

## PA DRIVER

CH. 1: PA Driver, Q8-c/T3  
CH. 2: PA base drive, Q9-b



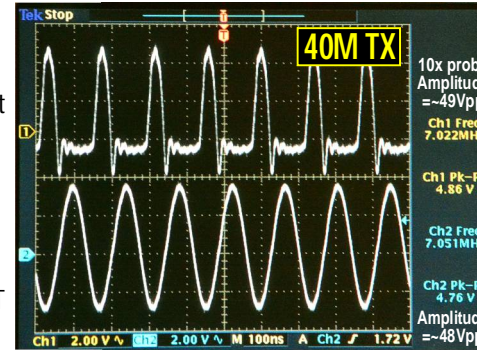
Q8-c 10x probe, 7MHz+harmonics = ~18Vpp  
Q9-b (PA base drive) 1x probe = ~700mVpp

CH. 1  
PA out  
Q9-c

CH. 2  
ANT  
RF OUT

## PA OUT & RF ANTENNA OUT

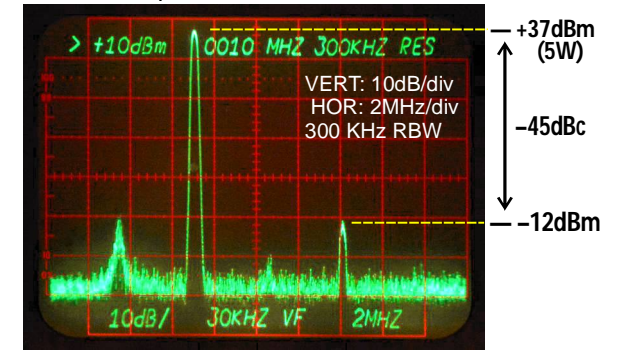
CH. 1: PA out, Q9-c (2SC2078)  
CH. 2: Ant. out (after LPF filters)



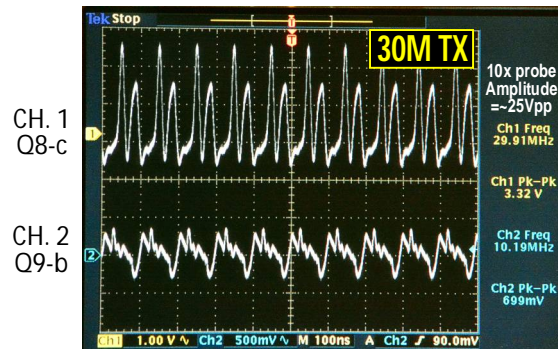
PA Q9-c should be <50% duty cycle for Class C  
Clean sinewave RF output due to output filters

## RF OUTPUT SPECTRUM

Measured with inline 30dB directional coupler.  
Ref. level (top division) is +40 dBm (not +10)



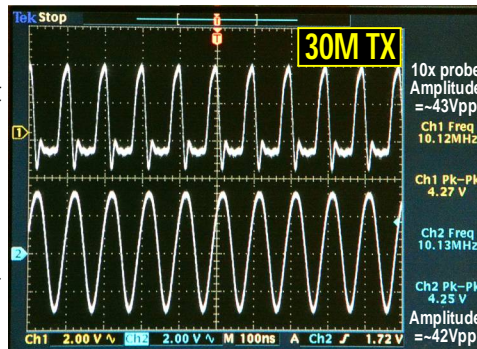
7 MHz 10 MHz 14 MHz  
40M spurious 3.58 MHz and 2nd harmonic -45 dBc



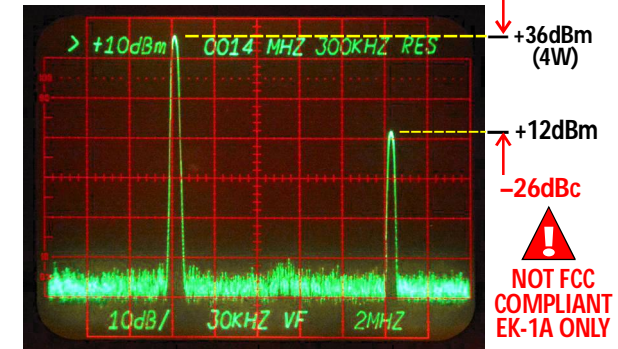
Q8-c 10x probe, 10MHz+harmonics = ~24Vpp  
Q9-b (PA base drive) 1x probe = ~700mVpp

CH. 1  
PA out  
Q9-c

CH. 2  
ANT  
RF OUT



4W = +36 dBm = 14.1Vrms = 40Vpp  
5W = +37 dBm = 15.8Vrms = 45Vpp



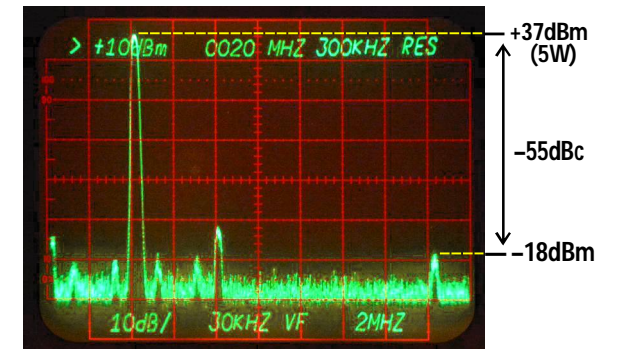
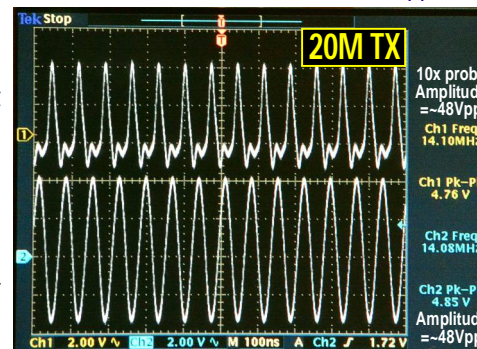
10.1 MHz 14 MHz 20.2 MHz  
30M 2nd harmonic -26 dBc (EK-1A model only)



Q8-c 10x probe, 14MHz+harmonics = ~24Vpp  
Q9-b (PA base drive) 1x probe = ~700mVpp

CH. 1  
PA out  
Q9-c

CH. 2  
ANT  
RF OUT



14 MHz 20 MHz 28 MHz  
20M 2nd harmonic -55 dBc

NOT FCC COMPLIANT  
EK-1A ONLY