

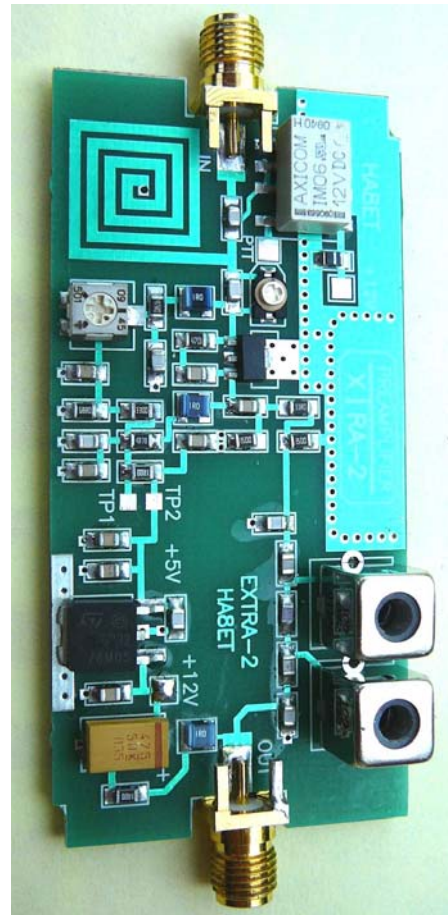
EXTRA-2

144 MHz CONTEST PREAMPLIFIER

Designed by HA8ET

Technical data:

Frequency range:.....144-146 MHz
Input/Output impedance: 50 Ω
Gain:..... >19,5 dB
Noise Figure.....<0,8 dB
S11:..... -14,3 dB @ 144MHz
Supply voltage:..... +12...15V/140mA
IP3.....> 22 dBm
+40 dBm IP3 GaAs FET (ATF-53189)
Excellent broadcast rejection
Unconditionally stable
Moderate sensitivity to ESD
Powered through antenna feed line, or separately
Connectors:.....BNC Females
Dimensions:.....74 x 37 x 30 mm



Introduction

The high number of extremely high signal levels at VHF contests causes bigger and bigger problems (spreading of multi-PAs, multi-antennas contest stations) nowadays. Hence low noise figure is no longer the primary requirement, rather strong signal performance (IMD characteristics) is.

Construction

This preamplifier was produced to replace circuits built with ATF-54143 pHEMPT FET. The ATF-54143 pHEMT is very sensitive to static voltages and TX power. Though the noise figure is favourable, the device is not stable unconditionally. This can cause many problems in the case of a nearby broadcasting or cellular base station.

"Avago Technologies' **ATF-53189** is a high linearity, medium power, low noise E-pHEMT FET in a low cost surface mount SOT89 package." The package has two source leads with

large surface areas for efficient heat dissipation and low inductance RF grounding. The enhancement mode technology provides superior performance while allowing a dc grounded source amplifier with a single polarity power supply to be easily designed and built. The enhancement mode PHEMT requires about a 0.6V potential between the gate and source, V_{GS} , for the target drain current, I_{DS} .

The applied voltage feedback improves the K stability factor. This does not cause significant noise figure increase. The gain of the FET at 145 MHz is approximately 30 dB, being too high. The amplification can be reduced from 30 to 24 dB with a 6 dB attenuator at the output of the preamp. It can be changed to -10dB if needed.

The attenuator increases the K stability factor further. At the output a band pass filter can be found, which improves the out-of-band selectivity. The insertion loss of the filter reduces the unnecessarily high amplification further to 20...21 dB. At 100 MHz the broadcast rejection is higher than -60 dB.

The input circuit consists of a 'T' match with suitable low loss microwave capacitors and spiral inductor.

The proper input matching can be adjusted by the CT capacitor.

The K1 relay is needed to be built in if TX power is more than 200 W. If you connect ground potential onto the PTT connector, the K1 relay will short-circuit the inputs. Therefore the isolation of the coaxial relay can be increased by 28 dB in TX mode.

Adjustments

The (professional) PCBs are 1.5mm, FR4, double sided with plated through holes. The boards are solder resist coated and silk screened to show component designations, i.e. R1, C1 etc.

I recommend soldering the spare parts with hot air soldering tool. At the bottom side the PCB must be soldered to the walls of the box at the IC1, the spiral inductor, the band pass filters and the 2 BNC sockets.

Then connect 12...15 V to the amplifier and adjust the needed 135 mA drain current with the potentiometer. In this way 135 mV can be measured between the TP1 and TP2 testpoints.

Then tune the L3 L4 TOKO inductors to the maximal sign of a beacon. The CT capacitor is set to the maximal default value at the input. The capacity must be reduced to that value where the current and original position of the marker meet an angle of 20 degrees. This status suits the noise minimum. 0

The preamplifier does not need other adjustments.

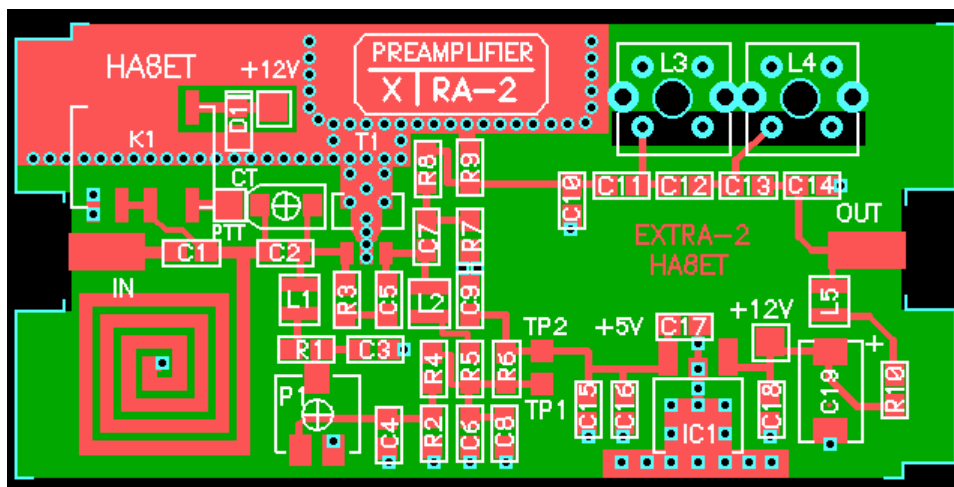
I wish a great success for every user.

Gyula

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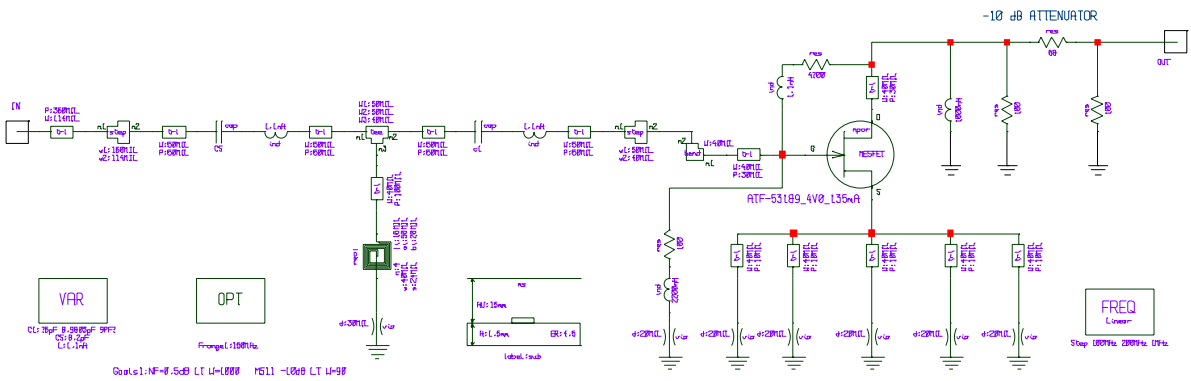
Part list

Reference	Value	Package	Distribut.	Type	Man.
CT	1,5-5 pF	SMD	Partminer	CTZ3E-05A-W-PF	AVX
C1 (Microwave!)	8,2 pF	0805	Partminer	08052U8R2CAT2A	AVX
C2 (Microwave!)	5,6 pF	0805	Partminer	08052U5R6CAT2A	AVX
C3, C6, C17	100 pF COG	0805	Farnell	C0805C101J5GAC	KEMET
C4, C5, C7, C8, C9, C16	1nF X7R	0805	Farnell	08055C102KAT2A	AVX
C10, C14	150 pF COG	0805	Farnell	C0805C151J5GAC	KEMET
C11, C13	56 pF COG	0805	Farnell	C0805C560J5GAC	KEMET
C12	3,3 pF COG	0805	Farnell	ERB21B5C2E3R3B	Murata
C15, C18	100 nF X7R	0805	Farnell	08055C104JAT2A	AVX
C19	4,7 uF/50 V	7343	Farnell	T495X475K050AT	KEMET
C20, C21 (Feed-through)	1 nF	-	Gigatechnik	BUBQ5-00	STELCO
L1, L2, L5	1000 nH	1008	TME	CW1008-1000	FerrocCore
L3, L4	24 nH	-	BEC	100072	TOKO
R1	47	0805	Farnell		
R2	68	0805	Farnell		
R3	4k7	0805	Farnell		
R4	330	0805	Farnell		
R5	4,7	0805	Farnell		
R6, R10	1	0805	Farnell		
R7, R9	150	0805	Farnell		
R8	33	0805	Farnell		
D1	-	0805	Farnell	1N4148 SMD	
T1	-	SOT-89	Farnell	ATF-53189	Avago
IC1	-	D-PAK	Farnell	78M05CDT	STM
P1	500	SMD	Farnell	TS53YJ500R	VISHAY
K1	-	SMD	Farnell	IM06GR	TYCO
Box	-	-	-	37 X 74 X 30 mm	
Connectors	BNC Female	-	Farnell	1-1337446-0	TYCO
PCB	-	-	HA8ET	71,5 X 34,5 mm	HA8ET

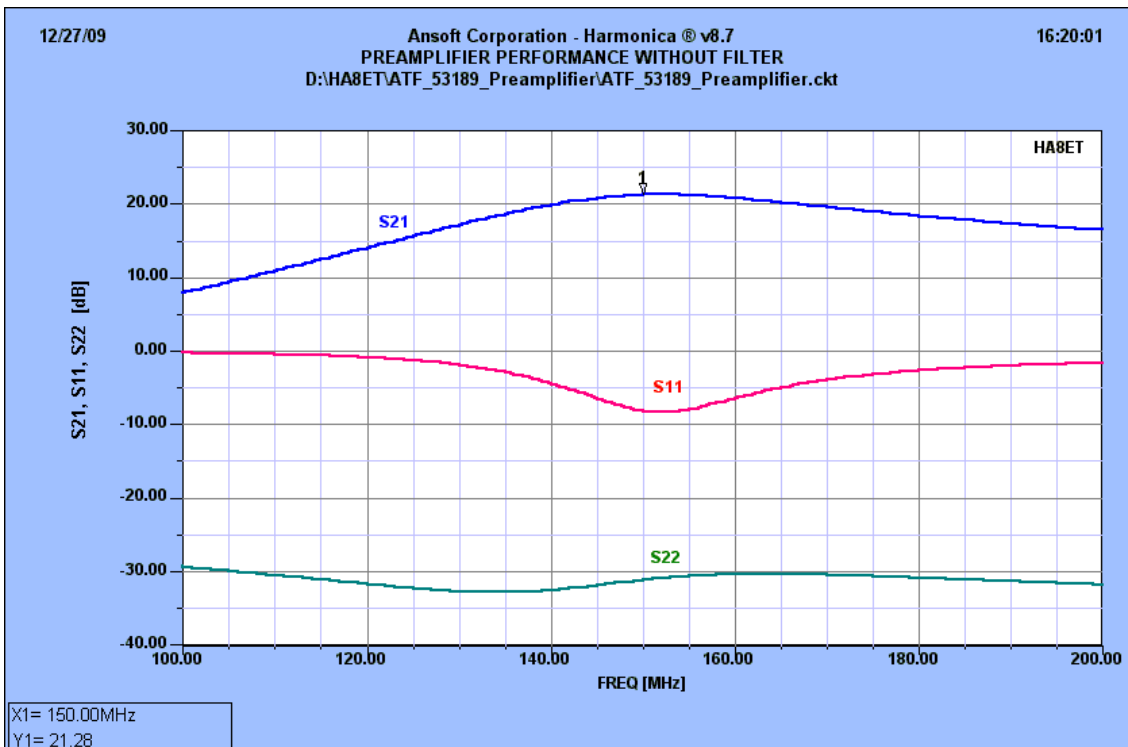


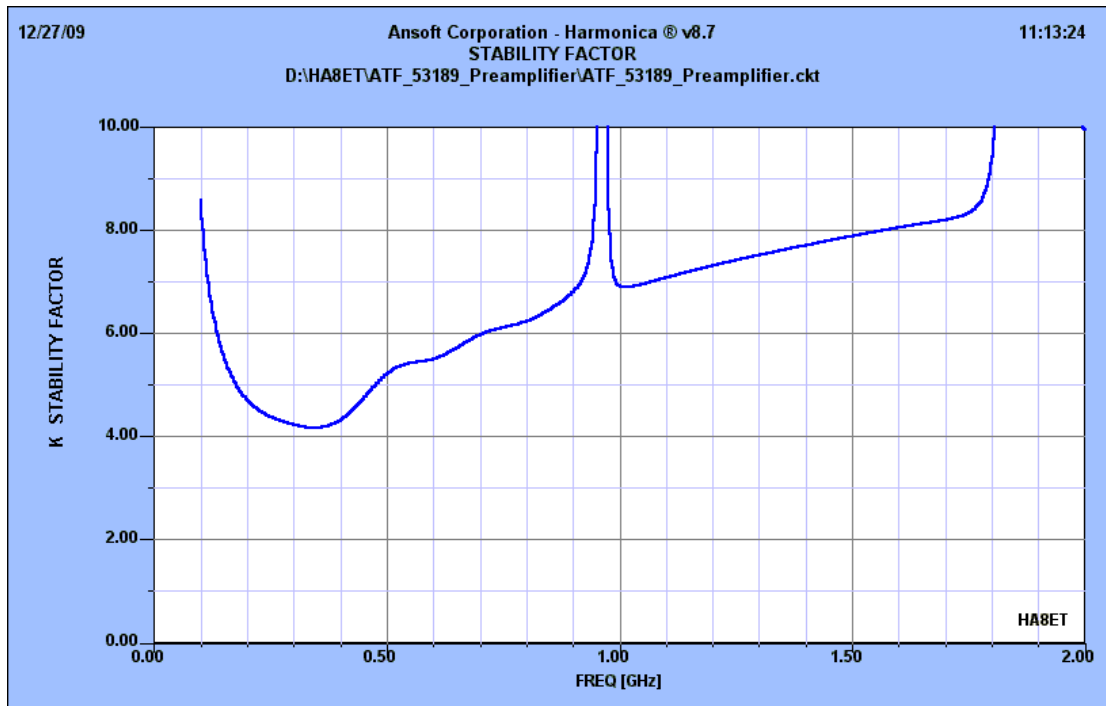
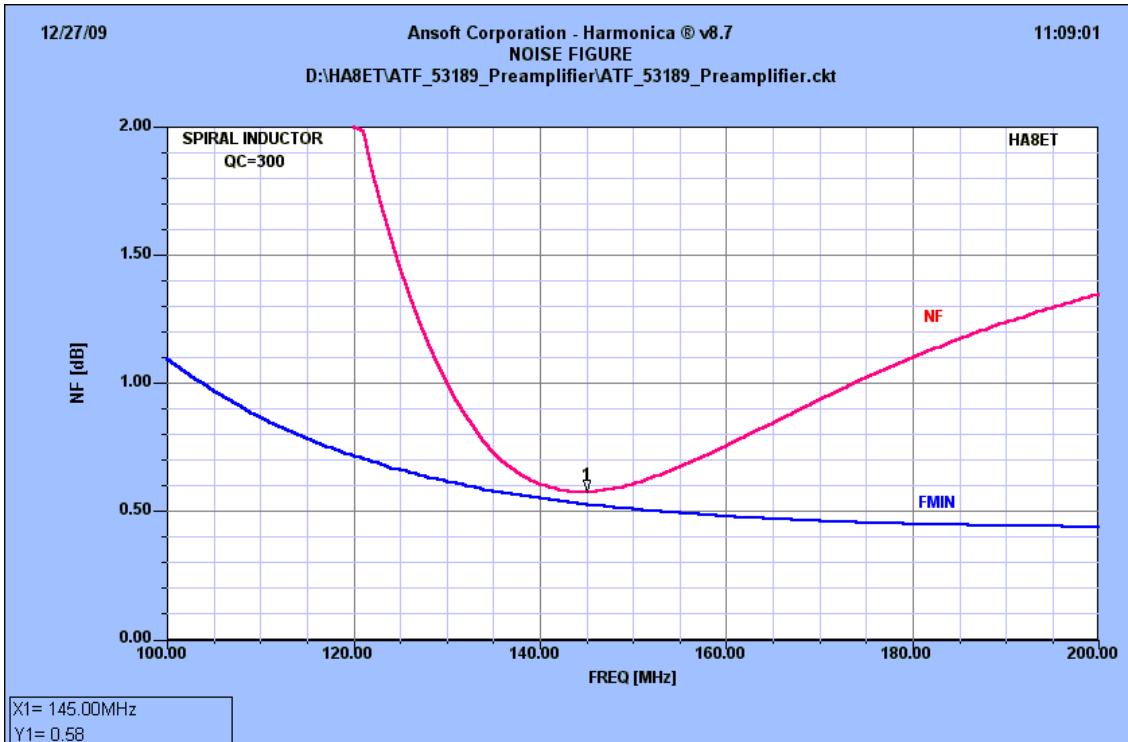
Component layout

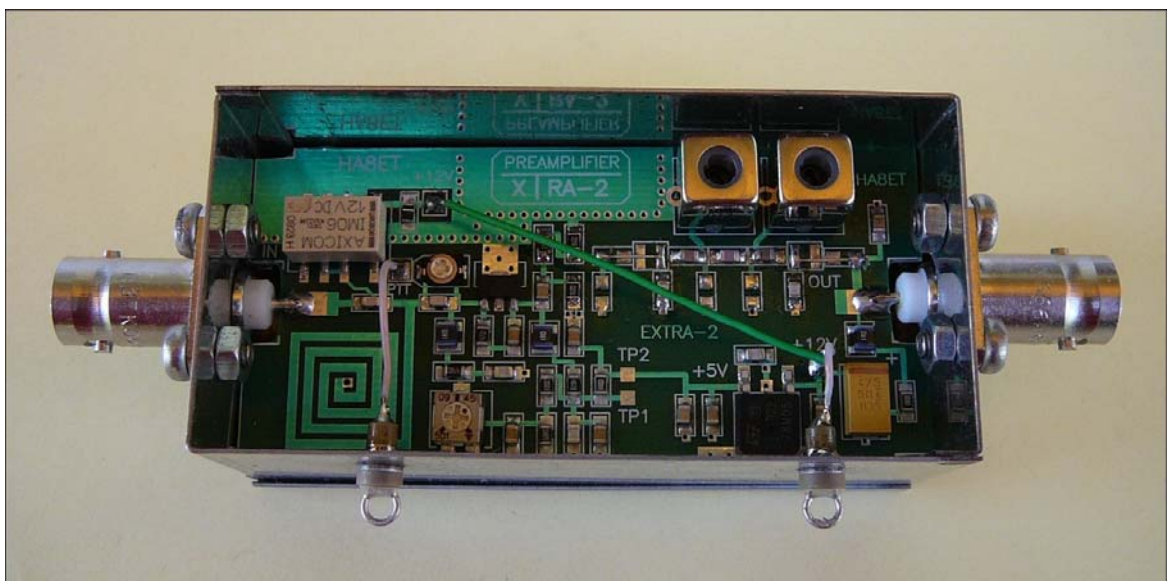
ATF_53189 144MHz PREAMPLIFIER
HABET

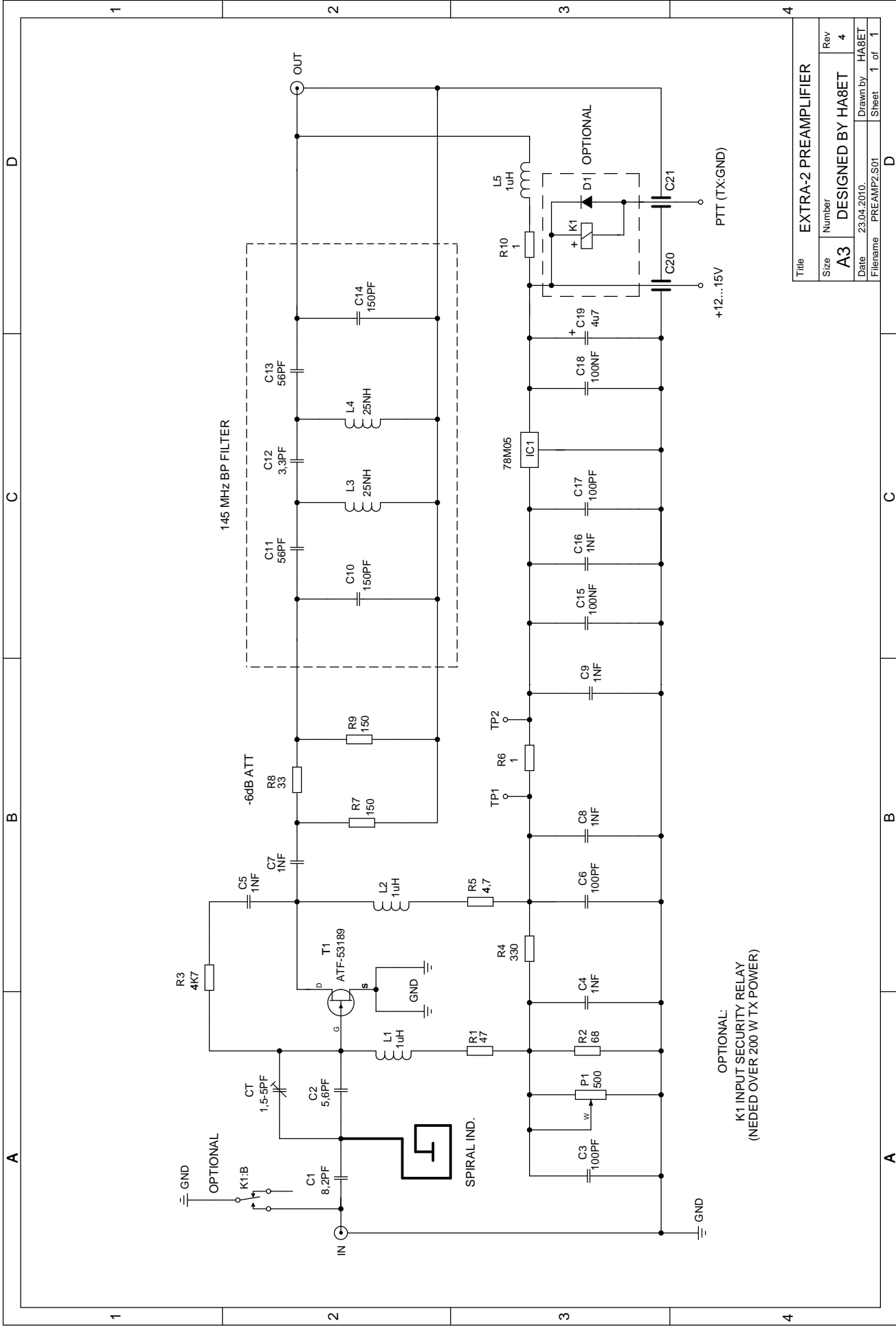


Circuit diagram in the ANSOFT Serenade 8.7









Title		EXTRA-2 PREAMPLIFIER	
Size	Number	Rev	
A3	DESIGNED BY HA8ET	4	
Date	23.04.2010.	Drawn by	HA8ET
Filename	PREAMP2.S01	Sheet	1 of 1

OPTIONAL:
K1 INPUT SECURITY RELAY
(NEEDED OVER 200 W TX POWER)