PRELIMINARY DATA

gfba 144e

Environmentally housed 144MHz switched preamplifier

The GFBA 144e is a very high performance 'masthead' preamplifier for the 144-148MHz amateur band.

It is unique in using a 'noiseless' negative-feedback circuit (the result of several months research at muTek) around a MGF1200 gasfet, resulting in a very low noise figure with superb dynamic performance - an input third-order inter-modulation intercept point typically 12dB better than any 'competitive' gasfet amplifiers not using nfb techniques is obtained.

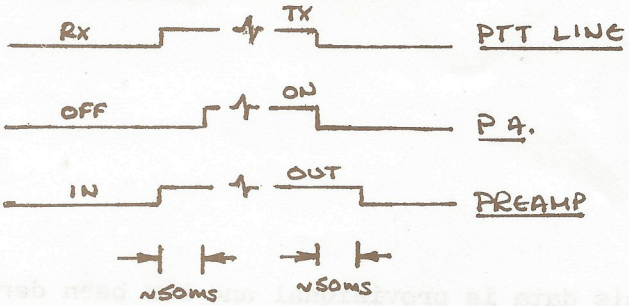
The use of 'noiseless' negative-feedback techniques means that the gasfet's inherently good noise figure is not compromised unduly. Conventional negative feedback circuit topologies can approach the signal handling performance of the circuit used in the GFBA 144e, however a large noise performance penalty is exacted. As an example, the MGF1200 can give noise figures of around 0.6dB at 144MHz when correctly noise-matched without the use of nfb. With conventional (resistive) feedback this increases to around 4dB! Using 'noiseless' feedback we see typical noise figures of around 0.75dB!

With the increasing occupancy of the vhf spectrum, the frequency response of a preamplifier is of paramount importance. It has always been a clear policy at muTek to ensure that our preamplifiers for specific bands have the best possible rejection of out of band signals. The GFBA 144e follows this tradition.

The internal rf transfer switching in the GFBA 144e is accomplished with coaxial relays. To ensure that long life is obtained from these expensive components, particularly when switching high powers, muTek limited will only supply the GFBA 144e with its companion ATCS 144s control sequencer. This unit provides sequenced switching functions for control of both the preamplifier and the station linear amplifier. The ATCS 144s operates from 11.5 - 14v dc and also provides power for the GFBA 144e via a separate two-core control cable. The use of a separate control cable is essential as the inevitable electrolytic corrosion occuring in rf connectors subjected to dc for long periods of time not only reduces reliability, but can also significantly degrade the performance of the amplifier in dynamic terms due to 'diode' effects.

The ATCS 144s will interface with all transceivers currently in use, having inbuilt 'rf sensing', as well as a full complement of hard switching functions.

ATCS 144s timing diagram.



Typical data

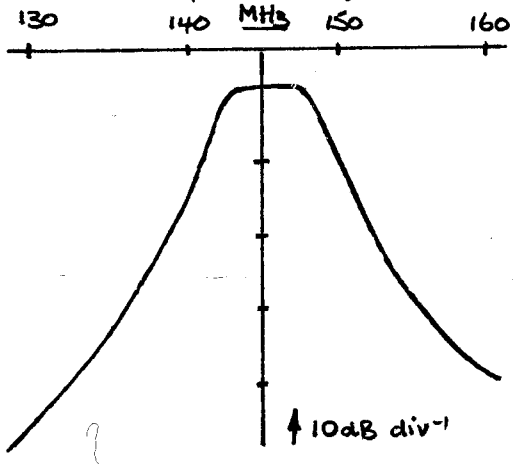
GFBA 144e

*Noise figure	<0.9dB
*Transducer Gain	+13dB
*Input third order intercept	+14dBm
*Output third order intercept	+27dBm
*1dB bandwidth	6MHz
*20dB bandwidth	15 MHz
*Power handling (maximum)	1kW pep (J3E) } antenna vswr 500W carrier (F3E) } = 1.1:1 500W pep (J3E) } antenna vswr 300W carrier (F3E) } = 2.0:1
*Size	160 x 80 x 55mm (excluding connectors and mounting bracket)
*Case details	Polycarbonate moulding generally to IP65 spec. but with 'breathing hole'
*RF connectors	typeN female

ATCS 144s

*Sequence delay	50ms
*Input modes	rf sensing dc on transceiver antenna port -'volts on receive' } switch -'volts on transmit' } selectable external 'ground on transmit' external 'volts on transmit'
*Output functions	'volts on receive' for GFBA 144e 'make on transmit' for power amp. (internally wirable to 'break on tx')

Bandpass response GFBA 144e



This data is provisional and has been derived from measurements made on early samples of the units described above. We expect the data to remain valid for future production, however we reserve the right to vary any parameter without notice.

PRELIMINARY DATA

gfba 144e

Environmentally housed 144MHz switched preamplifier

Thank you for buying muTek limited's GFBA 144e envoironmentally cased 144MHz band preamplifier. It represents a significant advance in the performance of low-noise amplifiers for the vhf spectrum: by the use of advanced 'noiseless' negative feedback circuitry, it has been possible to extend the strong-signal performance of the devices used, whilst maintaining a very low noise-figure.

The amplifier has inbuilt antenna transfer switching capable of handling up to 1kW in ssb service. This has been designed to operate in conjunction with the ATCS 144s controller/sequencer. Failure to do this is likely to result in considerable damage occuring to the preamplifier and will invalidate your guarantee.

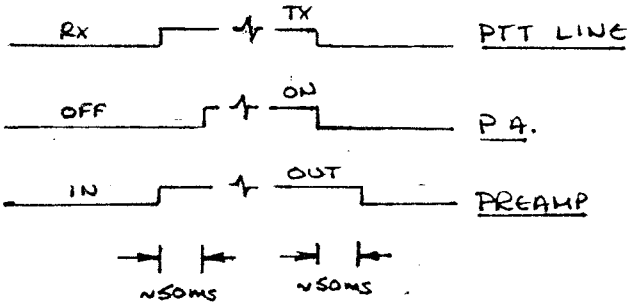
The ATCS 144s controller/sequencer is able to accept a wide variety of control signals from the transceiver: a positive voltage level present or a line grounded on transmit can be used to the unit, as can dc levels present at the the transceiver antenna socket. For those very few transceivers not providing some form of control output, an rf vox facility is also available. Hard switching is however very strongly recommended, and should be used wherever practicable

Circuit Description.

A shunt-L, series-L, shunt-C input matching network provides a noise-match to the gasfet feedback amplifier, this uses so-called noiseless-feedback in which the negative feedback is obtained in a non-dissipative manner by means of a transformer. This transformer is also used to provide a suitable output impedance transformation. The resistor across the secondary of this transformer serves only to damp unwanted spuriousphase-shifts at uhf and above. These can result in severe instabilities! As the resistor is effectively in the output of the amplifier it has no measurable effect upon noise figure.
The gasfet is biased using a bypassed source resistor. This is a superior method at vhf as the difficulties involved in bypassing the source adequately at higher frequencies do not apply, and the series resistive component provides some extra protection against overvoltage transients. Attention to possible supply-line transient damage has been given in the design of the power supply for the fet.
A feature of 'noiseless feedback' amplifiers is that they will only work properly if the load impedance is correct. To ensure this in the GFBA 144e, a second-stage amplifier with a highly linear bipolar transistor using negative feedback to further improve the linearity and provide well defined terminations is employed.
A fixed attenuator follows the second stage and has the dual purpose of correctly terminating the 3-pole output filter and also reducing the gain of the amplifier to managable proportions.
The amplifier dc supply is switched with the antenna relays which are energised in the receive mode only.

In order to maximise the life of the antenna relays and also to minimise the possibility of damage to the amplifier it is essential that the antenna transfer switching operation is completed before rf power is applied to the unit. This is the function of the ATCS144s.
The ATCS 144s is a comprehensive antenna changeover timer. It uses cmos logic to control via vmos driver transistors a pair of relays which interface with

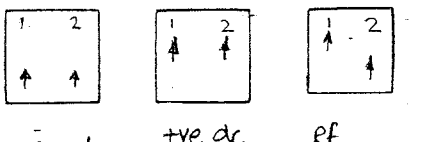
both the GFBA 144e and the station linear amplifier. The basic timing functions are generating a deliberate race between an and and an or gate resulting in the timing function shown graphically below. Other gate functions and some diode logic perform input processing.



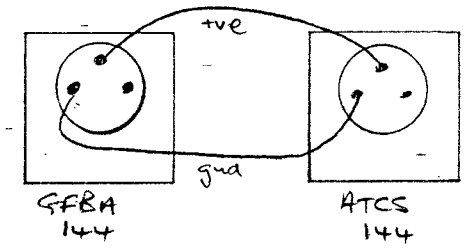
A wide variety of inputs may be used to control the sequencer. Many transceivers provide either a positive dc level or an externally accessible relay contact which makes to ground when on transmit. Other transceivers output a positive dc level via the antenna socket: this may be present either on transmit or receive. A few transeivers have no control output at all.
The ATCS will handle all of these!
As supplied the controller is set to accepteither a positive-going dc level or a make-to-ground on the appropriate input ports. A positive level on transmit present on the through rf line will also switch the unit. By altering an internal DIL switch the sense of this function may be reversed allowing operation with a positive dc level on receive. The DIL switch may also be set to allow the use of rf sensing, although this should only be used as a last alternative.

The ATCS 144s has two output ports. A three-pin socket provides dc supply to the GFBA 144e on receive, whilst an isolated make-on-transmit output is available to control a power amplifier. This may be internally rewired to provide a break-on transmit facility.
Control of the GFBA 144e by the sequencer is acheived via a two-core control cable. It is essential that the polarity of this link is observed. A separate control line has been selected over the usual 'dc-up-the-coax' scheme as it offers freedom from electrolytic corrosion in the coaxial cable and its connectors. This can easily result in reliability and intermodulation problems.

The GFBA 144e/ATCS 144s combination has been designed to operate from a nominal 13.8V supply. The current requirement is of the order of 250mA. It is important to ensure that at least 12.5V is present at the preamplifier when it is



DIL SWITCH SETTINGS



INTER-UNIT WIRING

commanded in the receive mode and the final length of control cable is installed.

A further point to observe in installation is that the preamplifier is mounted in a position such that the connectors are on the lower side of the case.

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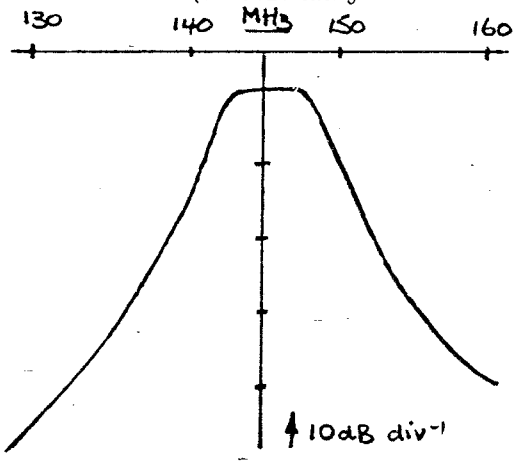
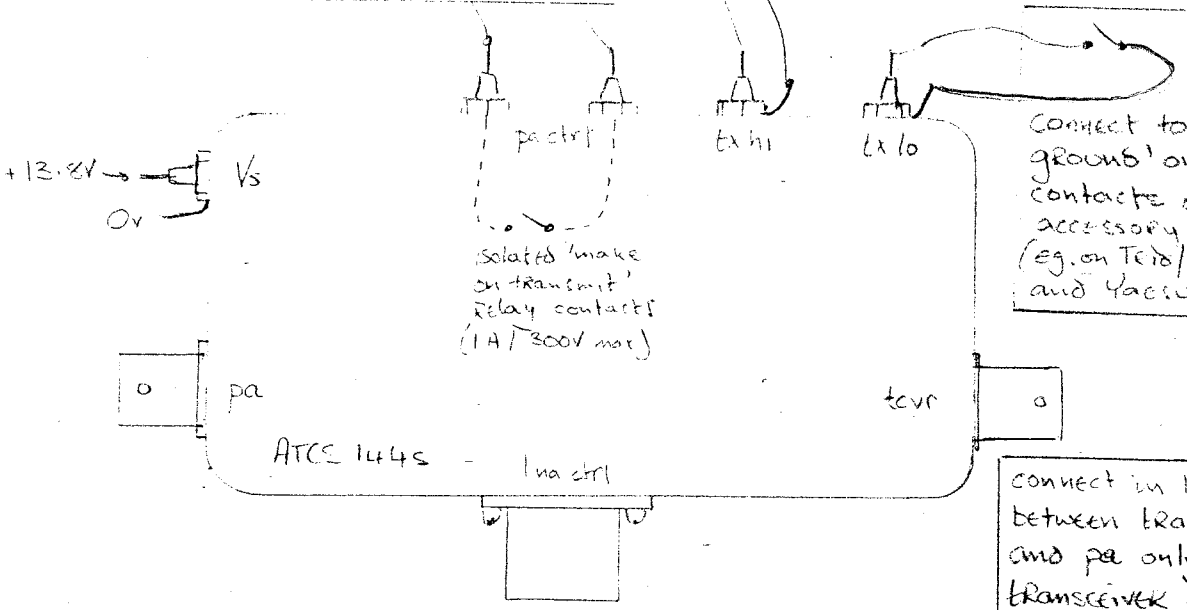
Bandpass response GFBA 144e



use these contacts to control p.a

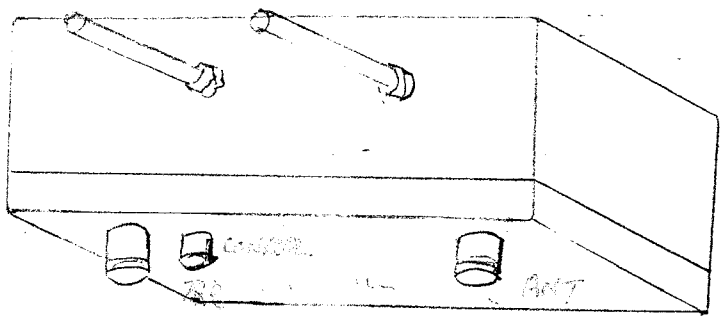
+5→18V on tx — connect to 'tve on transmit' line on tcvr accessory socket. eg Icom IC211/251



connect in line between transceiver and pa only if transceiver outputs hardswitching control on antenna socket. eg IC202

2-core cable to lna
(check that at least 12.5V is present at lna in Rx mode.)

ATCS 1446 INTERFACING DETAILS



MOUNT LNA WITH CONNECTORS DOWNWARDS!

GaAsFET 1446 MOUNTING DETAIL

Received 21st June 1983
G8GJJJ

muTek limited
rf technology

BRADWORTHY HOLSWORTHY DEVON EX22 7TU
Telephone: 0409 24-543

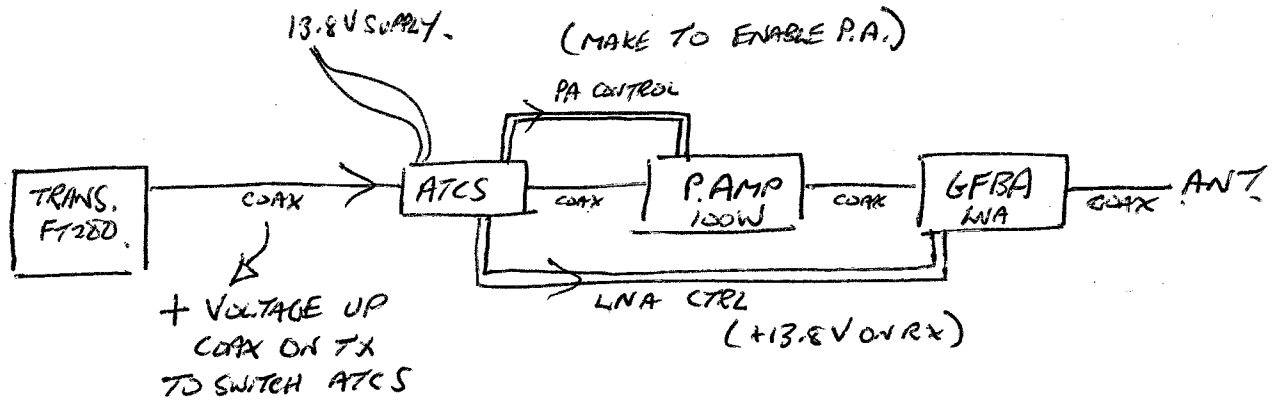
Revision.

If used with a power amplifier which has in-built r.f. switching, please disable this function so that the amplifier will only hard switch. This can usually be done by removing the appropriate r.f. "sniffing" capacitor from the amplifier input line. Any queries - please do get in touch.

With Compliments

G4JTJ
21/6/83.

GFBA 144 e PREAMP S/N° 3482
ATCS 144 S CONTROL BOX S/N° 3509



NOTES :- 1) RF VOX OF LINEAR AMP DISABLED.
2) FT280 MOD. TO GIVE +13.8V ON TX ON ANT. SOCKET.

Note there is no safety RF vox in the LNA!
Also the relays in the linear have to switch 100W because the TX is driving by the time the relays are energised. (would require inhibit of TX)
The LNA only has to switch the 10W from the transceiver.
The preamp can only be switched off and the linear on (if you want to.!) if the LNA control line is disconnected.