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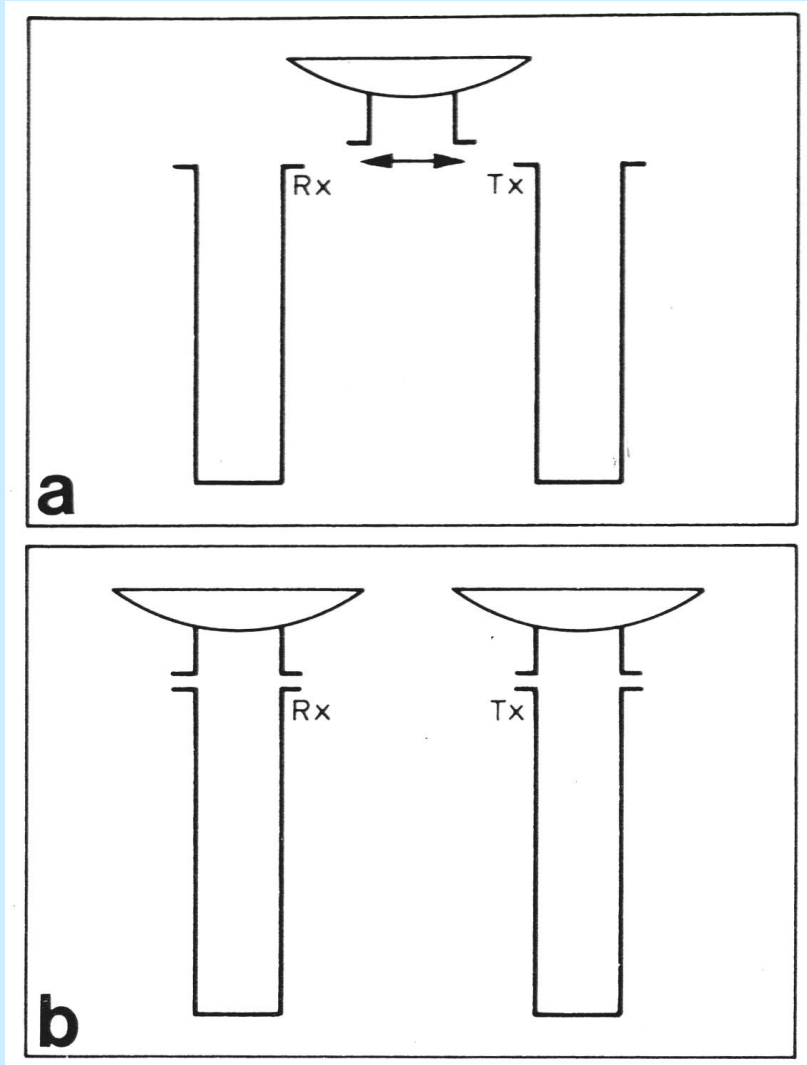
Simple 10 GHz Transmitters and Receivers

Barry G8AGN

What's Different ?

	<u>144 MHz</u>	<u>10 GHz</u>
Tx output	1 - 100 W	1 - 50 mW (wideband) 5 μ W - 10 W (narrowband)
Bandwidth	2.5 - 12.5 kHz	50 - 250 kHz (wideband)
Antenna Gain	0 - 20 dB	6 - 50 dB
Antenna Beamwidth	360 - 15 deg	180 - 1 deg

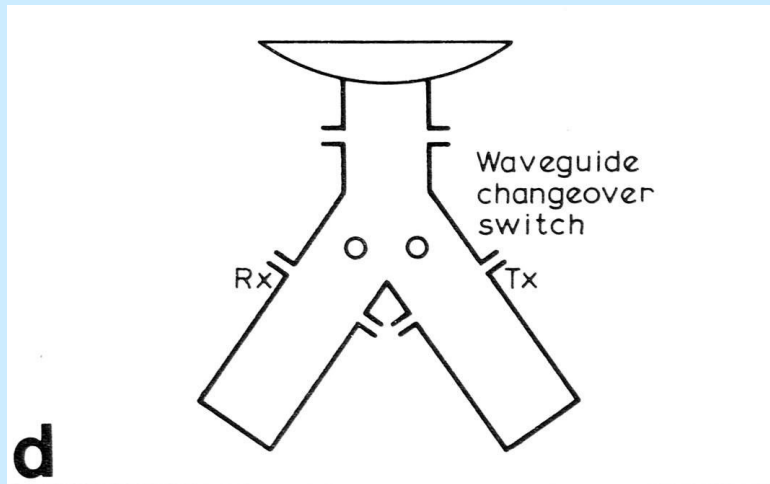
Transceiver arrangements - 1



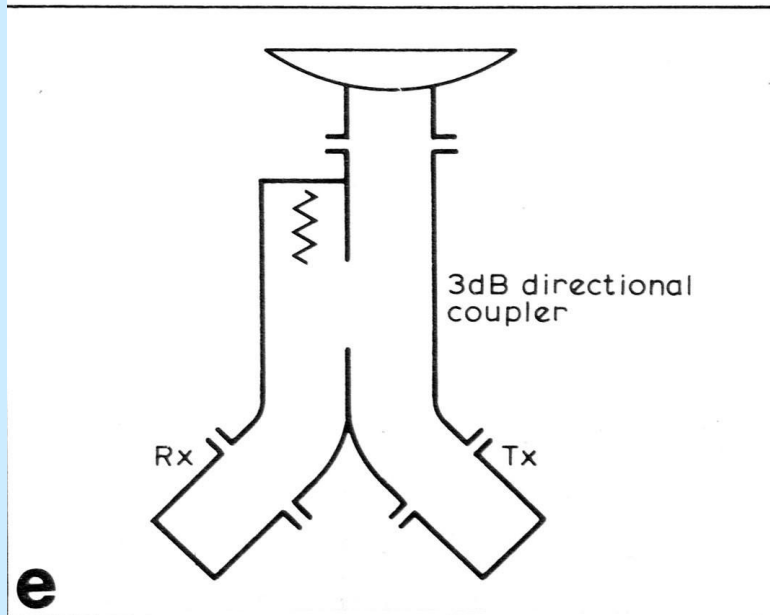
Swap antenna between
Tx and Rx

Separate antennas
for Tx and Rx

Transceiver arrangements - 2

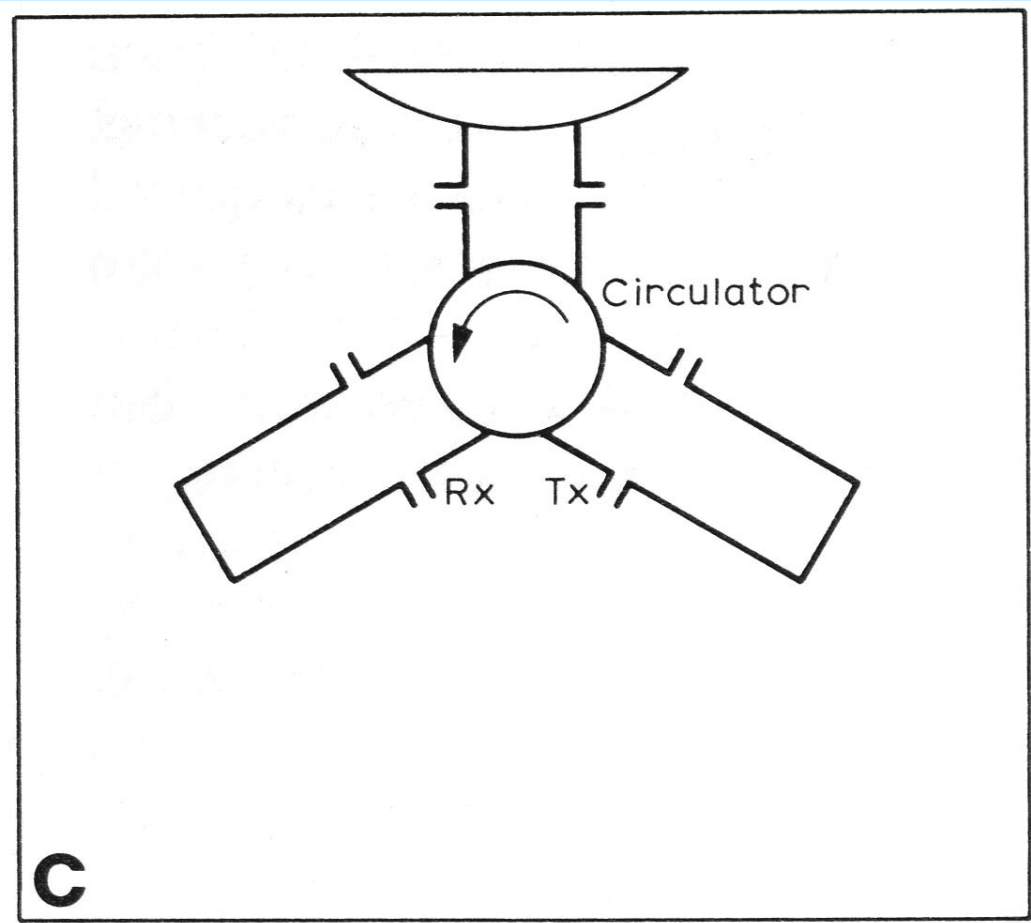


One antenna with
change-over switch



One antenna with
3 dB power splitter

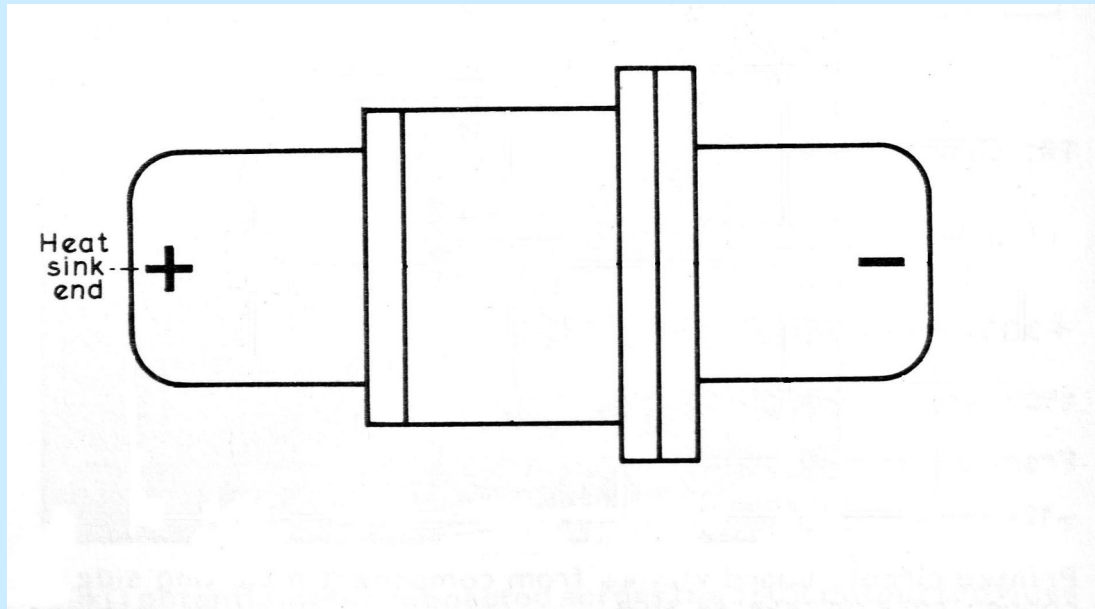
Transceiver arrangements - 3



One antenna with
circulator

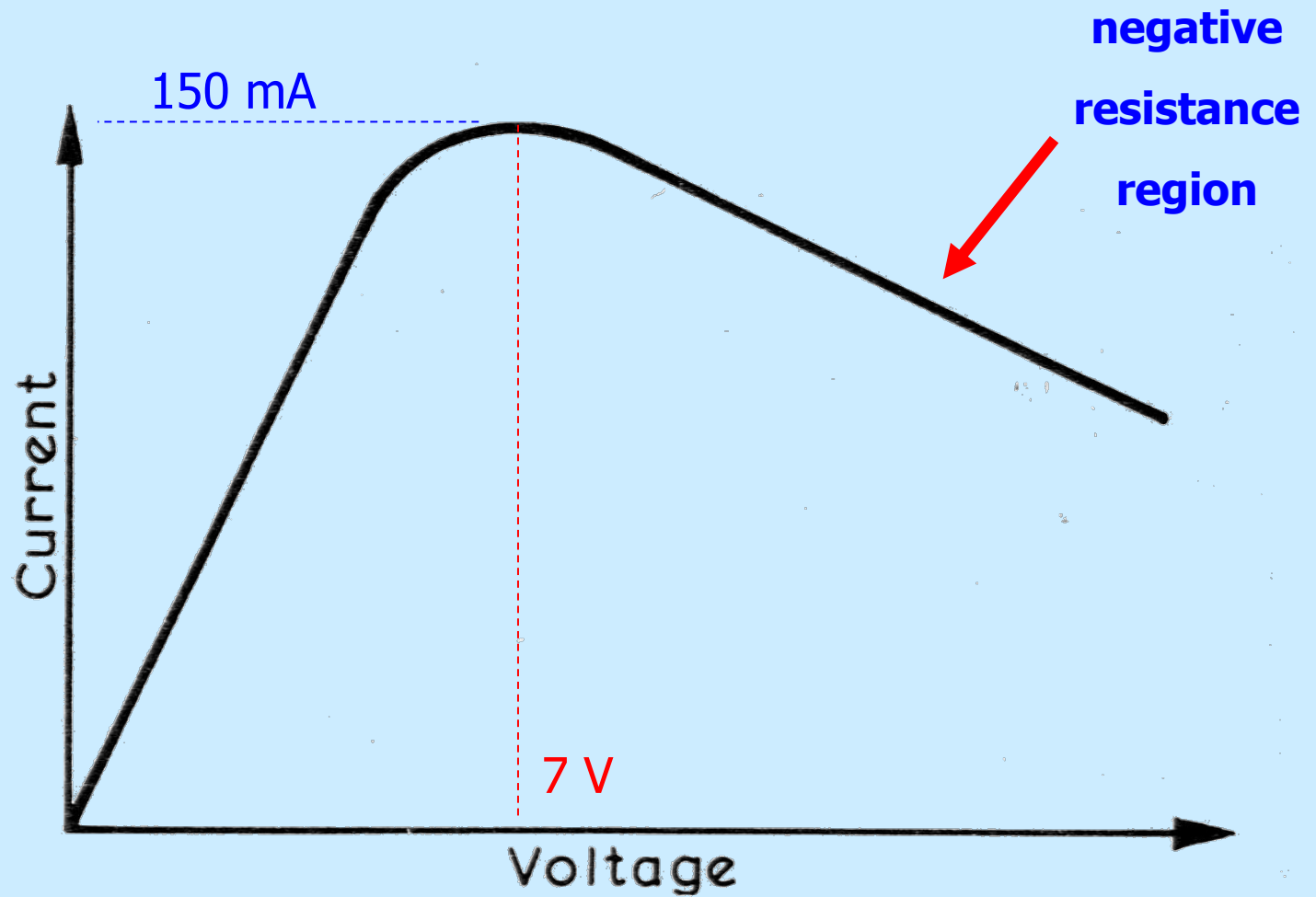
The Gunn Diode

An easy way to generate 10 GHz microwaves



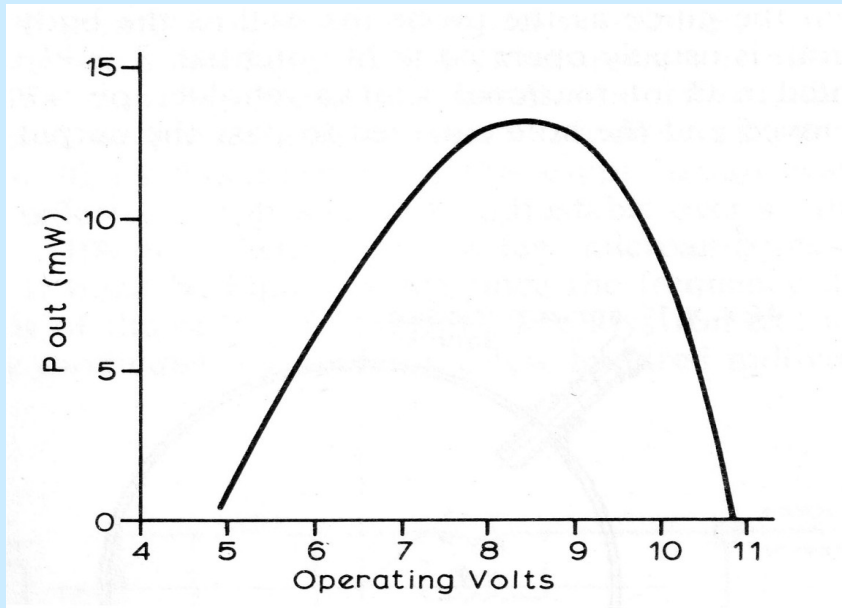
Note the polarity !

Gunn Diode Characteristics

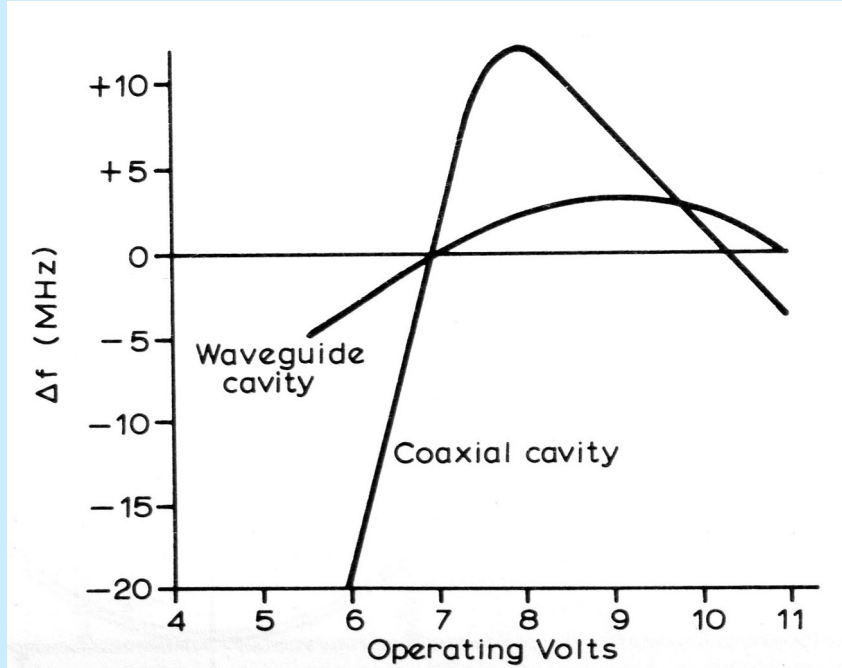


Gunn Diode oscillator

Power Output vs Bias Voltage



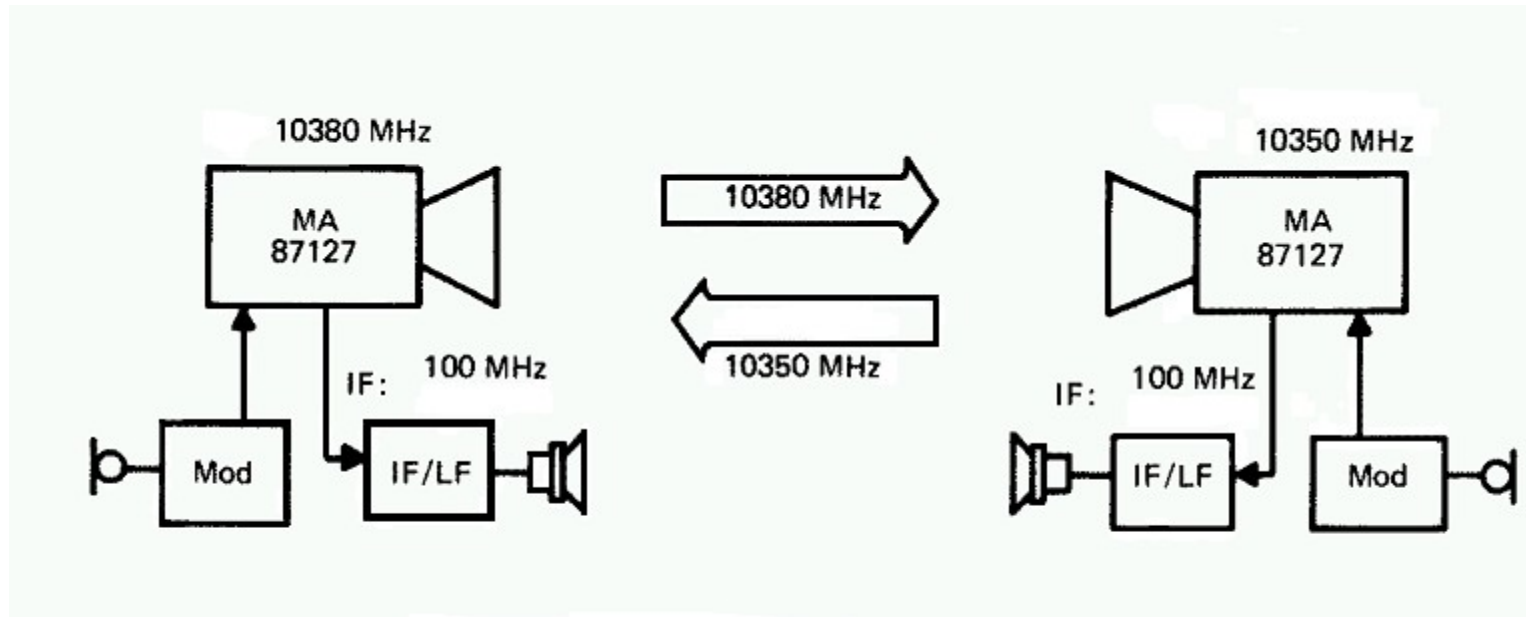
Frequency vs Bias Voltage



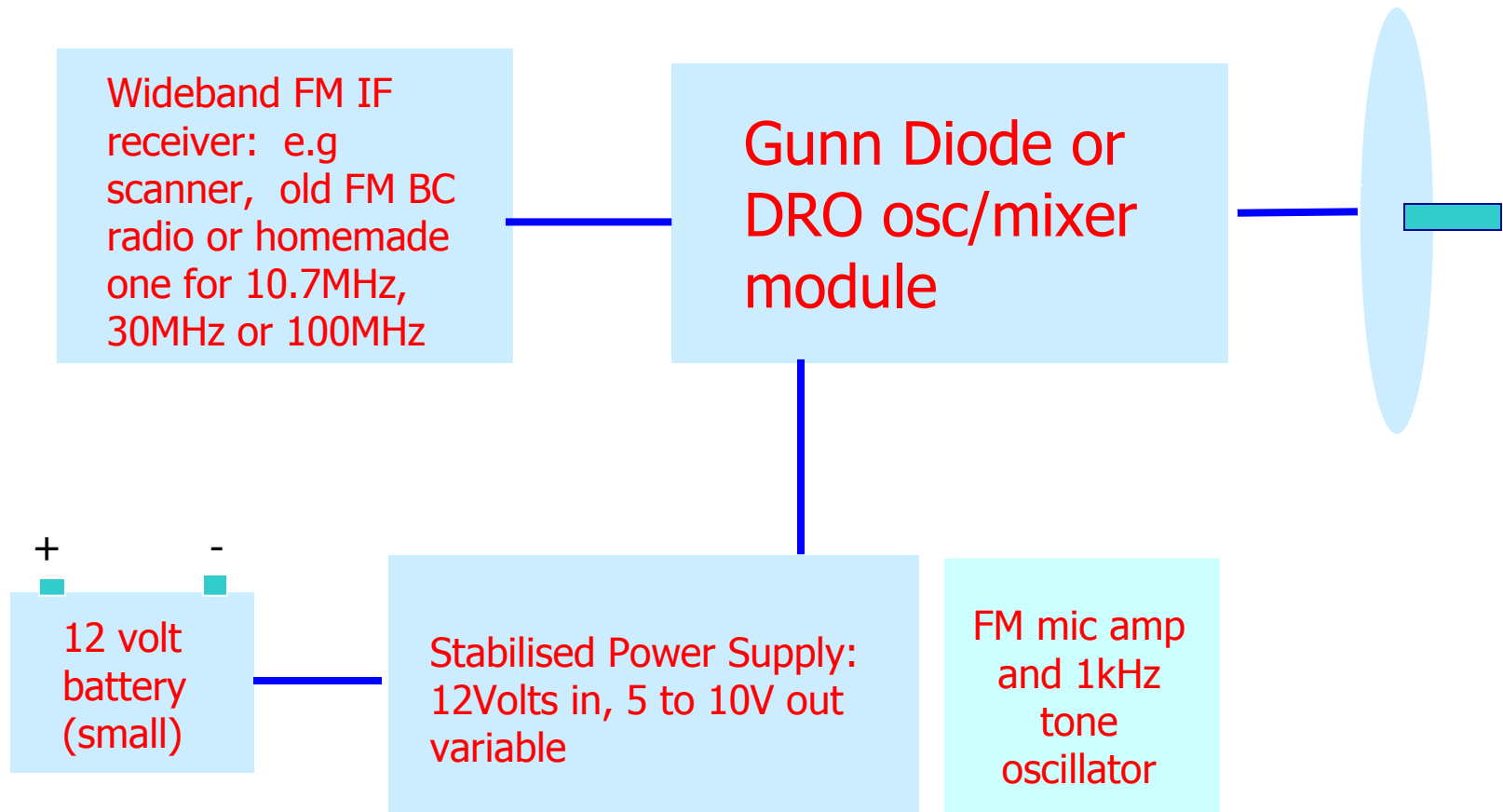
What is “simple” 10GHz wideband gear?

- It's easy to make but you need to know how to solder!
- Much of it is available in kit form at Maplin
- It all runs off a small 12 volt battery
- It's low power output (5 to 10 milliwatts)
- All levels of licence holders from Intermediate upwards can operate on 10GHz
- You won't work very far so you need to work in pairs with a pal.
- It's an excellent, fun and cheap way to “wet your feet” in microwaves
- Here 's a simple system in detail

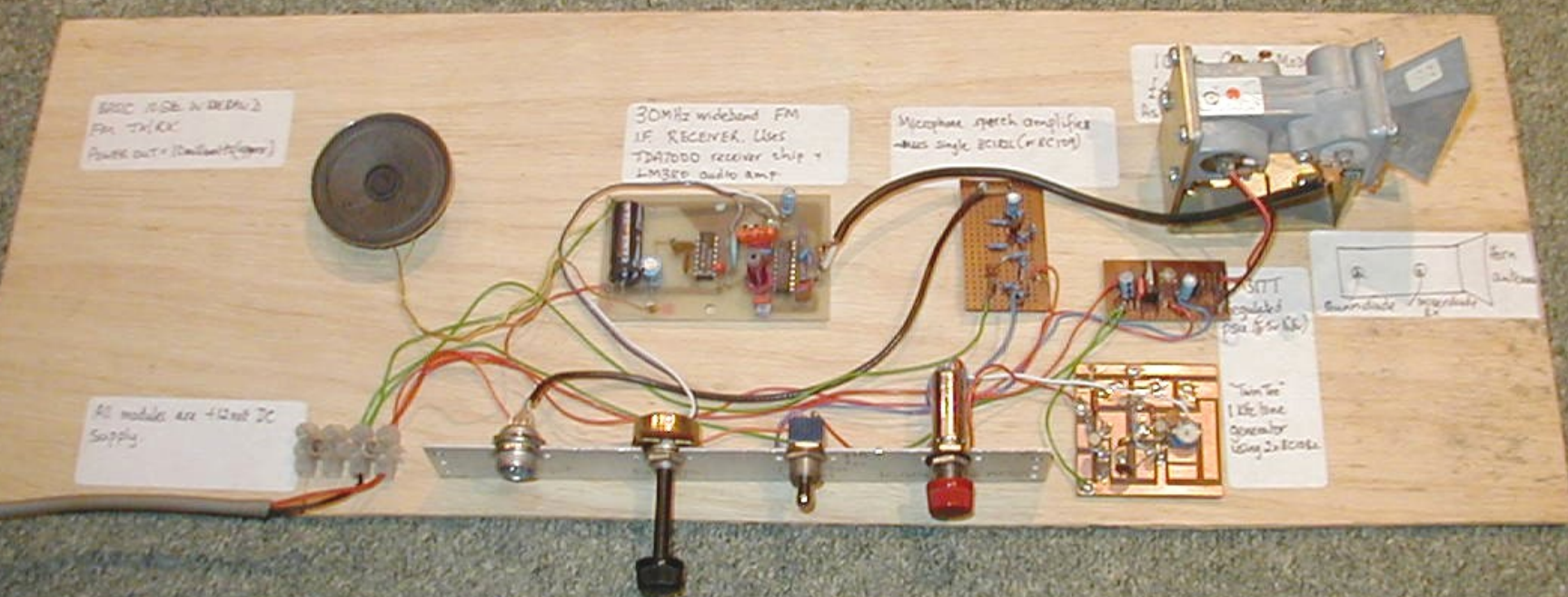
Full Duplex ... like a telephone!



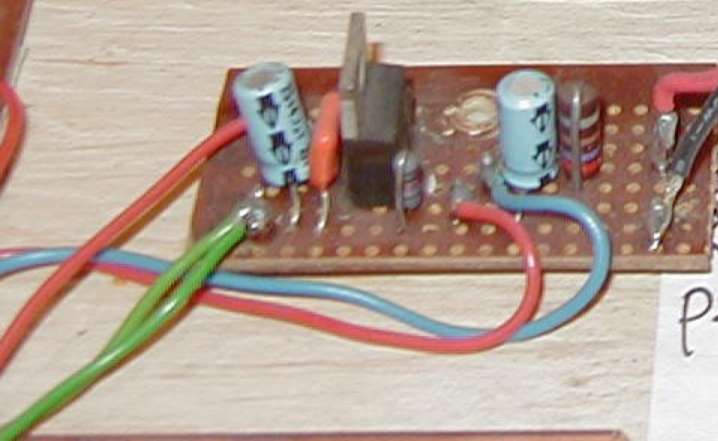
A simple microwave wideband FM system



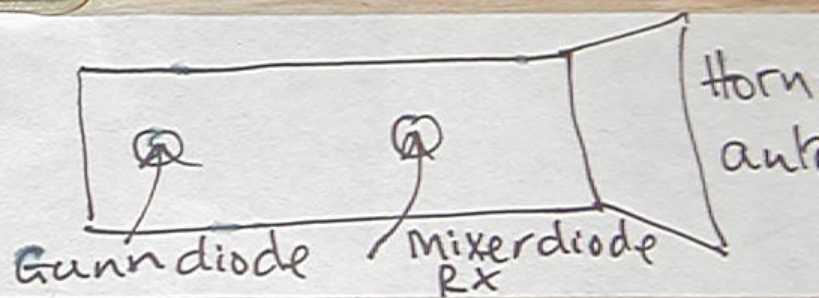
A "Breadboard" Wideband FM Transceiver for 10GHz



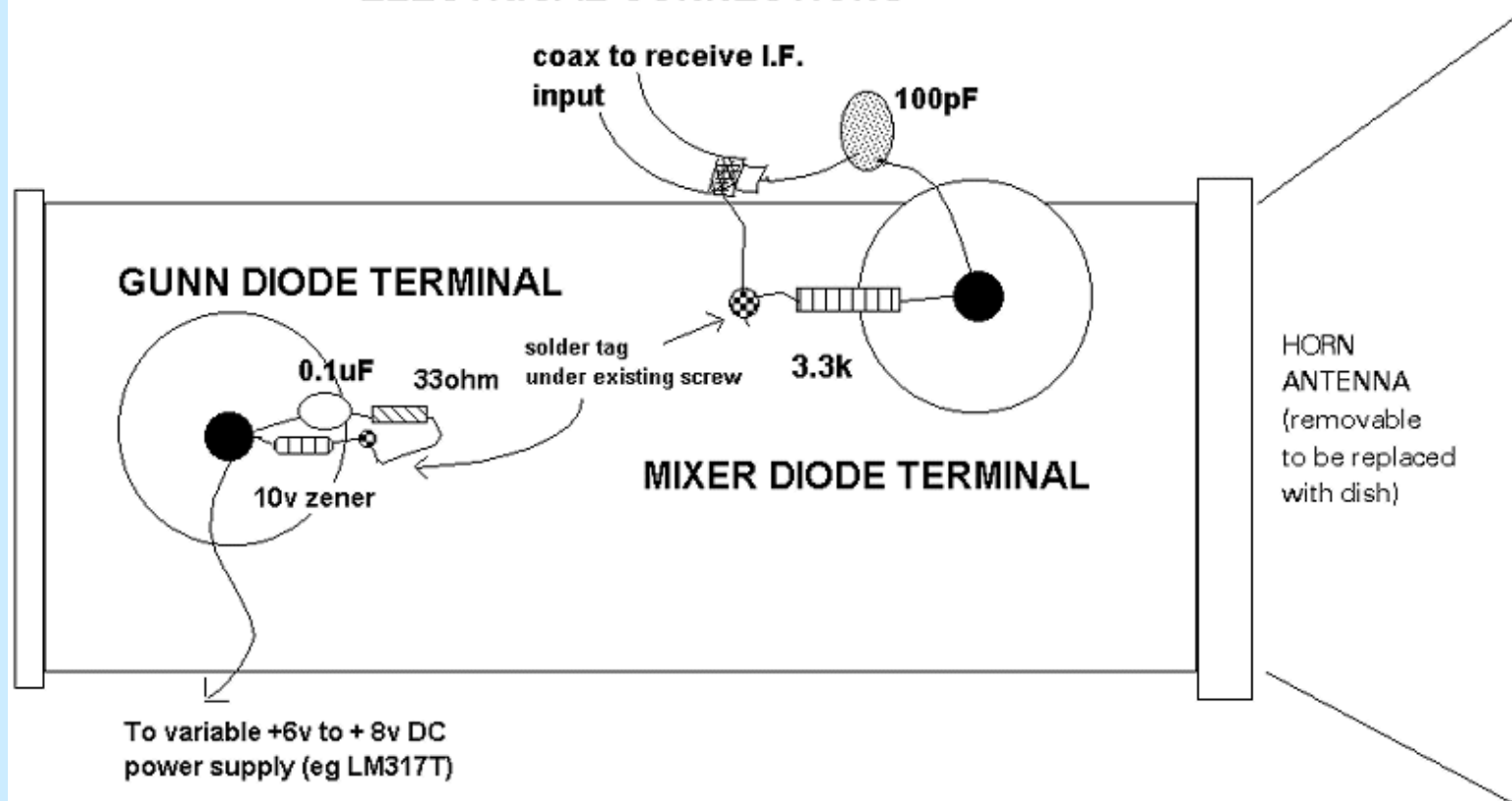
ch amplifier
(or BC109)



LM317T
regulated
psu. (6.5v to 8v)

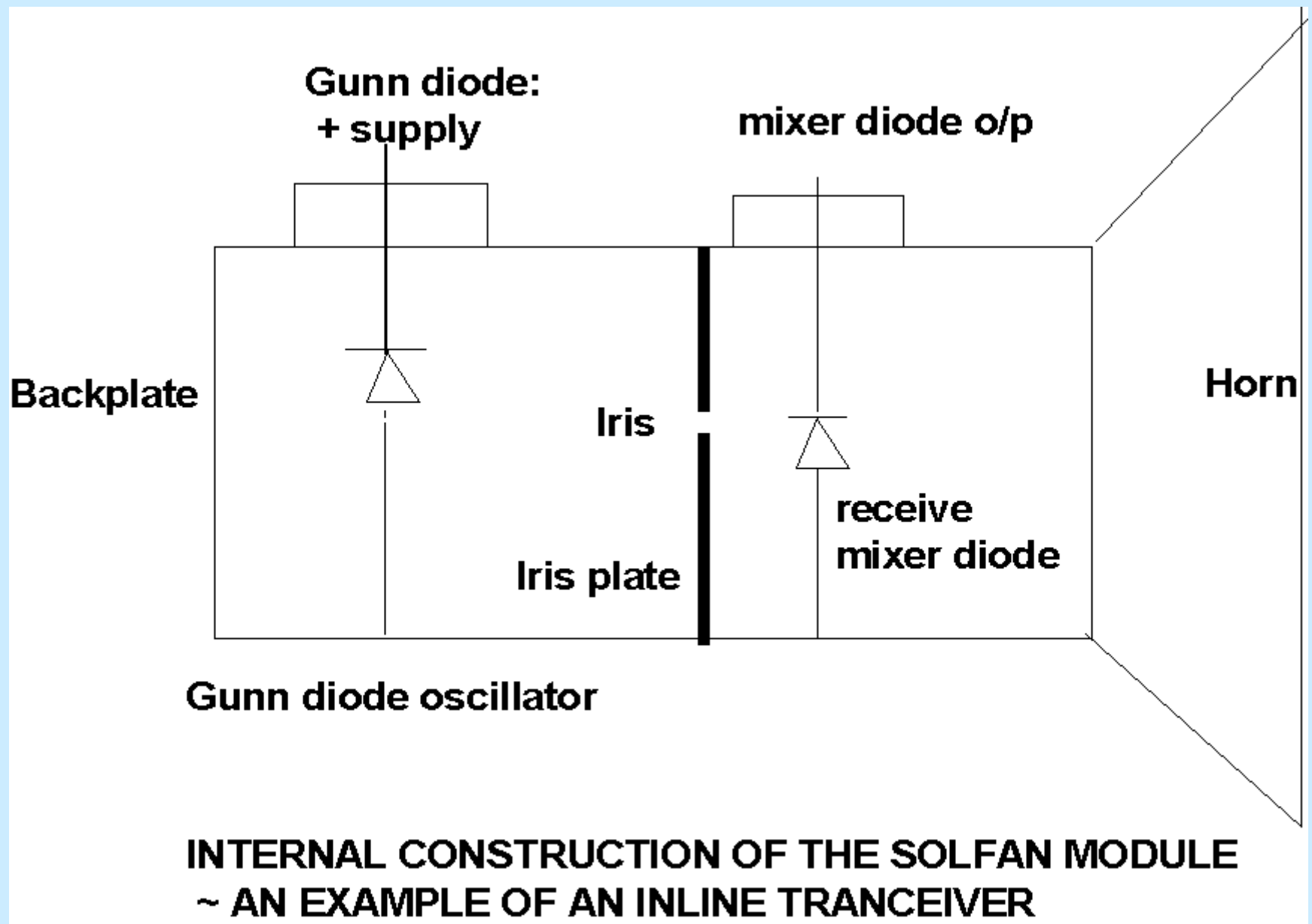


TOP VIEW OF SOLFAN-TYPE GUNN MODULE FOR X-BAND ELECTRICAL CONNECTIONS

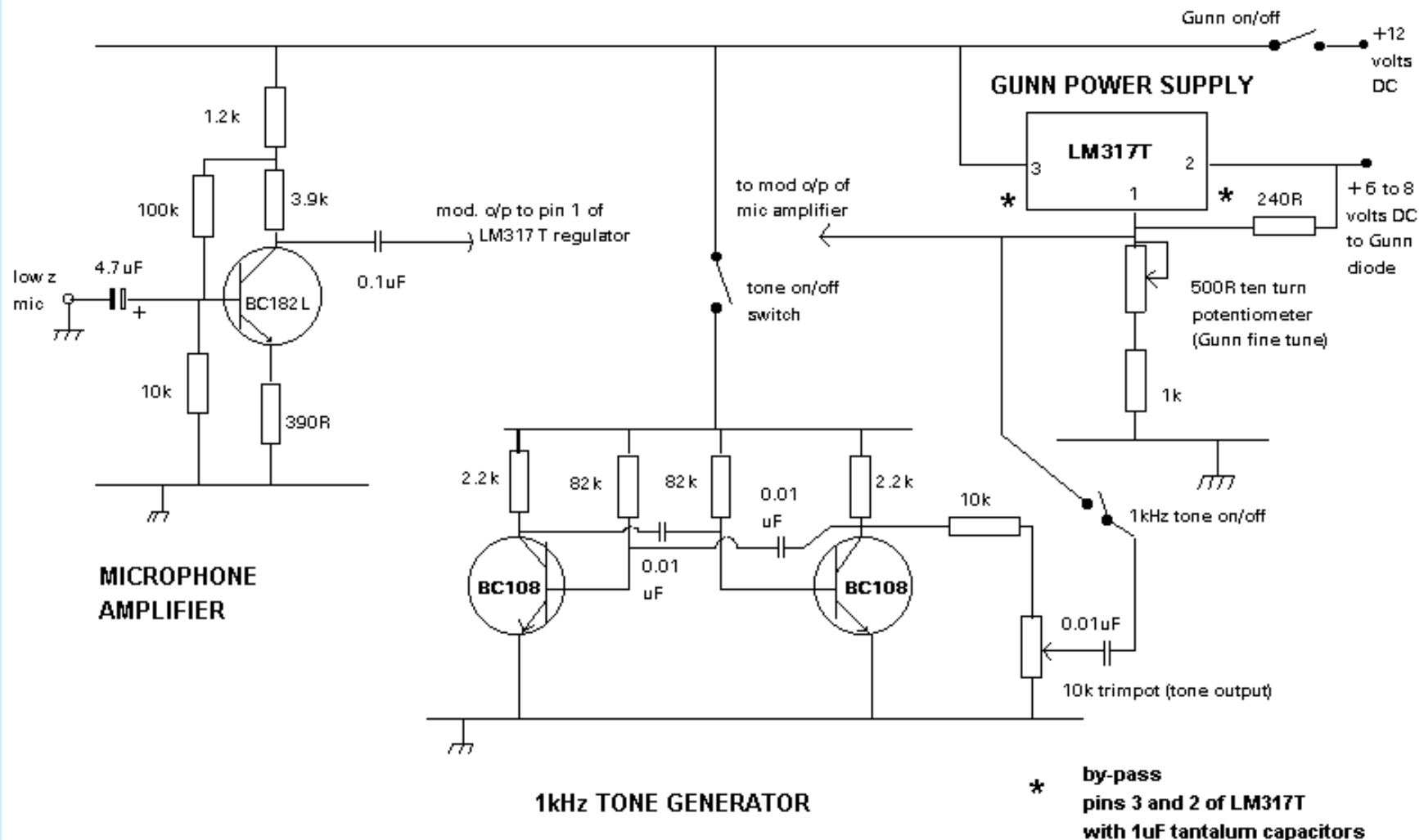


The components connected across the Gunn Diode terminal are transient suppressors. The 10 volt zener is to protect the diode from excess voltage.

The resistor across the mixer diode, to ground, is the DC return for the diode. A small value milliammeter (say 0-5mA) may be connected in series with the resistor or even replace it. Diode current can then be read and adjusted with the matching screw (see other side of Solfan Module) to give 0.5mA. Much more gives poor RX performance.



POWER SUPPLY/MODULATOR
FOR WIDEBAND FM GUNN DIODE MICROWAVE TRANSMITTER/RECEIVER
(Construct as one module or three separates, on veroboard)



THE SATELLITE LNB ...

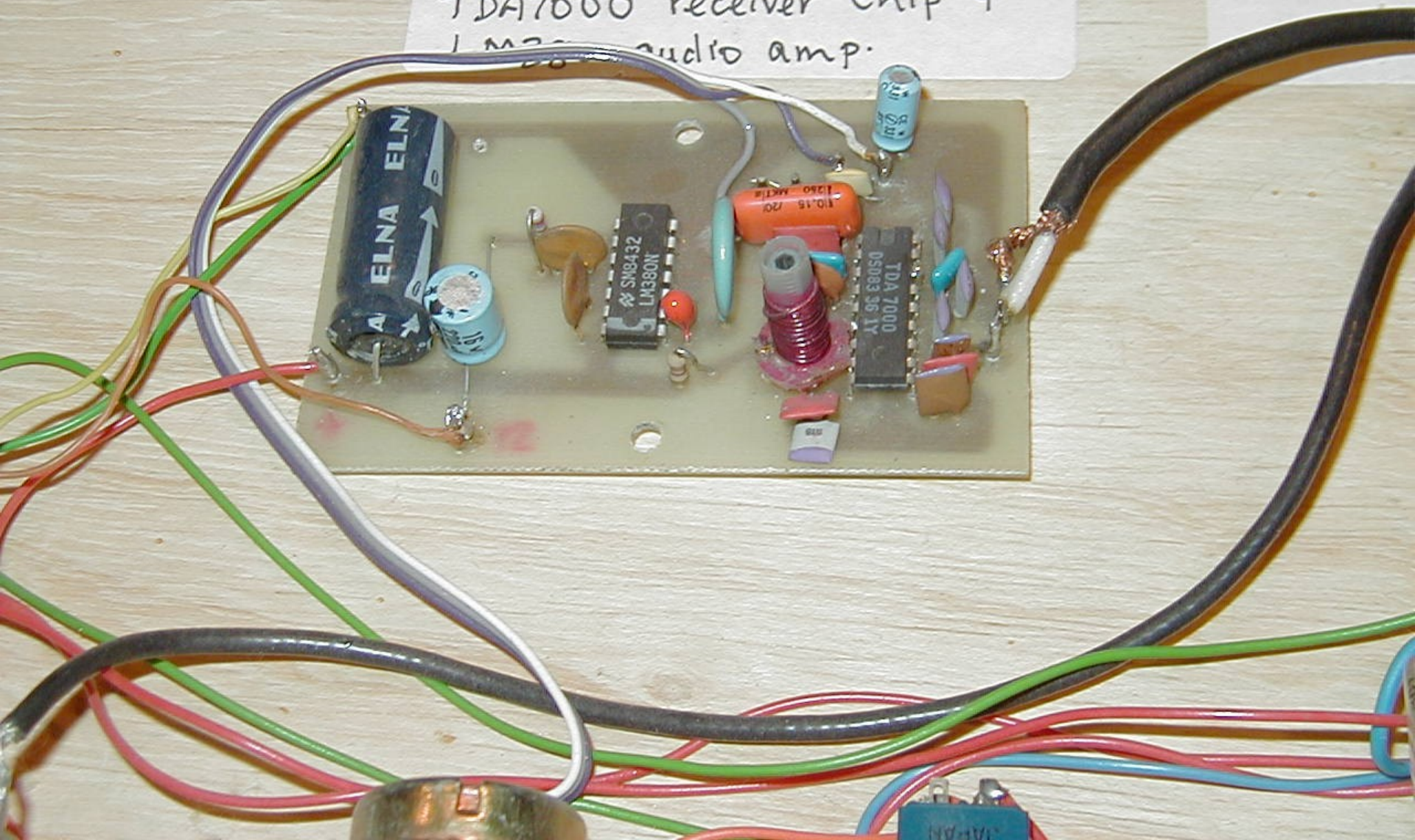
AN ALTERNATIVE TO THE GUNN DIODE MODULE

Old Sat TV LNBs and dishes are worth getting for use at 10GHz.
Modification as discussed by Peter, G3PYB.

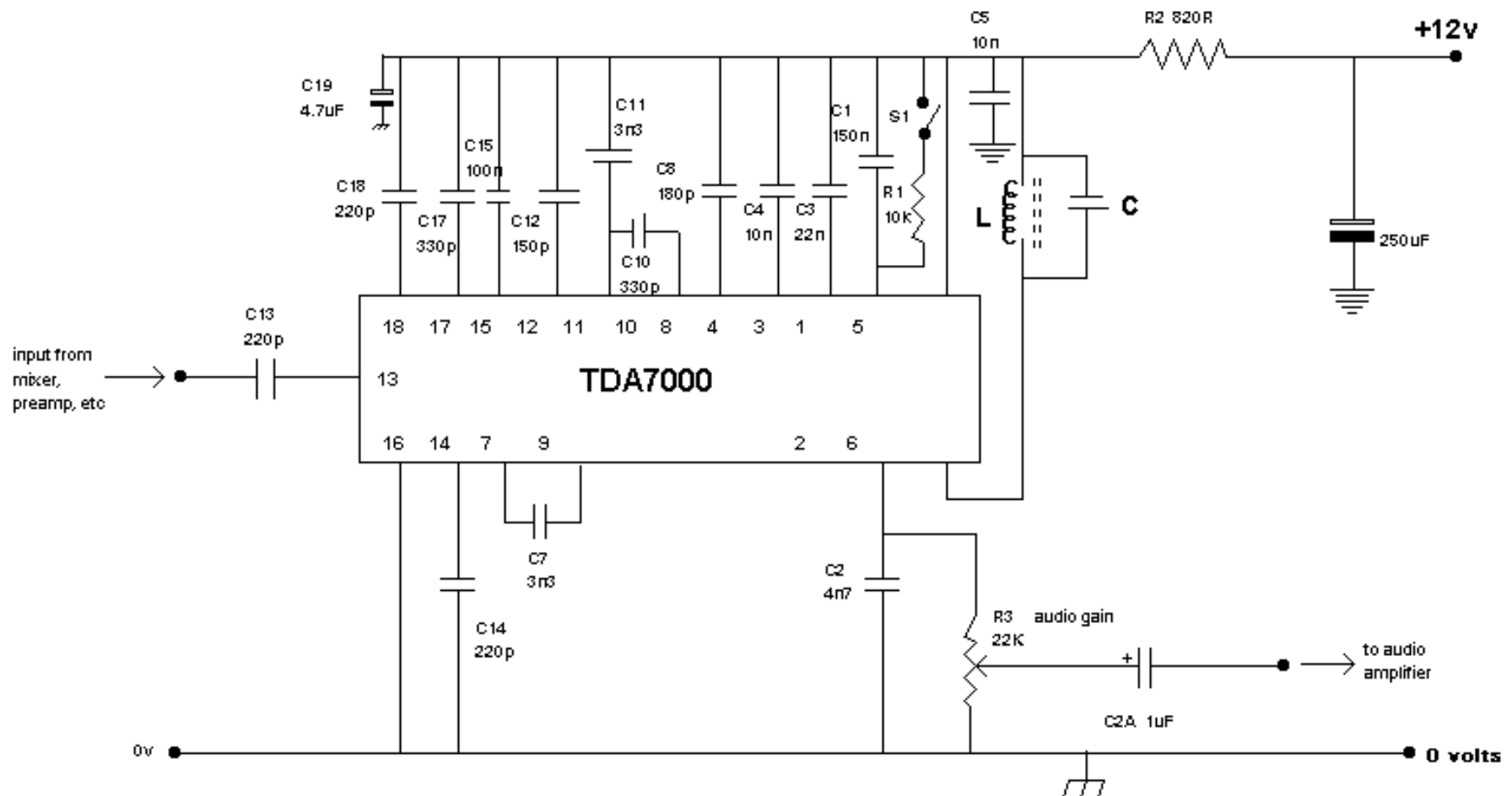


30MHz wideband FM
I.F. RECEIVER. Uses
TDA7000 receiver chip +
LM386 audio amp.

Microphone
-uses Sing

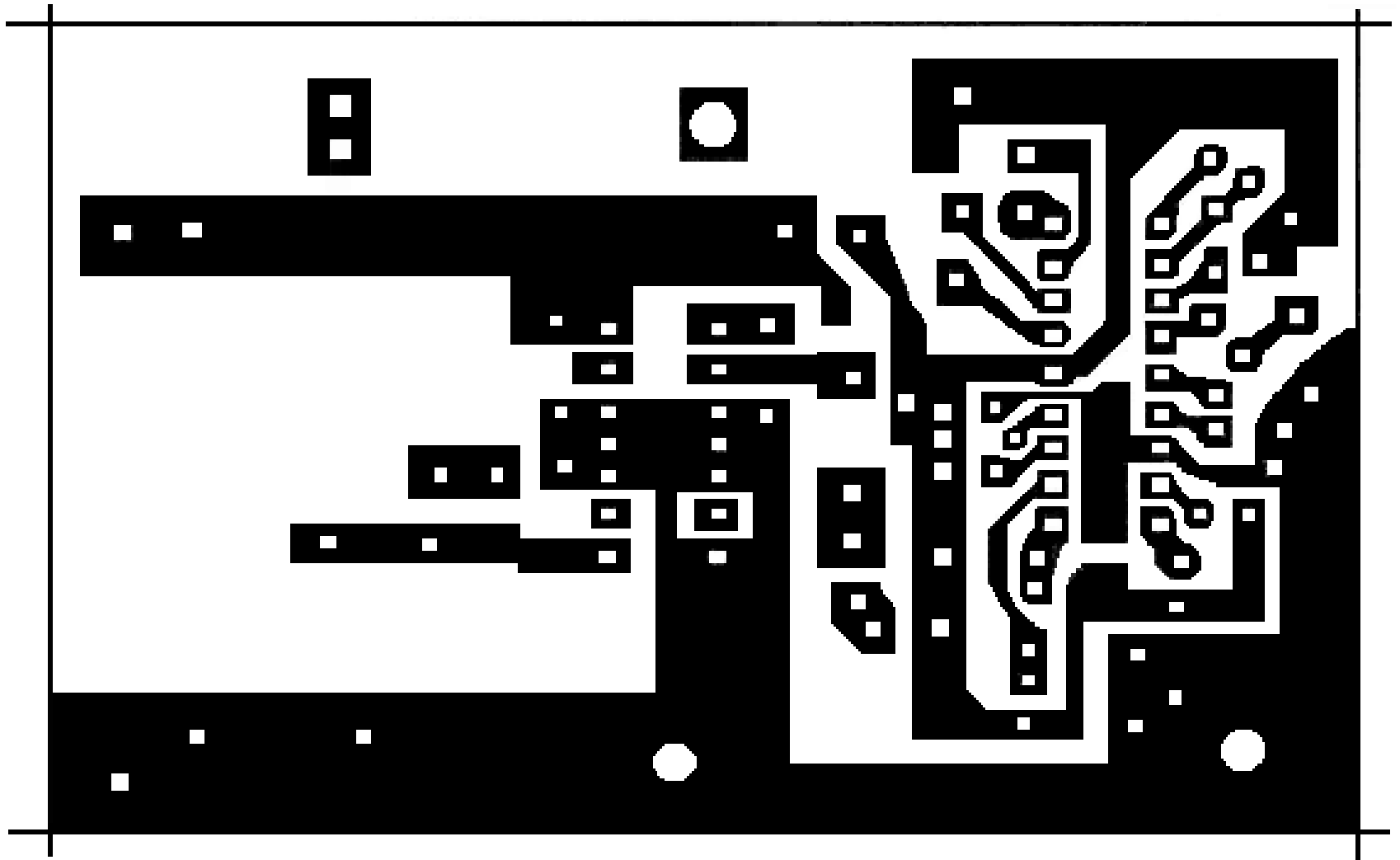


TDA 7000 30MHz I.F. FOR 10GHz WIDEBAND FM



NOTES: S1 = mute on/off. Open is mute on.

L + C : choose values to resonate at the desired IF
eg: for 30MHz IF use 22 turns 26 swg copper enamelled
closewound on 5mm diameter former with 3.3pF
in parallel



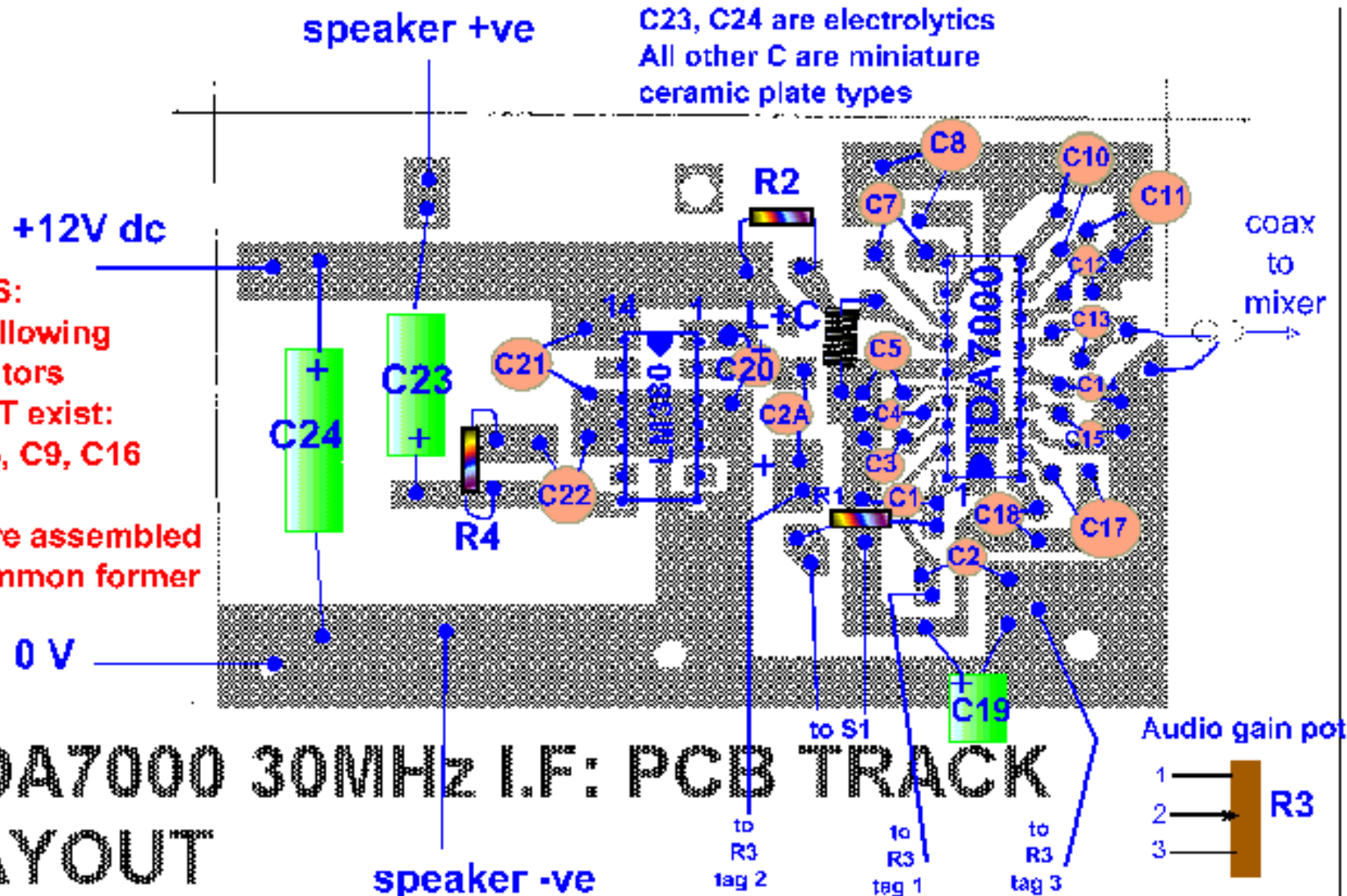
PCB dimensions = 90mm x 56.5mm

NOTE: C2A, C19, C20
are all 25VW tantalum
C23, C24 are electrolytics
All other C are miniature
ceramic plate types

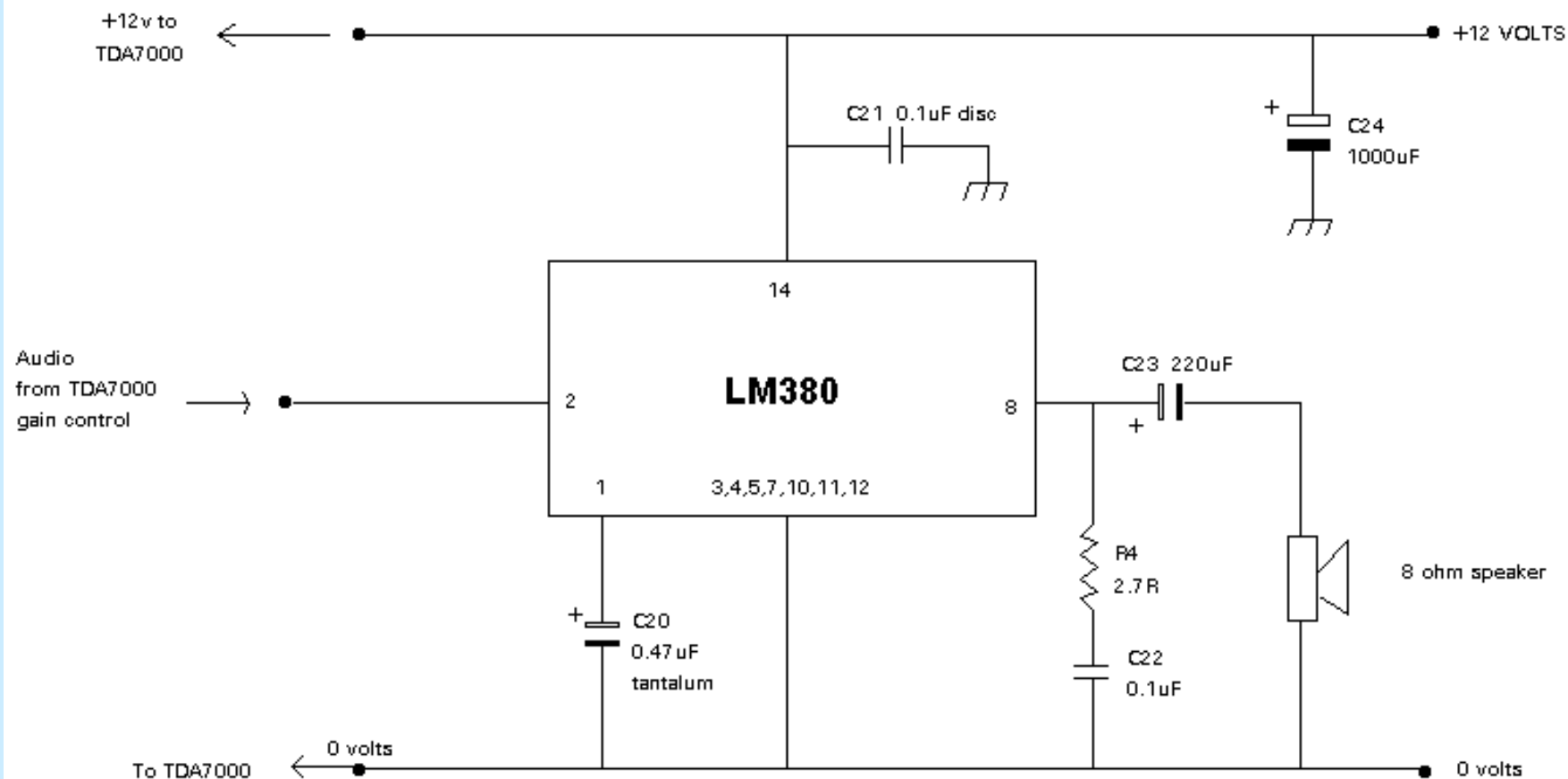
NOTES:
The following
capacitors
do NOT exist:
C6, C9, C16

L+C are assembled
on common former

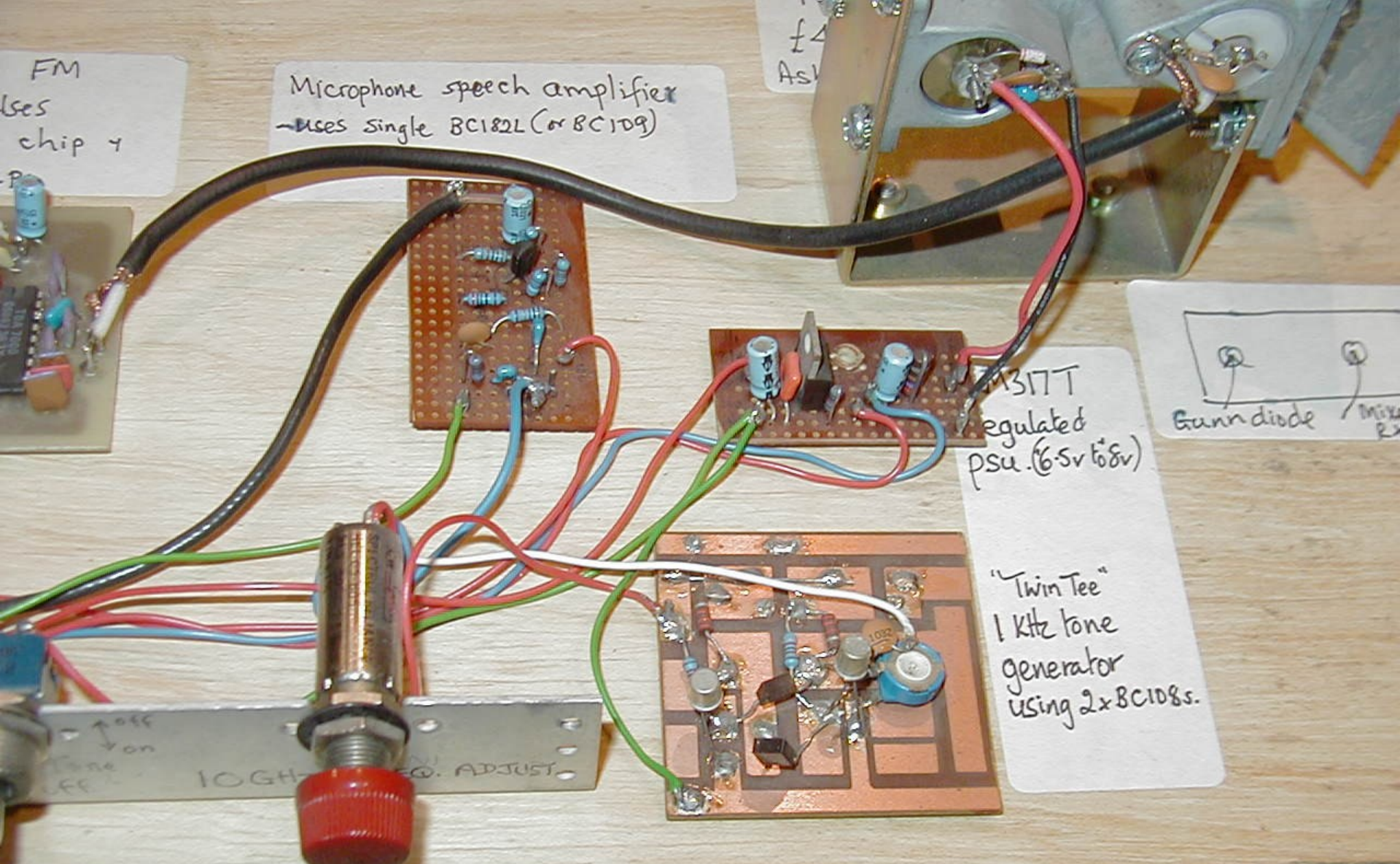
TDA7000 30MHz I.F. PCB TRACK LAYOUT



AUDIO AMPLIFIER / LOUDSPEAKER OUTPUT STAGE FOR TDA7000 RECEIVER



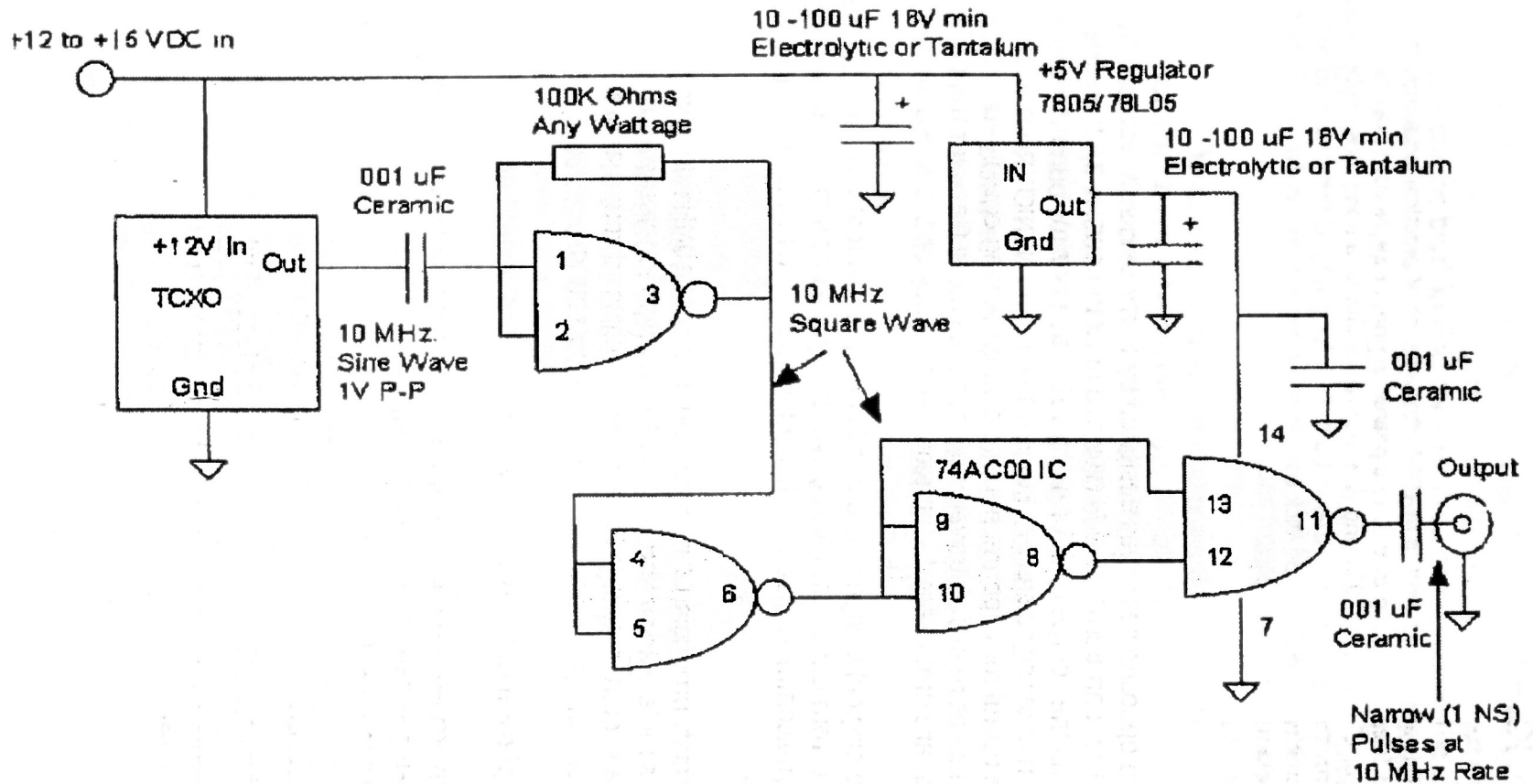
THIS MODULE CAN BE MADE SEPARATELY OR INCORPORATED WITH THE TDA7000 RECEIVER SECTION ON ONE PRINTED CIRCUIT BOARD



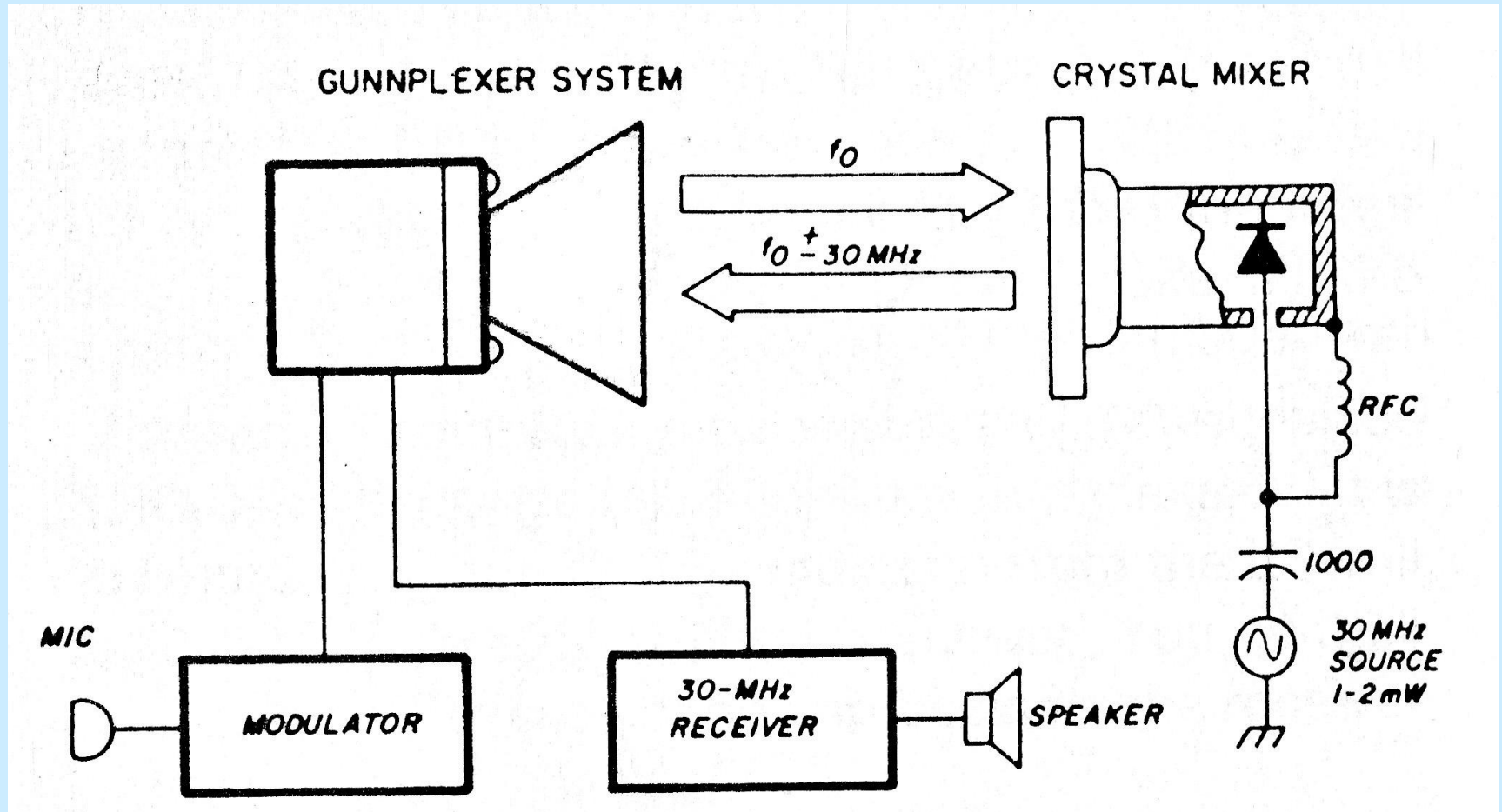
Note the variety of construction here ... printed circuit, Veroboard, "dead bug" style and point to point anything goes!

- The simple Gunn diode gear can be set up with very basic test gear .. a multi-meter and a wavemeter.
- Multi-meters should be in every amateur radio shack but 10GHz wavemeters are not so common! Look out for them at rallies or contact your local amateur microwave "elmer"!

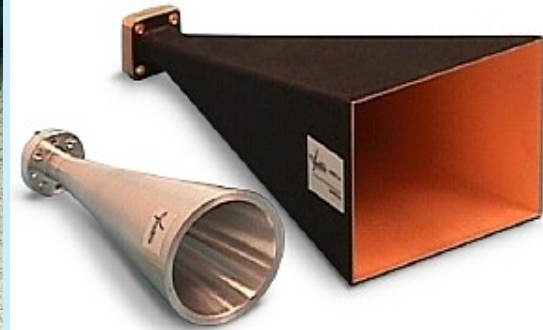
K6IZW's weak signal source



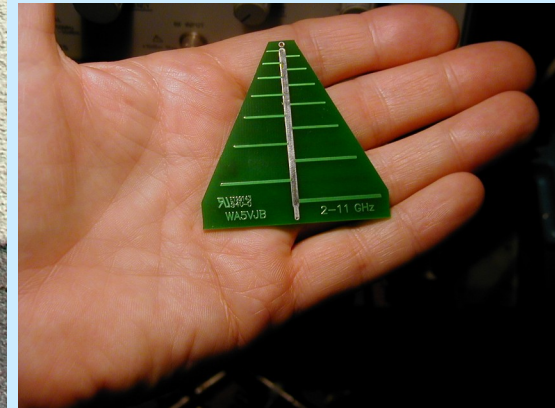
The Boomerang



Antennas



**Circular &
rectangular horns**



**2 - 11GHz log
periodic**

GM1BHQ/P





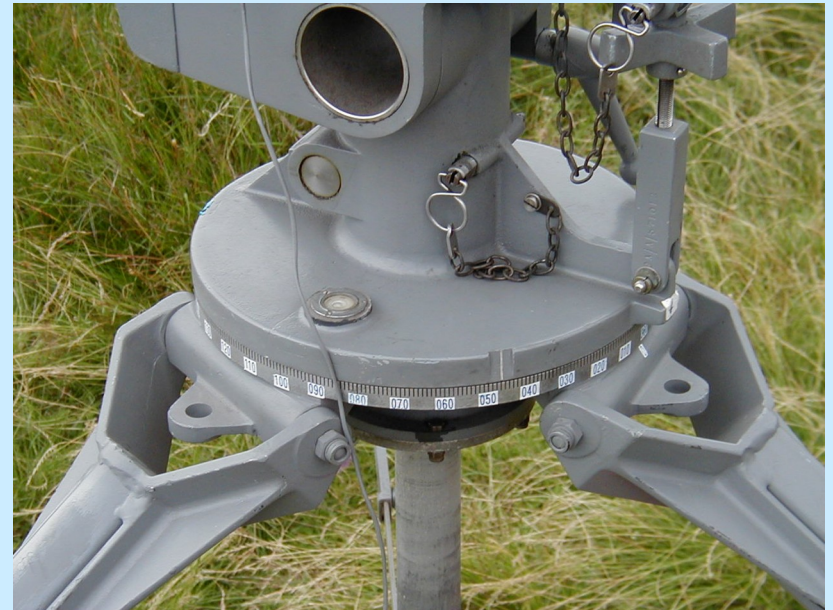
Making a contact

Paul M0EYT/P



The ex Outside Broadcast tripod makes a really strong base for the four foot diameter dish at G3PHO/P.

Once set up, the dish can be quickly set to any bearing with a 1 degree accuracy ... essential for dishes of this size at 10GHz.





Low power back-packable 2m ssb talkback transceivers



IC202S



The parts for the simple wideband gear can be obtained from ...

- Amateur Radio rallies (Solfan or other similar Gunn diode Doppler modules)
- Maplin .. The TD7000 IC, the LM380 audio amplifier. They also stock a cheap 1kHz tone oscillator kit.
- John Birkett of Lincoln ... for extra Gunn diodes and mixer diodes
- The Poundshop ... for cheap FM RX receivers

Hints for a successful contact

Barry G8AGN

The Essentials

Talkback link between the two stations

144.175MHz, ON4KST via WWW or mobile phone

Where are you ? (NGR)

Where is the other station ? (NGR)

This enables you to work out the antenna pointing angles and the separation between stations

What frequency is the other station on ?

Tx and Rx will be set on frequencies separated by the Rx IF

Microwave antennas give much higher gains than HF ones !

60cm offset dish on 10GHz = 35dB gain

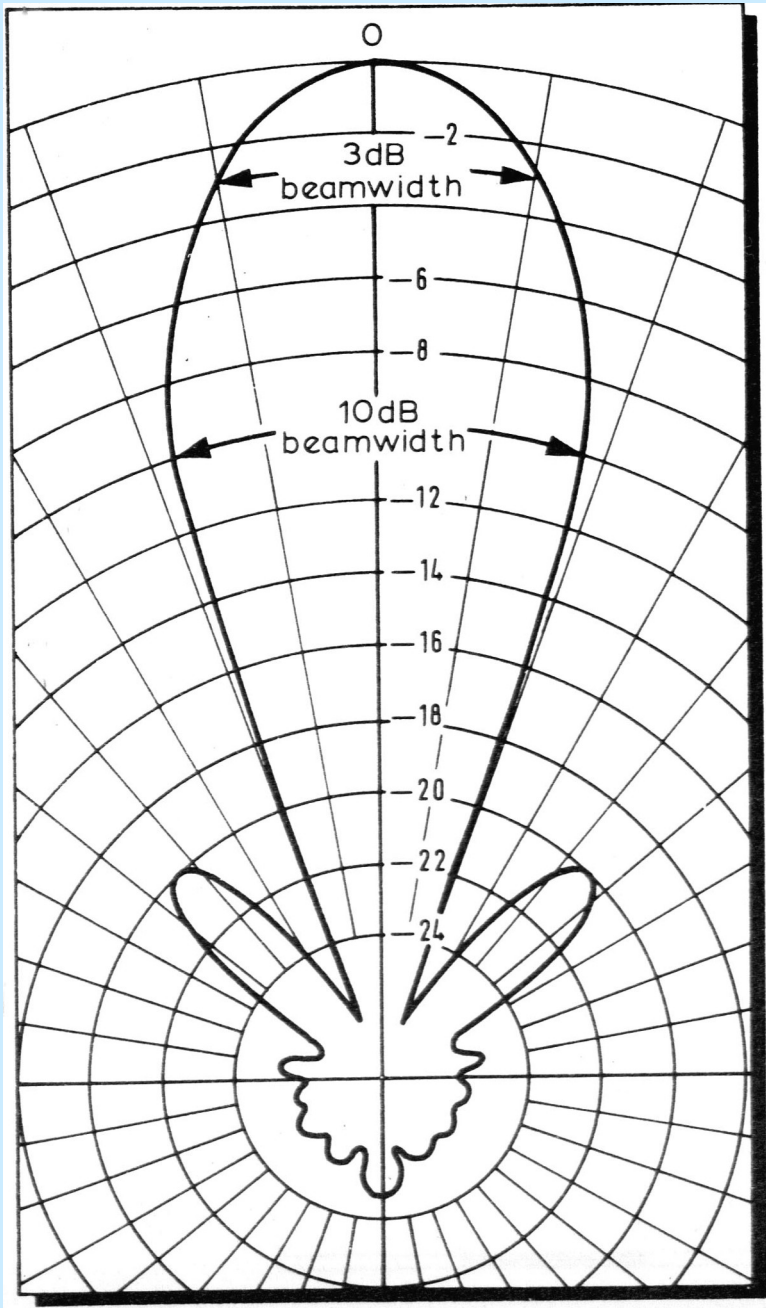
10mW into 60cm dish -> almost 40W ERP !

10W into 60cm dish -> almost 40KW ERP !

3 ele yagi on 14MHz = 6-7dB gain (optimist!)

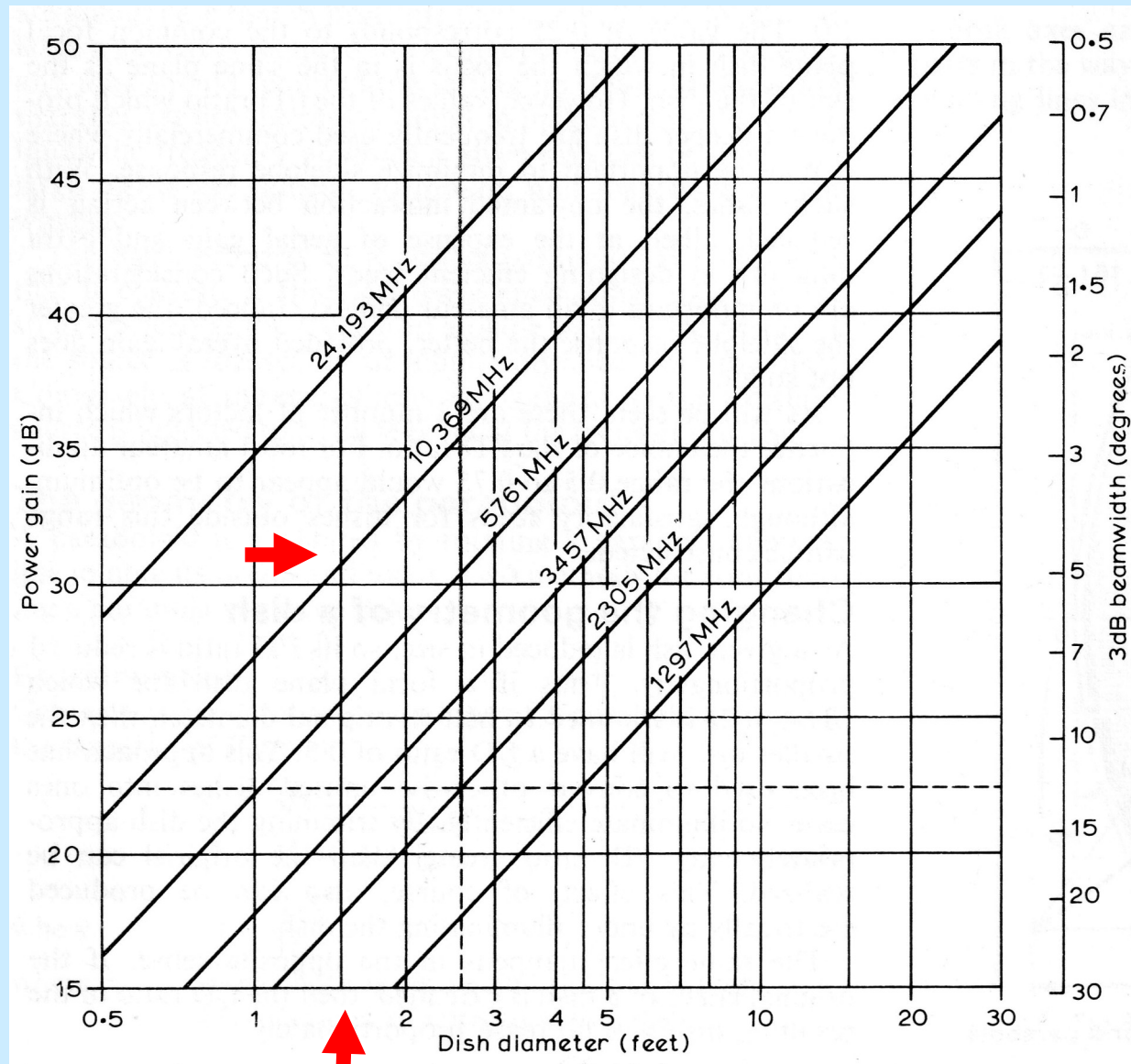
10W -> 3 el yagi = only 40W ERP

Radiation pattern of an antenna



The “Beamwidth” normally refers to the width at the $\frac{1}{2}$ power points (3 dB)

Antenna characteristics at microwave frequencies



Essential tools for /P operation



Dish alignment using a compass



Dish alignment using a compass



G8AGN's 3 ft dish
mounted on a scaffold pole

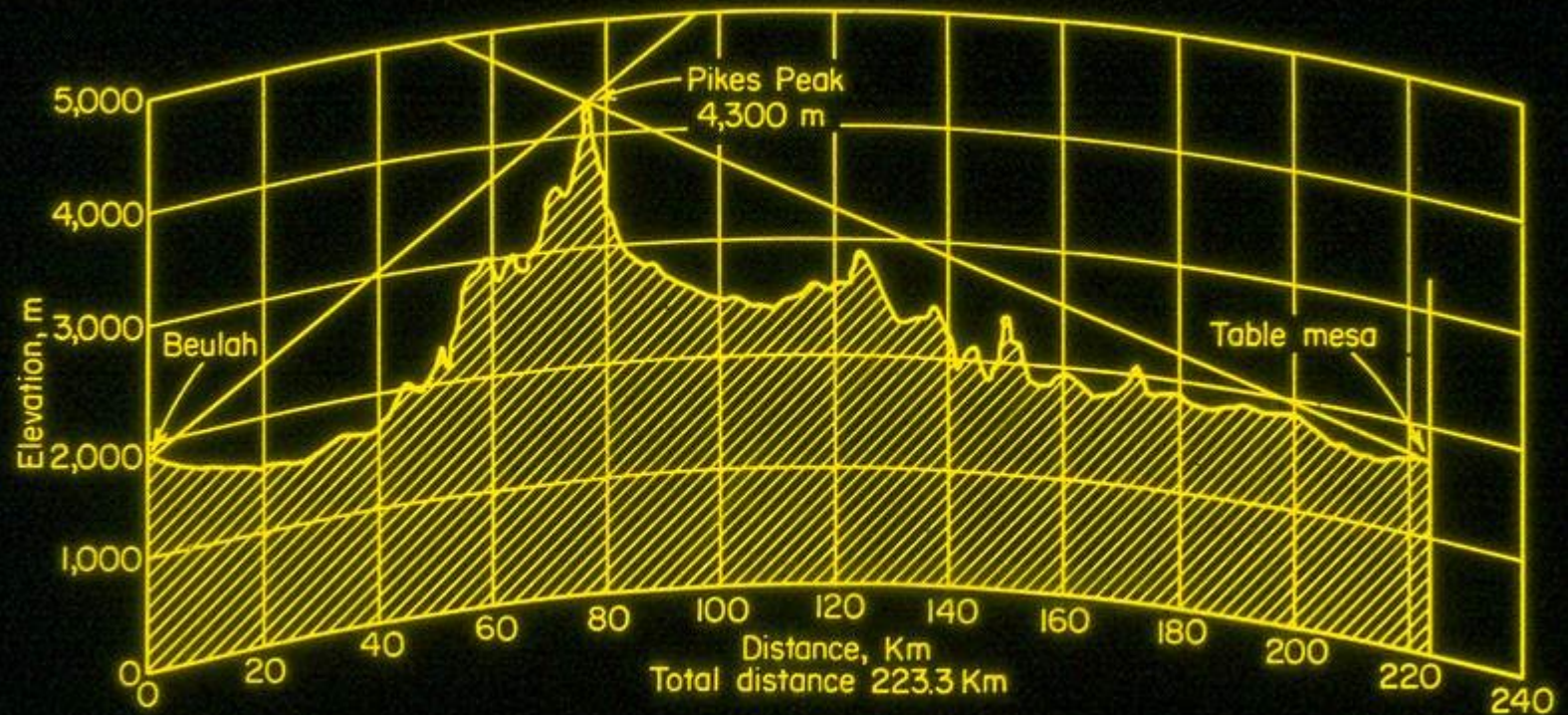
G8AGN/P on Merryton Low, Staffs



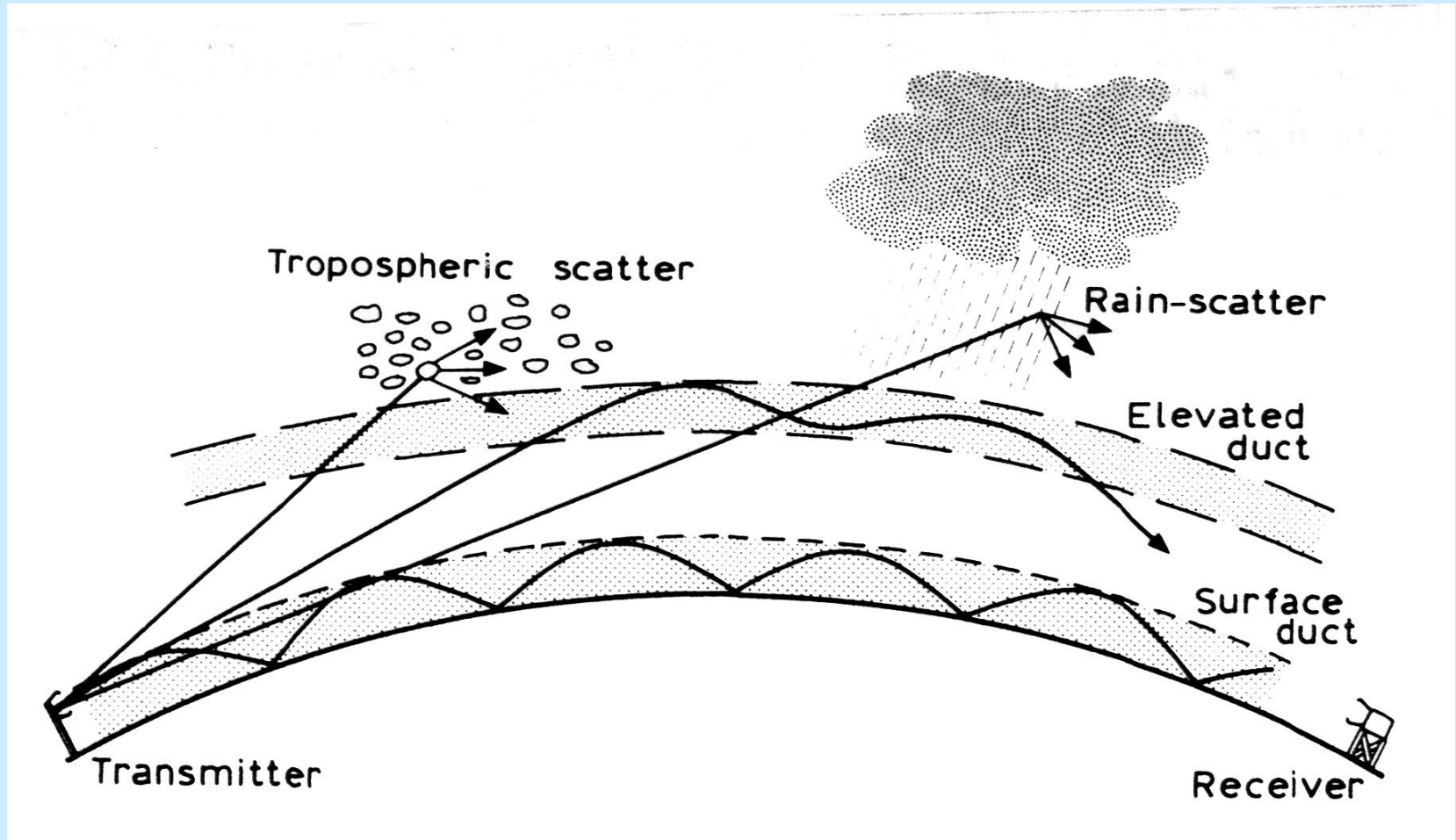
G8AGN/P on Merryton Low



Microwave path profile



Non line of sight contacts



A photograph of a sunset over the ocean. The sun is a bright yellow-orange circle on the horizon, with a gradient of colors from orange to blue in the sky. The foreground shows dark, silhouetted rocks and some sparse vegetation.

The End

or is it the beginning?