4 Aerial Doppler RDF

By G8MNY (Updated Jan 15)
(8 Bit ASCII graphics use code page 437 or 850, Terminal Font)

THE DOPPLER RDF PRINCIPLE
By moving a Rx aerial towards the Tx (rotating it around a center), the Rx frequency increases, & when going away it decreases. So on a FM Rx a tone will be heard at the frequency who’s phase compared to the aerial rotation position is the direction.

\[ + \text{Freq} \rightarrow \text{Tx} \]
\[ \text{No change} \quad \text{v ROTATNG} \quad \wedge \]
\[ - \text{Freq} \leftarrow \text{plan view} \]

To mimic a spinning aerial a least 4 identical aerials are needed. And each of these needs to be faded in & out in pseudo 1/2 sinewave manner. This assumes the 4 aerials don't interact!

EARLY KIT RDF
I have a 1981 commercial USA kit by Doppler Systems Arizona, model 3003, it uses a crystal timebase to clock 4 phases of an identical waveform stored in Proms.

\[ .-\]
\[ ;\text{1I} \]
\[ \text{\};1} \]
\[ .-\).
\[ 0^\circ \text{\;} .-\).]
\[ \text{\;} 2\text{I} \]
\[ \text{\;} 1\text{I} \]
\[ \text{\;} .-\).
\[ +90^\circ \text{\;} .-\).]
\[ \text{\;} .-\]
\[ ;\text{3I} \]
\[ \text{\;} \text{1I} \]
\[ \text{\;} .-\).
\[ +180^\circ \text{\;} .-\).]
\[ \text{\;} .-\]
\[ ;\text{4I} \]
\[ \text{\;} \text{1I} \]
\[ \text{\;} .-\)
\[ +270^\circ \text{\;} .-\)

SCHEMATIC

Ant 1  Ant 2

\[ \text{\;} \text{Four Gain Modulated} \]
\[ \text{\;} \text{Preamps} \]

\[ \begin{array}{c}
\text{\;} \text{ coax} \\
\text{\;} \text{ 6 way} \\
\end{array} \]

\[ \begin{array}{c}
\text{\;} \text{Waveform Generator} \\
\text{\;} \text{Crystal Timebase} \\
\text{\;} \text{Phase Comparator} \\
\text{\;} \text{Calibration Delay} \\
\text{\;} \text{Heading Deg & Polar Display} \\
\end{array} \]

\[ \begin{array}{c}
\text{\;} \text{300Hz} \\
\text{\;} \text{No 300Hz Squelch} \\
\text{\;} \text{Kill Display} \\
\end{array} \]

\[ \begin{array}{c}
\text{\;} \text{AF Signal Conditioning} \\
\text{\;} \text{Overload LED} \\
\end{array} \]

\[ \begin{array}{c}
\text{\;} \text{Scanner Rx} \\
\text{\;} \text{300Hz + AF} \\
\end{array} \]

G4APL  GB7CIP  10.9.2015
AERIALS
These must be identical with same length feeder etc. I used 4 magmounts with
short 1m leads to BNC plugs. Into these I can plug in aerials, telescopic ones
give 100-432MHz, for lower frequencies "coat hanger" wire can be cut & put into
PL259 plugs. It is important they are wired up in order correctly!

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<td>50MHz spacing</td>
<td>144MHz</td>
<td>432MHz</td>
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The aerial spacing needs to be about 1/4 wave for the doppler tone to develope,
the distance & the shape of the vehicle roof all affect the bearing
calibration!

RX SETUP
I use the simular sized AOR2002 Scanner for the Rx, modified with a Pre Vol AF
output (see below). The aerial arrangement with external preamp is optional,
but less cables. Mine preamp came unmounted outside the unit, so I put it in a
diecast with magnetic underside & 4 BNCs, but I also modified it with 4 step up
broad band RF transformers for more gain & terminated them on the PCB with 470R
instead of the 47Rs & added 2 clipping diodes as protection in case I Tx! With
the preamp output coil removed, it now gives useful gain 50-432MHz.

AF MODIFICATIONS
The original circuit had very little pre signal conditioning, only a few dBs
down at 200Hz & 1kHz, so any modulation kills the system. So I desigend a very
narrow wayne filter on a couple of the existing initial opamps in circuit...

The exact centre frequency is set on the multiturn preset by setting identical
losses at 290 & 310Hz, on the 1st op amp's test point & then the 2nd. The
overload detector pick of point is moved to an earlier stage & made it more
sensitive, so it operated before clipping occured.

DISPLAY
Polar display uses 16 LEDs in a circle for ease of navigating & 1 in the middle
to indicate power. As well as that there is a 0-360° bearing indication.

An overload LED indicates if there is too much AF drive.
IN PRACTICE
Anoyingly my scanner gives different 300Hz delays (phases?) between wideband & narrow band FM modes, so the barring changes if the bandwidth is changed. But I found on narrow band FM mode, the heavily clipped wideband FM AF, RDF 300Hz signal is fine. So I added a dedicated unsquelched narrow band FM AF O/P for RFD feed, & I can still listen to the AM & WBFM modes.

The main problem is RF multipath, if any of the 4 aerials sees an upset RF field (nulling) the result is useless.

Why Don't U send an interesting bul?

73 de John, G8MNY @ GB7CIP