To: Deuterium Array Group

From: Alan E.E. Rogers

Subject: IP2 measurement on the bench and in the field.

1] Bench measurement

Using a single ended common source HEMT ATF-54143 amplifier with the following bias voltages

\[ V_{DS} = 3\,\text{V} \]
\[ I_{DS} = 30\,\text{mA} \]
\[ V_{GS} \approx 0.5\,\text{V} \]

I injected a signal at 150 MHz through a narrow band filter to eliminate the 2\textsuperscript{nd} harmonic from the signal source. I measured

150 MHz output \(-41\,\text{dBm}\)
300 MHz IM2 output \(-119\,\text{dBm}\)

i.e. \[ IP2_{out} = -82 + 119 = +37\,\text{dBm} \]

I attempted the same measurements at 10 and 500 MHz

\[ IP2_{out} \text{ at } 10\,\text{MHz} \quad +45\,\text{dBm} \]
\[ IP2_{out} \text{ at } 500\,\text{MHz} \quad +29\,\text{dBm} \]

Since these measurements are not easy to make I placed errors at about \(\pm 5\,\text{dB}\).

2] Field measurement

The amplifier was connected to the 237 MHz standard gain antenna on the trailer and I measured
Freq. MHz | Source | Level at antenna output
---|---|---
175.26 | Ch 7 tv | -65 dBm
152.6 | Paging | -70 dBm
327.86 | IM2 | -143 dBm (referred to amp. Input.)

From which I calculate

\[
\begin{align*}
IP_{2\text{input}} &= +8 \text{ dBm} \\
IP_{2\text{output}} &= +33 \text{ dBm (amp. gain 25 dB)}
\end{align*}
\]

Measurement accuracy and signal strength variations limit the accuracy to about ± 5 dB.

Comments:

There are other signals around 152 MHz which when mixed by IM2 result in frequencies close to 327.4 MHz. For example:

<table>
<thead>
<tr>
<th>F1</th>
<th>F2</th>
<th>F1+F2</th>
<th>Strength*</th>
</tr>
</thead>
<tbody>
<tr>
<td>152.6</td>
<td>175.26</td>
<td>327.86</td>
<td>0 dB</td>
</tr>
<tr>
<td>152.48</td>
<td>175.26</td>
<td>327.74</td>
<td>-6 dB</td>
</tr>
<tr>
<td>152.37</td>
<td>175.26</td>
<td>327.63</td>
<td>-15 dB</td>
</tr>
</tbody>
</table>

* relative to 152.6 MHz

In addition there are many intermittent transmissions around 152 MHz.