What do all these sophisticated systems have in common?
Spectrum Microwave supports all these systems due in part to the expertise of their engineers and superior technology that makes Spectrum Microwave a center of Low Phase Noise Excellence.
They all require exceptionally Low Phase Noise performance amplifiers.
What is Phase Noise and why is it so important?
Every signal has Phase Noise to some degree, sometimes it is seen as jitter of some kind, but simply put,...
...it is unwanted noise on both sides of the carrier signal caused by random variations of the frequency and phase of the carrier.
Even the best crystal oscillators and signal generators have some degree of phase noise, expressed in dBc/Hz.
Besides Noise Figure, there is an additional characteristic of noise, the 1/f corner.
The 1/f corner, or sometimes referred to as the “knee” of the curve, is the point where the Phase Noise slope drops by 10 dB per decade.
So why is Phase Noise so important for my design?
As the graph illustrates, a poor 1/f knee places the signal into the thermal noise region.

Moving the 1/f corner closer to the carrier results in removing the noise from the signal.
So how does Phase Noise effect Doppler Radar, Missile Illuminators and other Data Transmission Systems?
Low Phase Noise is a key element in a Missile Illuminator.
For example, the objective of the system is to detect and amplify small reflected target signals.

Simply put, degraded Phase Noise can result in the loss of the intended target signal.
Degraded Phase Noise also impacts the bit error rate (BER) of all data transmission systems.
Improving the Phase Noise results in substantial BER performance improvement by increasing the S/N ratio in the receiver.
For all Doppler Radar designs, improving the Sub-clutter Visibility (SCV) is the bottom line.
This allows the radar to see small moving objects on its screen
Excessive Phase Noise will degrade the SCV of the system. Improving the Phase Noise however increases the cancelled S/N ratio thereby improving the SCV.
How does Spectrum Microwave measure Phase Noise?
Unlike measuring Phase Noise in a VCO, amplifiers require a much more sensitive measuring system with an extremely Low Noise Floor.
A typical Noise Floor for measuring VCO’s may only be on the order of –145 to –150 dBC/Hz.
For Low Phase Noise Amplifiers, a noise floor of at least -180 @100K Hz (offset from the carrier) is required in order to minimize the noise floor contribution to the amplifier’s additive phase noise.
Spectrum Microwave accomplishes this feat using an “enhanced” Agilent ES5500 system coupled with a Spectrum Microwave modified IFR low noise synthesizer.
This enables us to meet the required **Low Noise Floor** criteria for measuring **Low Phase Noise Amplifiers**.
At Spectrum Microwave we optimize our designs for Low Phase Noise and ...

RF AMPLIFIER
MODEL TM5152PM

Features
- High Gain: 17 dB Typical
- High Output Power: +20 dBm Typical
- Operating Temp. -55 °C to +85 °C
- Environmental Screening Available

Specifications

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Typical</th>
<th>Min/Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>10 - 300 MHz</td>
<td>10 - 300 MHz</td>
</tr>
<tr>
<td>Gain (dB)</td>
<td>17.0</td>
<td>16.0 Min.</td>
</tr>
<tr>
<td>Power @ 1 dB Comp. (dBm)</td>
<td>+20</td>
<td>+17.5 Min.</td>
</tr>
<tr>
<td>Reverse Isolation (dB)</td>
<td>- 20</td>
<td>- 19 Max.</td>
</tr>
<tr>
<td>VSWR</td>
<td>&lt; 1.5:1</td>
<td>2.1 Max.</td>
</tr>
<tr>
<td>Noise figure</td>
<td></td>
<td>2.1 Max.</td>
</tr>
</tbody>
</table>

Note: Care should always be taken to effectively ground the case of each unit.

Typical Performance Data

- Gain (dB)
- Reverse Isolation (dB)
- Phase Noise (dBc/Hz)

Guaranteed Phase Noise Performance (dBc/Hz)★

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Typical</th>
<th>Guarantee (mW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 Hz</td>
<td>-168</td>
<td>-164</td>
</tr>
<tr>
<td>1 kHz</td>
<td>-172</td>
<td>-170</td>
</tr>
<tr>
<td>10 kHz</td>
<td>-174</td>
<td>-172</td>
</tr>
<tr>
<td>100 kHz</td>
<td>-174</td>
<td>-172</td>
</tr>
<tr>
<td>1 MHz</td>
<td>-174</td>
<td>-172</td>
</tr>
</tbody>
</table>

Phase Noise Test Conditions:
- Center Frequency: 80 MHz
- Power Output: +20 dBm
- Temperature: 25 °C
- Agilent E5060A System

2707 Black Lake Place, Philadelphia, PA 19154
TEL 215-464-4000 ••• FAX 215-464-4001
...provide both Typical and Guaranteed Phase Noise Data on our amplifiers.
So if you want **MAXIMUM** performance out of your design....
Call us
to learn more
about
Spectrum Microwave
Low Phase Noise
Amplifiers!
215-464-4000