RF Power Amplifier Module for WiMAX Applications

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**Project Overview**

**Introduction**

WiMAX is a standards-based wireless technology that provides high-throughput broadband connections over long distances. This project aims to implement an effective power amplifier to reduce the power consumption of a WiMAX transceiver.

Wideband digital modulation requires a high degree of linearity, while linearity implies higher power consumption. To characterize the linearity specification and associated trade-offs, linearity requirements are firstly considered. The tradeoff between efficiency and linearity is a constant battle.

For WiMAX, a power amplifier can work at 4% to 5% efficiency for about a 6 dB back off from output P1 dB. Such a back off results in about a 2.5% or -31dB Error Vector Magnitude (EVM). IEEE 802.11 has about 10 % or -25dB EVM. Compared to IEEE802.11, WiMAX has the ability to transfer data with less error and more distant areas.

The linearity of the power gain affects the performance of the data transfer rate in the WiMAX network. The specific measurement devices were used to measure the power gain of the power amplifier and estimate the linearity.

**Aim and Objective**

The aim of the project is to design and fabricate the power amplifier module using InGaP HBT class AB power amplifier (PA) chips.

The objective of the project is to design the power amplifier module to suit the WiMAX standard as well as to improve the efficiency and cost of the module.
Simulations

ADS Simulation of HMC326MS8G

Block diagram

Modulated WiMAX Signal

Driver

PA

Receiver Circuit

Antenna

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Measurements

**Driver (HMC326MS8G)**

Power performance of driver HMC326MS8G at 3.5GHz

**Power Amplifier (HMC326MS8G)**

Power performance of power amplifier HMC327MS8G at 3.5GHz

Results

<table>
<thead>
<tr>
<th></th>
<th>Driver (HMC326MS8G)</th>
<th>PA (HMC327MS8G)</th>
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</thead>
<tbody>
<tr>
<td>Gain (dB)</td>
<td>20</td>
<td>18</td>
</tr>
<tr>
<td>PAE (%)</td>
<td>34</td>
<td>21</td>
</tr>
<tr>
<td>P1dB (dBm)</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>OIP3 (dBm)</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Power Down Isolation (dB)</td>
<td>20</td>
<td>20</td>
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</tbody>
</table>

Performance of module at 3.5GHz

Conclusion

In this project, a high gain driver and power amplifier were implemented. The maximum power gain of the power amplifier is 20dB and that of the driver is 18dB at 3.5GHz. They both provide enough power gain to amplifier the WiMAX signal in the transmitter.