Sequans Communications: from WiMAX to 4G

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Way Beyond the Standard
Sequans: leading the WiMAX market

Maturity of products
- More than half of the WIMAX Forum Certified™ MIMO products are based on Sequans chips
- Large number of Sequans-based terminals are deployed with leading BS vendors: Samsung, Motorola, Alcatel-Lucent, Cisco, Huawei, Alvarion, ZTE

Superior performance & best cost structure
- Maximum throughput
- Lowest power consumption
- Chips for low-cost CPE and mobile handsets

Technology leadership
- 2 Tx enabling UL MIMO
- Integrated RF/BB 65nm single die & triple-band RF
- Pico and femto cell
- Mobile WiMAX R1.5-ready and 802.16m in progress
Involved with leading global operators

- Malaysia: Packet One
- Russia: Scartel
- India: BSNL, Tata, Reliance
- USA: Clearwire
- Japan: UQ
- Korea: KT
- S. Africa: Vodacom
- Bolivia: Nuevatel
- Argentina: Argentina Telecom
- UK: UKBB
- France: SHD
- Pakistan: Mobilink
- South Africa: Vodacom
Largest customer base
WiMAX today: uplink is the bottleneck!

- Uplink directly limits the coverage

Typical WiMAX deployment 1Tx Mobile Station

<table>
<thead>
<tr>
<th></th>
<th>Base Station</th>
<th>Mobile Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tx power</td>
<td>43 dBm</td>
<td>23 dBm</td>
</tr>
<tr>
<td>Subch. gain</td>
<td>0 dB</td>
<td>16 dB</td>
</tr>
<tr>
<td>MIMO gain</td>
<td>2 dB</td>
<td>0 dB</td>
</tr>
</tbody>
</table>

=> 6 dB DL/UL imbalance
Increasing uplink budget with 2Tx

Sequans solution

2 Tx MS @ 23 dBm

Legacy solution

1 Tx MS @ 23 dBm

Link-budget gains

+4.5 dB : CDD

works today with existing base stations (WiMAX R1.0)

+5.5 dB: STC

requires support of STC at the base station (WiMAX R1.5)
Coverage gains with 2Tx CDD

+4.5 dB gain on link budget
+30% coverage
-40% capex

Loss of uplink connection
Loss of downlink connection
Loss of uplink connection 1Tx
Loss of downlink connection 2Tx CDD
SQN1210: continuing innovation

Industry-leading performance

SQN1210 launched at Mobile World Congress ‘09

The New SQN1210: SoC for Mobile WiMAX Mobile Stations

- The first 65nm single die baseband and RF chip
- Ultra low power consumption:
  - <350 mW active mode (with fully loaded MIMO traffic)
  - 0.5 mW standby mode
- Very high throughput >40 Mbps
- 10X10 package: no external SDRAM
- Triple band RF support: 2.3, 2.5, 3.5 GHz
- Supports 2Tx, uplink MIMO, and mimoMAX™ technology

First announced customer - ZyXEL
WiMAX: a foundation for 4G technology

• 4G technologies are based on same core technology as Mobile WiMAX

• At chip level, many core IP blocks can be leveraged
  – OFDM modulator/demodulator
  – FEC
  – Channel estimation
  – MIMO processing

• Main differences to be taken into account
  – 20MHz channels
  – FDD support (only H-FDD required for WiMAX R1.5)
Sequans vision for 4G

• Develop technology for leading 4G technologies
  – IEEE 802.16m
  – LTE

• Support smooth evolution of WiMAX operators to 4G
  – Converged dual-mode ICs for backwards compatibility

• Main differentiators
  – Efficient low-power implementation
  – Radio performance