Small Cell Wireless Infrastructure
Power Amplifiers

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Introduction to ANADIGICS

Who we are:

• A leading provider of RF products for wireless communications
  – Over 25 years of technology innovation
  – Products targeting consumer demand for increased bandwidth
  – Power Amplifiers and RF Front End Modules

• Focused on growth markets
  – 3G/4G handsets, smartphones and mobile broadband devices
  – Wireless Infrastructure and Small Cell
  – CATV Infrastructure and Subscriber
  – WiFi/WiMAX enabled handsets notebooks, netbooks, tablets and mobile internet devices

• Headquarters in Warren, NJ (U.S.A.)
• Approx. 500 employees
• Offices in 10 locations worldwide
Small Cell Infrastructure Market Drivers

• Networks transitioning:

  high mobility, voice-centric  high capacity, mobile data-centric

• Data off-load for increasing data demand

• Indoor User Growth
  (65% of mobile data usage is indoors)

• Increased operator revenue
  (example: Zone-based Applications)

• Faster network installation
  – leverage SoN (Self-optimized Network)

• Lower costs: Spacial efficiency vs. spectrum efficiency

• Better performance and user experience
  – enhanced QoS (Quality of Service)
  – enhanced coverage – service in places that are difficult to reach
Small Cell Power Amplifier Requirements

- **High Linearity**
  - ACPR performance for WCDMA and LTE downlinks

- **Good Power Efficiency**
  - Lower power consumption for lower operating costs

- **Good Long-term Reliability**
  - High MTTF for base station applications

- **Integrated and Easy to Use**
  - Support ODM / CM business models
Linearity

• Low EVM and good Adjacent Channel Power Rejection (ACPR) needed
  – Downlink (base station) requirements more stringent than Uplink (handset)
  – ACPR tested to TM1 (WCDMA) and ETM1.1 (LTE) standards
  – EVM characterized using ETM3.1 (LTE)
  – Support high data rates; maximize channel utilization and # of users

**ANADIGICS’ PAs exhibit low EVM and support ACPRs of -47 dBc to -50 dBc at rated power levels for WCDMA and LTE downlinks.**
Efficiency

- Good power efficiency enables:
  - Cost-effective supplies
  - Less complex thermal design
  - Smaller layouts

- Class AB design advantages:
  - Overall lower current
  - Lower average junction temperatures
  - Better efficiency for operation at both rated and backed-off power levels

**ANADIGICS’ PAs are optimized for the best RF performance and efficiency at both rated output powers and at backed-off levels.**
Reliability

- Good long-term reliability is required for infrastructure
  - Minimize failure rates and network down time
  - Minimize costs of maintenance and repair

- For GaAs devices, junction temperature affects MTTF
  - Lower temperatures improve MTTF; higher temps degrade MTTF
  - Junction temperatures that exceed 150 deg C can lead to damage

ANADIGICS’ PAs exhibit “cool” junction temperatures of about 120 deg C, when operating at rated power levels and with case temperatures as high as 85 deg C.
Integration, Packaging and Application

- Integrated 50-Ohm RF matching
  - Minimizes number of external components
  - Ensures optimal performance

- Small solution size
  - 7 x 7 x 1.3 mm package
  - Few external components

- Pin-compatible product family
  - For platform flexibility

ANADIGICS’ PAs require few supporting circuit components, and no external RF tuning.
ANADIGICS’ 3G/4G Small Cell Wireless Infrastructure Power Amplifier Product Portfolio

**Band 1** (& 4, 10) 2.11 to 2.17 GHz
- AWB7127: +24.5 dBm Linear Power, In production now
- AWB7227: +27 dBm Linear Power, In production now

**Band 2** 1.93 to 1.99 GHz
- AWB7123: +24.5 dBm Linear Power, In production now
- AWB7223: +27 dBm Linear Power, Pre-production now

**Band 7** 2.62 to 2.69 GHz
- AWB7128: +24.5 dBm Linear Power, sampling now
- AWB7228: +27 dBm Linear Power, In production now

**Band 5** (& 18, 19) 860 to 894 MHz
- AWB7125: +24.5 dBm Linear Power, sampling 2Q12
- AWB7225: +27 dBm Linear Power, sampling 2Q12

**Band 8** 925 to 960 MHz
- AWB7129: +24.5 dBm Linear Power, sampling 3Q12
- AWB7229: +27 dBm Linear Power, sampling 4Q12

**Bands 12-14** (& 17) 728 to 768 MHz
- AWB7124: +24.5 dBm Linear Power, sampling 3Q12
- AWB7224: +27 dBm Linear Power, sampling 4Q12
ANADIGICS: Your RF Advantage

Product Performance Drives Success

- Innovative designs for best-in-class products
- Key enabler of increased broadband speeds
- High linearity/ Low ACPR
- Low power consumption/ High efficiency
- High levels of integration and superior performance
Thank You!