LTE Base Station & Handset Components 2014: A *Heavy Reading* Competitive Analysis

EXECUTIVE SUMMARY

Long Term Evolution (LTE) deployments are growing rapidly: There are now 300 commercially launched LTE networks in 107 countries. Mobile subscribers using the latest apps and services are continually using greater bandwidth and demanding better connectivity. LTE and LTE Advanced (LTE-A) provide the reduced latency, increased peak bandwidth and greater network capacity required for the advanced voice, data and video applications embedded in the latest smartphones.

The initial build out of large, macro base stations for LTE services is being augmented by a range of small base stations for metro, enterprise, residential and rural deployments. This heterogeneous network supports both LTE and legacy 2G/3G technologies. The LTE infrastructure must work in conjunction with existing networks and across a wide range of frequency bands. This presents significant challenges to system developers and carriers.

Semiconductor components have been key to the successful rollout of LTE networks around the world. To support the continued development of LTE and the introduction of LTE-A, semiconductor vendors have developed devices that support a complex mix of frequency bands, networks, bandwidths and performance. These flexible and highly integrated devices are delivering cost-effective and power-efficient solutions that scale to support more users and greater bandwidth.

The latest LTE system-on-a-chip (SoC) devices for smartphones and tablets integrate multimode LTE modems and high-performance quad-core processors. Handset manufacturers have moved quickly to replace discrete LTE modems and application processors with these integrated SoC devices. These developments have enabled a new class of mid-range smartphones with eye-catching performance and seamless connectivity across LTE and 3G networks. There is, however, still a place for discrete modems and application processors in high-end smartphones and tablets. The next challenges that are being addressed are extending support for global roaming and increasing network bandwidths by using carrier aggregation.

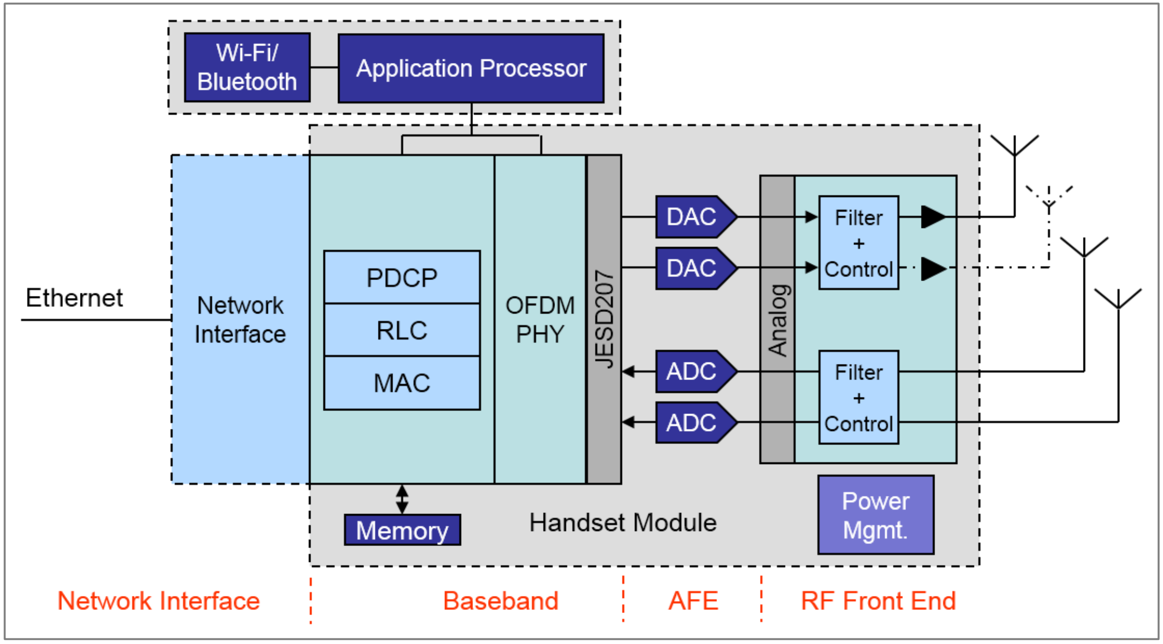
The global LTE semiconductor market is very competitive, with multiple vendors developing application processors, baseband and radio frequency (RF) devices for both base stations and user equipment. The rapid pace of development for LTE has fueled significant vendor consolidation, with market leaders acquiring smaller companies to combine complementary 3G, LTE and application processor technology and several key players exiting the market.

LTE Base Station & Handset Components 2014: A *Heavy Reading* Competitive Analysis identifies and analyzes the full spectrum of vendors developing LTE components for both base stations and user devices. It includes not only granular information on the components themselves – of interest to system OEMs, smartphone developers and service providers – but also insights into how the overall market and ecosystem is developing – of interest to a wide audience, including investors.

This report is based on a series of interviews conducted with a wide range of LTE silicon vendors during the first six months of 2014, along with product information supplied by vendors. The tables presented throughout the report are based on product documentation and supplemental data from our interviews and email exchanges. In total, the report evaluates and analyzes the products and strategies of 31 leading vendors in this rapidly growing market, including 119 baseband, RF and application processor devices.

The excerpt below shows a typical LTE subscriber unit with network interface, baseband, AFE, RF front-end and application processor. The leading vendors have integrated multimode baseband and application processor devices. Some application processors integrate Wi-Fi and Bluetooth functions. Several vendors supply chipsets mounted onto a multi-chip module to reduce cost and real estate. A few vendors have complete chipsets that include application processor, baseband, AFE, RF front end and power management chip.

Excerpt 1: LTE Subscriber Unit



Source: Earlswood Marketing

LTE smartphones use the highest-performance application processors. The excerpt below lists the leading application processors that are suitable for LTE smartphones and tablets.

Excerpt 2: LTE-Ready Application Processor Summary

COMPANY/ DEVICE	PROCESSOR CORE	# OF CORES	MAX CORE SPEED	PROCESS	PACKAGE	AVAIL-ABILITY
Allwinner UltraOcta A80	ARM Cortex-A15 + A7	4+4	N/D	N/D	N/D	Sampling
Allwinner A31	ARM Cortex-A7	4	N/D	N/D	N/D	Production
Intel Atom Z2480 (Medfield)	Atom	1	2.0GHz	32nm	12x12mm	Production
Intel Atom Z25xx (Clover Trail)	Atom	2	2.0GHz	32nm	14x14mm	Production
Intel Atom Z34xx (Merrifield)	Atom 64-bit (Silvermont)	2	2.13GHz	22nm	14x14mm	Production
Intel Atom Z35xx (Moorefield)	Atom 64-bit (Silvermont)	4	2.3GHz	22nm	N/D	Production

COMPANY/ DEVICE	PROCESSOR CORE	# OF CORES	MAX CORE SPEED	PROCESS	PACKAGE	AVAIL-ABILITY
Intel Atom Z37xx (Bay Trail)	Atom 64-bit (Silvermont)	4	2.4GHz	22nm	17x17mm	Production
Marvell PXA2128	ARMv7 (+ Hybrid LPM ARMv7)	2 (+1)	1.2GHz (624MHz)	40nm	19x19 or 12x12 PoP	Production
Nvidia Tegra 3	ARM A9	4	1.6GHz	40nm	14x14mm	Production
Nvidia Tegra 4	ARM Cortex-A15	4	1.9GHz	28nm	23x23mm BGA or 14x14mm FCCSP	Production
Nvidia Tegra K1 32-bit	ARM Cortex-A15	4+1	2.3GHz	28nm	23x23 FCBGA, 16x16 S-FCCSP, 15x15 FC PoP	Sampling
Nvidia Tegra K1 64-bit	ARMv8	N/D	N/D	N/D	23x23 FCBGA, 16x16 S-FCCSP, 15x15 FC PoP	2014
Qualcomm APQ8064T (Snapdragon 600)	Krait 300	4	1.9GHz	28nm	N/D	Production
Qualcomm APQ8074 (Snapdragon 800)	Krait 400	4	2.3GHz	28nm	N/D	Production
Qualcomm APQ8084 (Snapdragon 805)	Krait 400	4	2.7GHz	28nm	N/D	Production
Rockchip RK3168	ARM A9	2	1.5GHz	28nm	19x19mm TFBGA453	Production
Rockchip RK3188	ARM A9	2	1.6GHz	28nm	19x19mm TFBGA453	Production
Rockchip RK3288	ARM A17	4	1.8GHz	28nm	N/D	Production

Source: Heavy Reading

Report Scope & Structure

LTE Base Station & Handset Components 2014: A *Heavy Reading* Competitive Analysis is structured as follows:

Section I is an introduction to the report, with complete report key findings.

Section II explores the dynamics of the LTE market, provides an overview of LTE and LTE-A technology and covers seven vendors that provide intellectual property used in LTE silicon devices.

Section III focuses on base station solutions and examines 33 devices, including integrated LTE base station devices, LTE PHY devices and LTE MAC and control devices.

Section IV presents detailed product and strategy analysis for nine vendors that provide integrated LTE base station devices, LTE PHY devices and/or LTE MAC and control devices.

Section V analyzes 59 baseband devices and application processors for LTE and LTE-A user devices, including handsets, tablets and USB dongles.

Section VI presents detailed product and strategy analysis for 14 suppliers of integrated multimode handset devices, LTE baseband devices and/or application processors for LTE handsets, tablets and USB dongles.

Section VII analyzes 27 RF devices available for LTE and presents detailed product and strategy analysis for four vendors that provide RF devices and are not covered elsewhere in this report.

LTE Base Station & Handset Components 2014: A *Heavy Reading* Competitive Analysis is published in PDF format.

LTE COMPONENT VENDORS PROFILED (31)

Allwinner Technology Co. Ltd. / www.allwinnertech.com

Altair Semiconductor Ltd. / www.altair-semi.com

Altera Corp. (Nasdaq: ALTR) / www.altera.com

Analog Devices Inc. (NYSE: ADI) / www.analog.com

ARM Ltd. / www.arm.com

Avago Technologies Ltd. (Nasdaq: AVGO) / www.avagotech.com

Broadcom Corp. (Nasdaq: BRCM) / www.broadcom.com

Cadence Design Systems Inc. / www.cadence.com

Cavium Inc. (Nasdaq: CAVM) / www.cavium.com

Ceva Inc. (Nasdaq: CEVA) / www.ceva-dsp.com

Datang Leadcore Technology Co. Ltd., a subsidiary of the Datang Telecom Technology & Industry Group / www.datanggroup.cn

Ericsson AB (Nasdaq: ERIC) / www.ericsson.com

Freescale Semiconductor Inc. (NYSE: FSL) / www.freescale.com

GCT Semiconductor Inc. / www.gctsemi.com

Imagination Technologies Group plc (LSE: IMG) / www.imgtec.com

Intel Corp. (Nasdaq: INTC) / www.intel.com

Lime Microsystems Ltd. / www.limemicro.com

Marvell Technology Group Ltd. (Nasdaq: MRVL) / www.marvell.com

Maxim Integrated Products Inc. (Nasdaq: MXIM) / www.maxim-ic.com

Mediatek Inc. / www.mediatek.com

Nvidia Inc. (Nasdaq: NVDA) / www.nvidia.com

Octasic Inc. / www.octasic.com

PMC-Sierra Inc. (Nasdaq: PMCS) / www.pmc-sierra.com

Qualcomm Inc. (Nasdaq: QCOM) / www.qualcomm.com

Rising Microelectronics Co. Ltd. / www.rising-ic.com

Rockchip Electronics Co. Ltd. / www.rock-chips.com

Sequans Communications S.A. (NYSE: SQNS) / www.sequans.com

Spreadtrum Communications Inc. / www.spreadtrum.com

Texas Instruments Inc. (NYSE: TXN) / www.ti.com

Vivante Corp. / www.vivantecorp.com

Xilinx Inc. (Nasdaq: XLNX) / www.xilinx.com

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* All charts and figures in this report are original to *Heavy Reading*, unless otherwise noted.