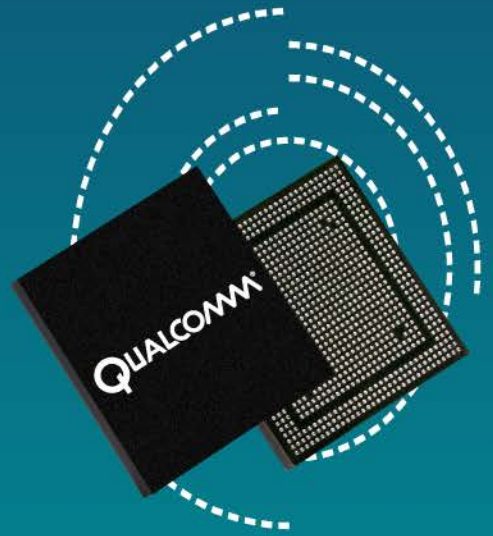
Qualcomm
TECHNOLOGIES, INC



MPSS.BO.2.x Modem Overview

80-NM328-28 B

Qualcomm Technologies, Inc.
5775 Morehouse Drive
San Diego, CA 92121
U.S.A.

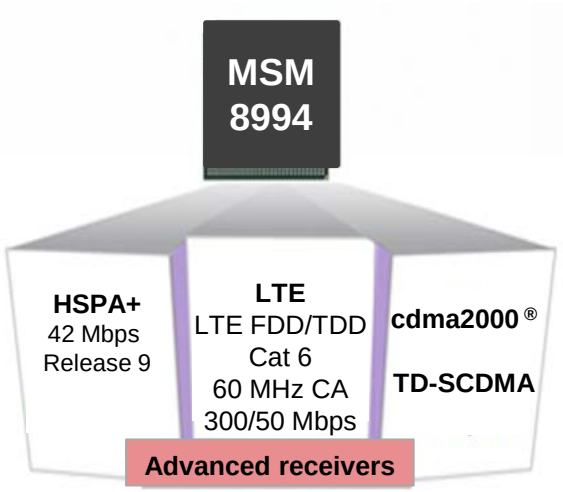
Revision History

Revision	Date	Description
A	Apr 2014	Initial release.
B	Sep 2014	Updated Slides 5, 12, 14, 16, and 25.

Contents

Introduction

- Advanced 4th generation LTE multimode modem
- 20-nm, 64-bit, processors SoC
  - 4xA57 2MB L2
  - 4xA53 512KB L2
- Supports all major modem technologies
  - LTE Cat 6 (300/50 Mbps)
    Release 10/Release 11
    - FDD/TDD 60 MHz DL 3x Carrier Aggregation (CA)
  - DC HSUPA (Release 9)
    1xAdv, DOrB, DOrA, gRICE
  - TD-SCDMA 16 QAM (2.8 Mbps)
  - GERAN – VAMOS Level 2
- Single RF chip solution for 2x DL CA – WTR3925
  - Additional WTR is required for 3x DL CA, SVLTE, DSDA

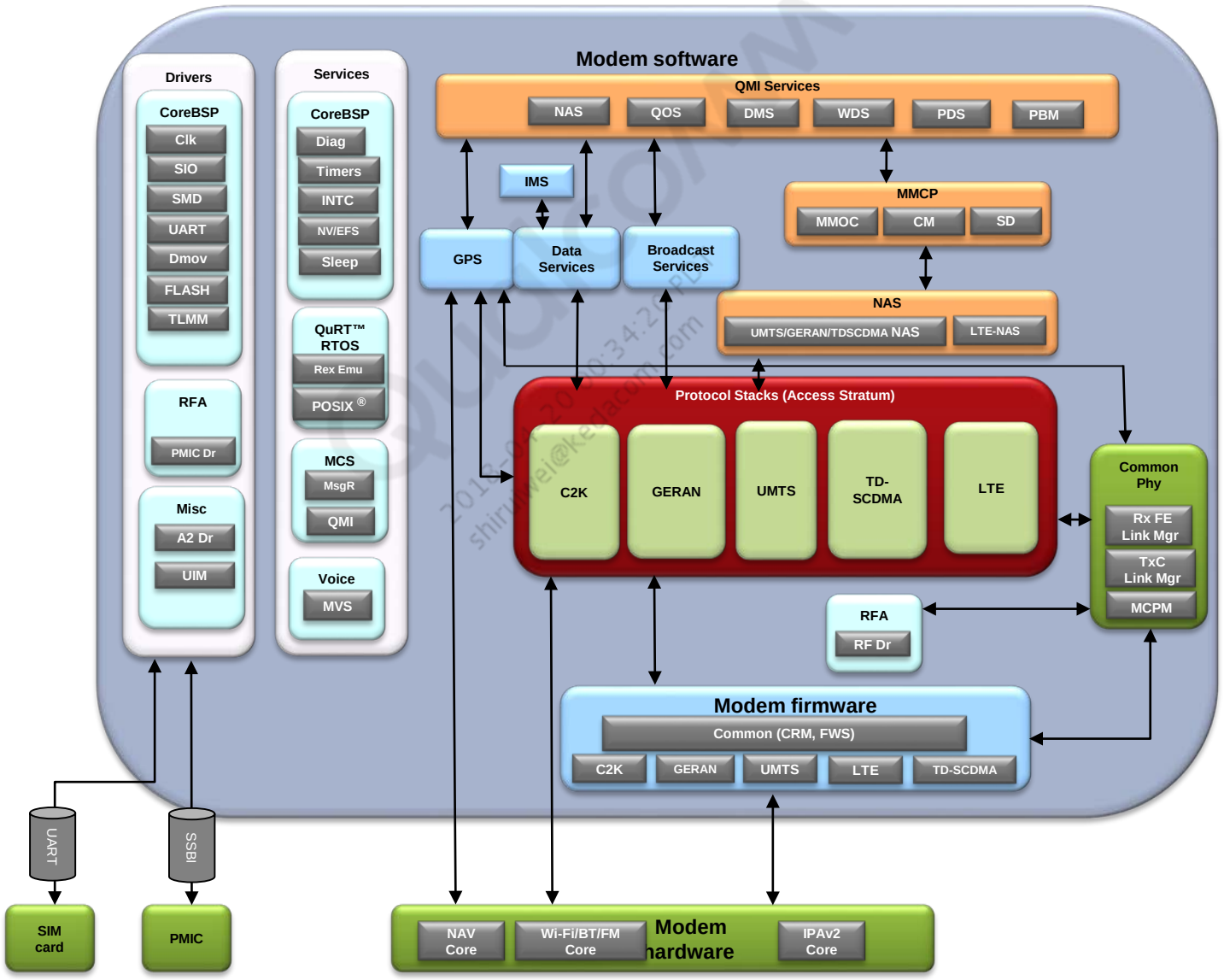


Introduction (cont.)

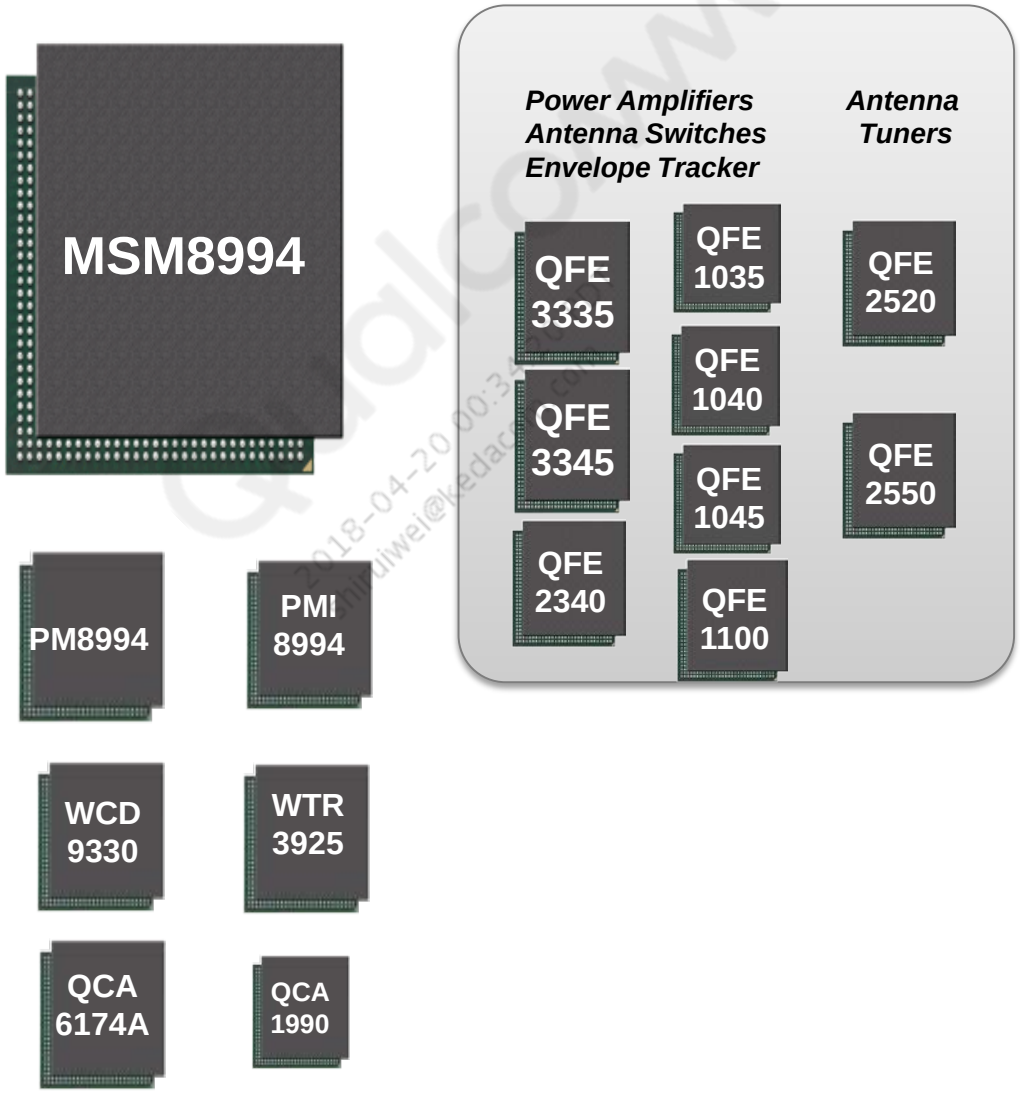
- Advanced receivers and interference cancelation
  - LTE NLIC, FeICIC, TM9, UL Coordinated Multi Point (CoMP)*
  - TM10 on LTE FDD and TDD
- Envelope tracking for LTE FDD and TD-SCDMA
- Supports Concurrent RATs (CRATs)
  - 1xSRLTE multimode Cat 4 TDD-FDD-LTE/C with hybrid-DO
  - 1xSLTE, gSLTE
  - SGLTE/SGTDS multimode TDD-LTE/TDS/G
- HO RxD (three-way/four-way RxD)*
  - LTE FDD and TDD, UMTS
- Supports CSFB-UMTS/TDS, e1xCSFB, and VoLTE
- eMBMS (Release 11)
- LTE FDD→1xSRVCC*

*In later Product Lines (PLs)

Modem Subsystem Architecture



MSM8994 Chipset Configuration – Smartphone and WAN Tablet



MSM8994 Chipset Configuration – Smartphone and WAN Tablet (cont.)

- Qualcomm RF360™ (RF360) benefits
  - High levels of integration
  - Reduced PCB area footprint
  - Time to market advantages
  - Leverage QMC reference platform
  - Reduce multi-SKUs to one SKU

- MSM8994 – 15.6 x15 mm POP, 2xLPDDR4
- RFIC – WTR3925 LTE CA , WTR3905 (non-CA)
- Power management
  - PM8994 – Power management for MSM™
  - PMI8994 – Power management for platform
- Codec – WCD9330
- Connectivity
  - QCA6174A WLAN 2x2 802.11 a/b/g/n/ac + BT4.1
  - NFC – QCA1990

MSM8994 Chipset Configuration – Smartphone and WAN Tablet (cont.)

- RF360 frontend solution
  - QFE3335 low-band PA
  - QFE3345 mid-band PA
  - QFE2340 high-band PA
  - QFE1100 envelope power tracker
  - QFE2520 primary antenna matching tuner
  - QFE2550 diversity antenna matching tuner
  - QFE1035 low-band dual feed antenna cross switch
  - QFE1045 mid/high-band dual feed antenna cross switch
  - QFE1040 RxD switch

MSM8994 Base Variants

Variant	LTE (Mbps)	CA	RF	Description
8994-1	300/50	3x (60 MHz)	1x WTR3925 + 1x WTR3905	CDMA/LTE/WCDMA/ TD-SCDMA/GSM
8994-3	300/50	2x (40 MHz)	1x WTR3925	CDMA/LTE/WCDMA/ TD-SCDMA/GSM
8994-5	150/50	2x (20 MHz)	1x WTR3915 if 2x CA (20 MHz) 1x WTR3905 if no CA	CDMA/LTE/WCDMA/ TD-SCDMA/GSM
8994-9	300/50	3x (60 MHz)	1x WTR3925 +1x WTR3905	LTE/WCDMA/TD-SCDMA/GSM
8994-B	300/50	2x (40 MHz)	1x WTR3925	LTE/WCDMA/TD-SCDMA/GSM
8994-D	150/50	2x (20 MHz)	1x WTR3915 if 2x CA (20 MHz) 1x WTR3905 if no CA	LTE/WCDMA/TD-SCDMA/GSM
8094-1	NA	NA	WGR7640	APQ – Modems disabled

- Pin compatible, drop-in replacements
- Same software release for all variants
- Same RF, PMIC, and connectivity companion devices

New Modem Architecture

- New modem architecture compared to previous family chipsets to support:
  - LTE Cat 6 data rates
  - LTE FDD/TDD DL 60 MHz 3x CA
  - DC HSUPA
  - FE-FACH (selected subfeatures)
  - GERAN – VAMOS Level 2
  - CRAT – 1xSRLTE, SRLTE, gSRLTE, and gSLTE
- Hexagon™ Ver 5.5 processor
  - 650 MHz – Nominal, 800 MHz – Turbo
  - 4 hardware threads
  - 1 MB L2 cache

New Modem Architecture (cont.)

- Single RF chip solution for 2xDL CA – WTR3925 (compared to two-RF chip solution on MDM9x25/MSM8974)
  - Additional WTR is required to support DL 3x CA, SVLTE, and DSDA
- A2-PER functionality combined with IPAv2 core
- IPA+PCIe/HSIC form the new peripheral subsystem (main data path)
- PCIe interface to AP
- Support for SS USB 3.0
- Integrated navigation Gen 8C, Wi-Fi®/Bluetooth®/FM cores

MSM8974 vs MSM8994

Technology area	Feature	MSM8974	MSM8994
GERAN	VAMOS-II	No	Yes
UMTS	3GPP release compliance	Release 9 Release 10 mandatory features	Release 9 Release 10 mandatory features
	HSPA+	Cat 24 (42 Mbps)	Cat 29 (63 Mbps)
LTE	LTE FDD/TDD cat	Cat 4 (150/50 Mbps)	Cat 6 (300/50 Mbps)
	LTE FDD/TDD release compliance	Release 10	Release 10 Release 11 mandatory features
	LTE FDD CA	20 MHz	60 MHz
	LTE TDD CA	No	60 MHz
	CSG support (LTE Femto)	No	Yes
	eMBMS service continuity	No	Yes
	SGLTE	Yes	Yes
TD-SCDMA	Support for TD-SCDMA RAT	Yes	Yes
NAS	3GPP release compliance	Release 10	Release 11
USIM	3GPP compliance	Release 10	Release 10
IMS	VoLTE	Yes	Yes

Key New Modem Features

- LTE – LTE FDD/TDD Cat 6
  - FDD – 300/50 Mbps
  - TDD – 222/26 Mbps
  - 60 and 40 MHz LTE DL FDD/TDD CA
    - DL FDD-CA – 20 MHz intraband noncontiguous
    - DL FDD and TDD CA – 60 and 40 MHz interband
    - DL TDD-CA – 60 and 40 MHz intraband contiguous and noncontiguous
  - TM10 (CoMP) (Release 11)
  - TM9 (CSI-RS, DM-RS)
    - FDD up to eight Tx
    - TDD up to eight Tx
  - WAN-WAN Nonlinear Interference Cancellation (NL-IC) (selected combinations)
  - eMBMS service continuity (Release 11)
  - FGI102 – Trigger type 1 SRS (aperiodic SRS) transmission
  - RRC connection reject with deprioritization for FDD and TTD (Release 11)
  - Home eNodeB (up to Release 10, depending on IOT availability)

Key New Modem Features (cont.)

- LTE advanced receivers – NLIC, FeICIC-IC, eICIC-IC, Data IC (FC)
- VoIP and VT over iWLAN, SRVCC, and VoLTE emergency call service category
- WCDMA
  - DC-HSUPA (Cat 8, 11 Mbps) Release 9
  - FE FACH – Absolute priority-based reselection to LTE FDD
- GERAN
  - VAMOS Level 2
  - TIGHTER – Tightened link-level performance requirements for single antenna MS-PS
- CRAT support
  - 1xSRLTE
  - 1xSLTE
  - SGLTE
  - SGTDS
- QMI/RIL – QCCI/QCSI QMI services
  - New client and server interfaces are added

LTE (FDD/TDD)

- 3x DL CA
  - Supports up to three active DL component carriers
  - Maximum 60 MHz aggregate bandwidth
  - Supports inter- and intraband CA
  - Supports FDD and TDD modes
- Potential benefits
  - Enables operators to further aggregate fragmented spectrum
  - Can provide improved throughputs at cell edge as well as increases in average throughputs
  - Enables multiuser scheduling across carrier providing diversity gains
- No peak DL data rate increase for 3x DL CA
  - Peak DL data rate is limited by UE category – 300 Mbps for Cat 6 (see [S12])

LTE (FDD/TDD) (cont.)

- LTE TDD CA
  - Supports up to three active component carriers
  - Maximum 60 MHz aggregate bandwidth
  - Supports inter- and intraband CA
  - Supports different UL/DL TDD configurations on interband component carriers (Release 11)
    - Full duplex – Support for simultaneous Tx/Rx; feature is optional with UE capability signaling
    - Half duplex – No simultaneous UL/DL transmission; mandatory in Release 11
- Further Enhanced ICIC (Fe-ICIC)
  - Part of Release 11
  - In Fe-ICIC, the ICIC is assisted by the data provided by the network
  - The network provides this assistance in the form of NeighCellsCRS-Info list
  - For each cell in the list, the assistance information consists of the PCI, MBSFN configuration, and number of antenna ports
  - When the cell to be measured has CRS colliding with a cell whose CRS assistance information is available, the UE can use it to cancel the CRS for measurement patterns

LTE (FDD/TDD) (cont.)

- TM10 (CoMP)
  - This was introduced in Release 11 and is an enhancement to TM9 to support CoMP.
  - CoMP transmission/reception improves interference management, cell coverage, cell edge throughput, and spectral efficiency.
  - With CoMP, the UE may be able to receive signals from multiple cell sites and the UE's transmissions may be received at multiple cell sites regardless of the system load.

LTE (FDD/TDD) (cont.)

- Key features
  - LTE FDD/TDD Cat 6
    - LTE FDD – 300/50
    - LTE TDD – 222/26 Mbps
  - CA (FDD/TDD DL)
    - Multiple component carriers are aggregated to form a larger overall transmission bandwidth
    - Supports CA for LTE bandwidths {5, 10, 15, 20} + {5, 10, 15, 20} MHz permutations
    - List of CA band combinations as specified in [S26]
    - Indicated through the supported band combination list – Bitmap indicates the combinations supported by the UE
    - DL FDD and TDD 2x CA – 40 MHz interband/intraband, contiguous and noncontiguous
      - Intra- and interband are treated differently
      - Intraband – Processes 40 MHz bandwidth signals with single RF chain
    - 40 MHz DL CA supported through single RF chip – WTR3925

LTE (FDD/TDD) (cont.)

- Key features (cont.)
  - TM9 (CSI-RS, DM-RS) – Eight-layer spatial multiplexing
    - FDD up to eight Tx
    - TDD up to eight Tx
    - Introduced in Release 10 to boost cell edge data rates and reduce interference
    - Extends the concept of MIMO to eight layers transmission
    - Supports both SU-MIMO and MU-MIMO and can dynamically switch between two modes
    - Introduces new Reference Signals (RSs) that decouple RS for traffic demodulation and RS for channel estimation
      - Common Service Interface Reference Signal (CSI-RS) for feedback
        - New RS for channel estimation
        - CRS-based interference measurement
        - Requires new Channel State Feedback (CSF) computation/report for eight Tx antennas
      - UE-RS – UE-specific RS for demodulating traffic
      - CRS for control, RRM, as with previous TMs
        - Reference signals for mobility measurements, CCH/PBCH demodulation
    - Supports new DCI format (DCI 2C)
    - TM9 combined with CA and eICIC creates a highly spectrally efficient network

LTE (FDD/TDD) (cont.)

- WAN-WAN NL-IC
  - Near-harmonic relationship between Tx and Rx frequencies exists for certain interband CA combinations
    - Example – B4 (2110 to 2155 MHz), B17/B12 (700 to 716 MHz); AT&T, third harmonic, and Tx LO
  - NL-IC goal is to mitigate Tx signal interference by synthesizing and canceling it
  - NL-IC is turned on/off for power efficiency based on:
    - CA band combination and potential overlap
    - Tx power level, Rx power level, and SNR
    - UL allocation and UL activity
- eICIC* (Release 10) without IC
  - Enhanced Intercell Interference Coordination in Release 10 (Release 8 ICIC not efficient)
  - Supports HetNet deployment
  - 3GPP Release 10 eICIC does not require IC
  - 3GPP Release 11 feICIC provides network assistance for IC
  - Creates Almost Blank Subframes (ABS) with minimal macro transmission
    - Macro only uses non-ABS for data, but still sends CRS on ABS
    - Pico uses ABS for CRE UE, non-ABS for UEs with stronger pico coverage than macro
    - X2 interface for coordination of ABS over backhaul among eNBs
    - Modified RRM/RLM/CSF procedures restricted to specific subframes

*In later PLs

LTE (FDD/TDD) (cont.)

- FGI102 – Trigger type 1 SRS (aperiodic SRS) transmission
  - SRSs are used to estimate uplink channel quality in other frequency areas as a basis for scheduling decisions.
  - Aperiodic SRS is introduced in Release 10 for flexible SRS transmission.
  - Aperiodic transmissions are dynamically triggered via PDCCH.
  - Trigger type 1 – DCI formats 0/4/1A for FDD and TDD and DCI formats 2B/2C for TDD.
- RRC connection reject with deprioritization for FDD and TTD (Release 11)
  - The LTE eNB, depending on the nature of the problem experienced in the network, rejects a connection establishment request with indications that deprioritize either the serving frequency or all of the LTE frequencies for a specified duration.
  - Upon receiving such a deprioritization indication, the UE modifies the current cell reselection layer prioritizations such that the priority of the serving LTE frequency or all of the LTE neighbor frequencies is lowered.
  - If the waitTime included in the rejection is longer than the Treselect of the neighbors, the UE should be able to reselect to the highest priority neighbor (after deprioritization has been applied).
  - This reselection results in the UE avoiding a potentially congested eNB.
- Home eNB (up to Release 10, depending on IOT availability)

LTE (FDD/TDD) (cont.)

- eMBMS service continuity
  - Basic eMBMS functions are defined in Release 9
  - However, eMBMS is not fully taken into consideration in mobility in Release 9/ Release 10
    - In Idle mode, the normal cell selection/reselection procedure may result in the UE camping on a cell that does not provide the desired eMBMS service.
    - In Connected mode, the UE may be handed over or redirected to a cell not providing the desired eMBMS service.
  - Service continuity in Release 11
    - This specifies cell selection/reselection mechanisms to enable the UE to receive the desired MBMS services in RRC Idle mode.
    - It also specifies the signalling mechanisms to enable the network to provide continuity of the desired MBMS services reception in RRC Connected mode.

UMTS

- DC-HSUPA (Release 9)
  - Supports up to 11.5 Mbps UL
  - Two adjacent 5 MHz carriers
  - Dual-cell operation on adjacent frequencies

- Absolute priority-based reselection to LTE FDD/TDD from WCDMA
  - Definition – The network assigns priorities to the LTE FDD/TDD cells for the UE to prioritize the reselection
  - Implementation – Procedures executed
    - cellReselectionPriority specifies the absolute priority for EUTRA frequencies.
    - If the threshold criteria is met, the UE reselects the highest-priority LTE frequency.
  - FE FACH – Absolute priority-based reselection to LTE FDD
    - This extends support of absolute priority reselection to CELL_FACH state (W→W, W→G, and W→L).
    - The specification introduces Extension IE in existing SIB19 to indicate FACH reselection information. The network indicates to the UE which one of the two layers to measure in CELL_FACH (HIGH_PRIORITY or ALL_PRIORITY).
  - Release 11 3GPP feature

CRATs

- 1x Single Radio LTE (1xSRLTE)
  - A single-transceiver design that supports dual receive operation by enabling tuning away LTE to receive 1X pages when LTE is in the Access, Connected, or Idle state; a 1xSRLTE device enables 1X voice or LTE data, i.e., when the UE receives or originates a 1X voice call, LTE activity is suspended; upon completion of the 1X voice call, LTE operation resumes
  - This is similar to how 1xEVDO works in Hybrid mode
  - Motivation – To save battery power and cost of second transceiver and associated circuitry
  - Limitation – Cannot support simultaneous voice (1X) and data (LTE) operation, i.e., SVLTE
- 1x Simultaneous LTE (1xSLTE)
  - A working mode (1xS-DRxLTE) that allows LTE and 1X operation simultaneously; in this mode, when LTE and 1X RAT contend for radio resources in LTE Active/1X Idle or LTE Idle/1X Idle state, LTE and 1X RAT continue operation using PRx-Tx and DRx chain, respectively
  - This is similar to how 1xEVDO works in SHDR mode

CRATs (cont.)

- GSM Single Radio LTE (gSRLTE)
  - A single-transceiver design that supports dual receive operation by enabling tuning away LTE to receive GSM pages when LTE is in the Access, Connected, or Idle state; a gSRLTE device enables GSM voice or LTE data, i.e., when the UE receives or originates a GSM voice call, LTE activity is suspended; upon completion of the GSM voice call, LTE operation resumes
  - Motivation – To save battery power and cost of second transceiver and associated circuitry
  - Limitation – Cannot support simultaneous voice (GSM) and data (LTE) operation, i.e., SGLTE
- GSM Simultaneous LTE (gSLTE)
  - A working mode (gS-DRxLTE) that allows LTE and GSM operation simultaneously; in this mode, when LTE and GSM RAT contend for radio resources in LTE Active/GSM Idle or LTE Idle/GSM Idle state, LTE and GSM RAT continue operation using PRx-Tx and DRx chain, respectively

UIM Key Features

- M2M – SIM access profile in Client mode
  - Supports M2M use case in the automotive industry
  - More vehicles are projected to have a modem with a local SIM to support features such as emergency calls and telematics use cases; a new mechanism allows establishing a Bluetooth link between the user device, e.g., phone, and the vehicle modem to use the remote SIM on the end user's mobile device instead of the local SIM, thus allowing the end user to bring their mobile subscription, contacts, and preferences into the vehicle environment without any manual intervention
- Support for on-chip configuration in NV mode and configuration for multiple slots
  - Allows auto-activating on-chip at power-up
  - On-chip support for SIM/USIM configurations
- Subscription manager – Allows switching between two SIMs based on user selection; only UIM drivers will be dual SIM aware

UIM Key Features (cont.)

- NFC
  - Extended APDU support for NFC/ISIS
  - Enhanced feature to support CMCC NFC test specifications
- SIM busy feature
  - Allows clients to be aware of when the SIM is busy so that appropriate actions can be taken by the individual tasks waiting for the response from the SIM card
- USB UICC
  - Transformation of UIM to a multimedia card by supporting Integrated Circuit Card Device (ICCD), Mass Storage (MS), and Communication Device Class-Ethernet Emulation Model (CDC-EEM) interfaces
- New SimLock solution in ARM® TrustZone®
  - Redesigned for improved security

UIM Key Features (cont.)

- Toolkit support
  - Bearer Independent Protocol (BIP) over WLAN
    - BIP support over WLAN using the TCP/IP stack on the apps processor
    - Support available for prioritizing either WLAN or cellular
  - GSTK support for UIM runtime configuration for DSDS targets
    - Reorganization of GSTK code to remove FEATURE_DUAL_SIM feature flag and use runtime determination that is currently available
  - UIM elimination of activation
    - Verizon requirement to reduce activity during the activation process
  - UICC DNS resolution changes
    - Currently, BIP only allows the UICC to use hard-coded IP addresses for the destination; this limits its flexibility in the network, where destinations are typically addressed by domain names
    - Added a mechanism for the UICC to retrieve the IP addresses of the DNS servers configured in the network for the link to the gateway
    - Added a mechanism for an indication to the terminal that a link could be kept established so that the full data exchange sequence can be handled efficiently
  - GSTK for single baseband SGLTE
  - SIM hotswap and recovery support in toolkit

GERAN Key Features

- VAMOS (Level 2) – Release 9 feature
  - This increases the voice handling capacity of a network.
  - In the current network implementation, a timeslot can be shared with a maximum of two mobile stations using two Half Rate (HR) channels (TDMA slot used in alternate frame per subscriber).
  - With VAMOS, each HR channel can be further shared between two mobile stations, each assigned TSC from different TSC sets. Hence, up to four mobile stations can be shared on a single time slot, increasing the voice capacity of the network.
  - VAMOS-II has more stringent performance requirements. To improve SACCH performance, the concept of shifted SACCH was introduced for VAMOS-II.
  - For a VAMOS subchannel allocated with training sequence from TSC set 2, the SACCH time slot is shifted to a different position.
  - The base station signals the VAMOS level used to the UE with the following commands:
    - Assignment command
    - Channel mode modify
    - Handover command

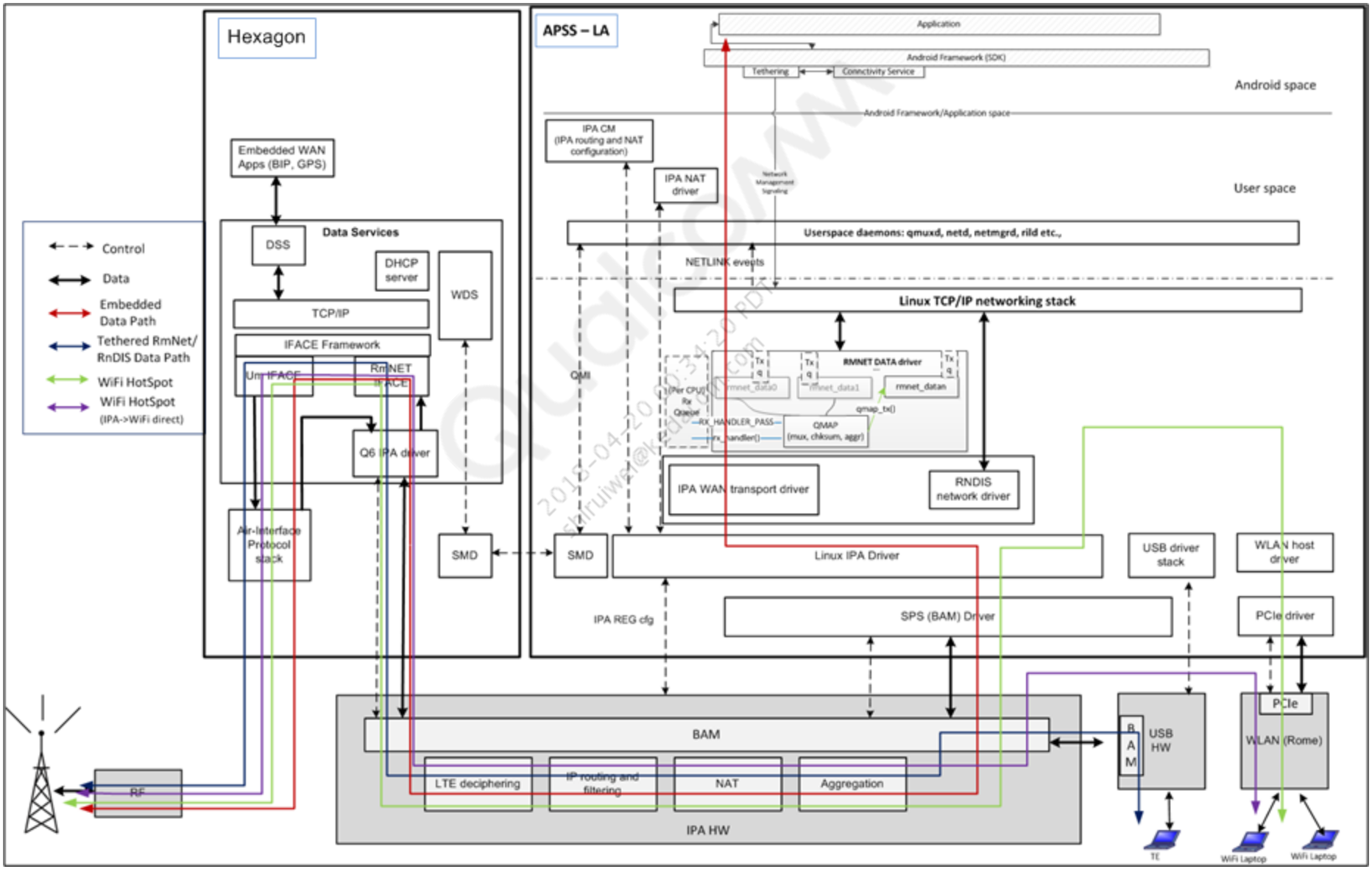
GERAN Key Features (cont.)

- Tightened link-level performance requirements for single antenna MS-PS
  - With this feature, the UE complies with the more stringent performance requirements as per [S27].
- MSRD DARP Phase II
  - With this feature, the UE complies with the reference sensitivity level and reference interference level requirements for DARP Phase II as per [S28].
  - DARP Phase II has stringent spec requirements on BLER and BER performance expectations.
- A5/4 and GEA4
  - A5/4 and GEA4 are encryption algorithms for GSM and GPRS, respectively.
  - These algorithms are stream ciphers used to encrypt/decrypt blocks of data under a confidentiality key KC.
  - These algorithms are based on the KASUMI algorithm specified in [S29].
  - A5/4 is the same algorithm as A5/3 but with KLEN changed from 64 to 128 bits.
  - GEA4 is the same algorithm as GEA3 but with KLEN changed from 64 to 128 bits.

Data Services

- LTE Cat 6 (300 DL/50 UL Mbps)
- MSM architecture with IPA
  - Replaces A2 PER blocks from previous generation MSMs
  - IPA Q6, IPA Linux® drivers for interfacing IPA hardware
- DS profile refactoring
  - Supports a new family of profiles for EPC
  - Unified storage format for all 3GPP and eHRPD profiles
- 3GPP Release 11 DS requirements addition
  - Session Management (SM) backoff timer handling for network-initiated PDN connectivity deactivation
  - Supports new SM cause codes #65 and #66
- Stateless DHCPv6 additions
  - IPv6 DNS and PCSCF addresses are configured via stateless DHCPv6
- ePDG support for WLAN offload
  - Uses WLAN to access EPC via the ePDG over the IWLAN_S2B interface and allow mobility between WLAN and WWAN EPC RATs
  - Supports NSWO traffic and MAPCON functionality

High-Level Software Architecture



QMI/RmNet

- Dynamic port configuration
  - Control and data ports are no longer statically configured. There are no predefined ports in QMUX.
  - On bootup, peripheral drivers on A7 or Apps Processor (AP) request port opening and closing via Data Port Mapper (DPM) QMI messages and then QMUX on the modem configures ports accordingly.
- Single control channel
  - Number of physical channels is limited. To support multi-PDN, AP must use a single QMI control channel to control multi-PDN data calls and use QMAP for data channel muxing.
  - QMI WDS, QoS, and other data call-related services define a bind message to bind clients to desired data channels. The bind message should be the first message sent after a client is allocated.
  - Without binding, the number of PDNs that can be supported is limited to the number of physical channels, e.g., two.

QMI/RmNet (cont.)

- Qualcomm Mux and Aggregation Protocol (QMAP)
  - QMAP is required to mux logical data channels into a physical channel
  - QMI-based flow control or QMAP in-band flow control is required when QMAP is used
- Other changes
  - rmnet_config.txt EFS file is deprecated and is being replaced by NV 72522 (rmnet global config)
  - Old autoconnect NV 3534 is deprecated and is being replaced by a new NV (TBD)

QCCI/QCSI QMI Services

- QMI Common Client Interface – New QCSI API function
  - Instead of qmi_csi_register(), call qmi_csi_register_with_options() which takes in an additional qmi_csi_options parameter that can be set with various values to modify the default behavior of QCSI ServiceOther changes
    - QMI_CSI_OPTIONS_SET_INSTANCE_ID(opt, inst)
    - QMI_CSI_OPTIONS_SET_SCOPE(opt, _scope)
    - QMI_CSI_OPTIONS_SET_MAX_OUTSTANDING_INDS(opt, _max)
    - QMI_CSI_OPTIONS_SET_RAW_REQUEST_CB(opt _raw_req)
    - QMI_CSI_OPTIONS_SET_PRE_REQUEST_CB(opt, _pre_req)
    - QMI_CSI_OPTIONS_SET_RESUME_IND_CB(opt, _resume_cb_)
    - QMI_CSI_OPTIONS_SET_REQ_HANDLER_TBL(opt, _tbl, _size)
- QMI Common Server Interface – New QCCI API function
  - Init instance
    - Helper blocking function to lookup and initialize a connection to a service with a specific instance ID (or QMI_CLIENT_INSTANCE_ANY)
    - Handles the notifier initialization and waiting aspect of client init
  - Register notify callback
    - Asynchronous callback-based addition to qmi_client_notifier_init()

IMS

- SRVCC Before Ringing (bSRVCC)
  - SRVCC during call before ringing/alerting
- SRVCC of video call over LTE to CS voice
- Voice over IP over interworking Wireless Local Area Network (VoIP over iWLAN) (Connected and Idle mode)
- Video Telephony over interworking Wireless Local Area Network (VT over iWLAN)
- Support for VoLTE emergency call service category
  - Supports emergency service category setting in emergency call setup procedure
- VT/UCE
  - Video telephony and UCE requirements for AT&T
- VT multitasking
  - VT multitasking requirements and OEM responsibilities

IMS (cont.)

- Mid-call video resolution adaptation
  - Video best encoded frame rate changed to match the adopted bit rate for best possible video quality
- HD video telephony (APSS)
  - Supports HD VT (1024 x 768 at 15 fps and 1280 x 720 at 15 fps) with Level 3.1 constrained baseline and constrained high profile
- Support for Globally Routable User agent URI (GRUU)
  - Supports GRUU parameter in requests and responses and takes appropriate action based on the parameters

RF

- WTR3925 is a multimode, multiband RF 28nm CMOS transceiver
  - Single-chip solution for LTE DL CA 20+20 MHz
  - 28nm for power savings
  - Uses two-wire MIPI_RFFE for configure, control, and status
  - Feedback receiver for closed loop power control
  - Real-time ILPC correction
  - Tx RSB correction
  - Rx RSB correction
  - IIP2 sensor (RFFE control to WTR)

References

Ref.	Document	
Qualcomm Technologies		
Q1	*Application Note: Software Glossary for Customers*	CL93-V3077-1
Standards		
S1	*Single Radio Voice Call Continuity (SRVCC); Stage 2*	3GPP TS 23.216 (Jun 2013)
S2	*Requirements for Support of Radio Resource Management (FDD)*	3GPP TS 25.133 (Oct 2013)
S3	*Physical Layer Procedures (FDD)*	3GPP TS 25.214 (Oct 2013)
S4	*High Speed Downlink Packet Access (HSDPA); Overall Description; Stage 2*	3GPP TS 25.308 (Sep 2013)
S5	*Medium Access Control (MAC) Protocol Specification*	3GPP TS 25.321 (Jul 2013)
S6	*Radio Link Control (RLC) Protocol Specification*	3GPP TS 25.322 (Apr 2013)
S7	*Radio Resource Control (RRC); Protocol Specification*	3GPP TS 25.331 (Oct 2013)
S8	*Evolved Universal Terrestrial Radio Access (E-UTRA); Requirements for Support of Radio Resource Management*	3GPP TS 36.133 (Oct 2013)
S9	*Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Layer Procedures*	3GPP TS 36.213 (Oct 2013)
S10	*Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall Description; Stage 2*	3GPP TS 36.300 (Sep 2013)

References (cont.)

Ref.	Document	
Standards		
S11	*Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) Procedures in Idle Mode*	3GPP TS 36.304 (Sep 2013)
S12	*Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) Radio Access Capabilities*	3GPP TS 36.306 (Sep 2013)
S13	*Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol Specification*	3GPP TS 36.331 (Sep 2013)
S14	*Mobile Radio Interface Layer 3 Specification; Radio Resource Control (RRC) Protocol*	3GPP TS 44.018 (Oct 2013)
S15	*Radio Subsystem Link Control*	3GPP TS 45.008 (Sep 2013)
S16	*cdma2000 High Rate Packet Data Air Interface Specification*	3GPP2 C.S0024-A v3.0 (Sep 2006)
S17	*E-UTRAN – cdma2000 Connectivity and Interworking: Air Interface Specification*	3GPP2 C.S0087-0 v1.0 (May 2009)
S18	*Upper Layer (Layer 3) Signaling Standard for cdma2000 Spread Spectrum Systems*	3GPP2 C.S0005-E v2.0 (Jul 2011)
S19	*Circuit Switched (CS) Fallback in Evolved Packet System (EPS); Stage 2*	3GPP TS 23.272 (Sep 2013)
S20	*Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Improved Network Controlled Mobility Between E-UTRAN and 3GPP2/Mobile WiMAX Radio Technologies*	3GPP TS 36.938 (Feb 2010)

References (cont.)

Ref.	Document	
Standards		
S21	*Non-Access-Stratum (NAS) Protocol for Evolved Packet System (EPS); Stage 3*	3GPP TS 24.301 (Oct 2013)
S22	*UTRAN Overall Description*	3GPP TS 25.401 (Jan 2013)
S23	*E-UTRAN – cdma2000 1X Connectivity and Interworking Air Interface Specification*	3GPP2 C.S0097-0 (Apr 2011)
S24	*Administration of Parameter Value Assignments for cdma2000 Spread Spectrum Standards*	3GPP2 C.R1001-H (Jul 2011)
S25	*Mobile Radio Interface Layer 3 Specification; Core Network Protocols; Stage 3*	3GPP 24.008 (Oct 2013)
S26	*Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) Radio Transmission and Reception*	3GPP TS 36.101 (Jul 2014)
S27	*Radio Transmission and Reception*	3GPP TS 45.005 (Dec 2013)
S28	*Release Independent Downlink Advanced Receiver Performance (DARP); Implementation Guidelines*	3GPP TS 45.015 (Sep 2012)
S29	*3G Security; Specification of the 3GPP Confidentiality and Integrity Algorithms; Document 2: Kasumi Specification*	3GPP TS 35.202 (Sep 2012)

Questions?

https://support.cdmatech.com