Cellular Networking Perspectives

Editor: David.Crowe@cnp-wireless.com Vol. 11, No. 12 December, 2002

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WiFi Aims for Even Higher Speeds

IEEE 802.15 is considering a project to define a physical layer providing at least 100 Mbps of bandwidth. By comparison, current 802.11b systems offer a maximum of 11 Mbps.

Frequency bands being considered for this new physical layer are 25 and 60 GHz. The controversial UWB (Ultra Wide-Band) technology will be considered. This may not make public wireless carriers happy, as many believe that this will result in considerable interference with their systems.

Companies are required to make a non-binding declaration of their intent to submit a technical proposal by February 3, 2003. 802.15 will spend most of the remainder of 2003 refining the technical requirements and selection criteria.

For more information, consult:

www.ieee802.org/15/pub/SG3a.html

Number Pooling and TLDNs

On November 26, 2002, the TIA circulated an advisory about a potential problem regarding TLDNs and Number Pooling – two days after the US Number Pooling mandate came into effect.

TLDNs are the phone numbers used by all cellular systems to provide call delivery. The number belongs to a Serving System and is transferred to the Home System of a roamer by call delivery setup signaling. Routing with this number through the PSTN will result in calls being directed to the correct serving MSC.

During the development of TIA IS-756 for Number Portability, it was assumed that the TLDN numbers would not be portable. Indeed, since they are invisible to wireless consumers, there is no reason that they should be portable. Well, almost no reason.

Several years ago, AT&T Wireless discovered that some of its wireless office systems had problems because of this assumption. The TLDNs came from the PBX block of numbers, so if phone service for the PBX was ported, so would the TLDNs. A work-around would be to leave the TLDNs with the old carrier or obtain a new block of numbers from the new carrier. But this increases the management burden and requires a level of understanding of wireless issues that most PBX managers will not have.

Number Pooling introduces an even worse problem. Number blocks that are not fully utilized will be shared between carriers. If a wireless carrier applies for numbers within a rate center, and cannot justify obtaining an entire block of 10,000 numbers, they will be assigned a Pooled block of a multiple of 1,000 numbers.

Pooled blocks of numbers are essentially ported. Delivering a call to any number in the block will result in a number portability query to determine the destination.

Obtaining TLDNs from within non-pooled blocks is not a very good solution, because it requires the assignment of 10,000 numbers for a handful of TLDNs. If that is done, Number Pooling will waste far more numbers than it saves.

IS-756 implements the assumption that TLDNs are not ported by setting the FCI bit in the outgoing ISUP IAM message to tell intermediate carriers not to perform a number portability query. Consequently, a call being delivered from an IS-756-capable Home System to a Serving System using a pooled block of numbers may fail, because the necessary number portability query will be suppressed.

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The severity of this problem is unknown. The U.S. number portability mandate has been delayed until 2003, so IS-756 implementations may be rare. Plus, they may be systems that also must support Number Pooling. If so, they already have a solution. It is also possible that intermediate carriers (e.g. IXCs) ignore the FCI bit that is used to suppress number portability queries for TLDNs.

Local Carriers Criticize VoIP Numbering Usage

Three US Local Exchange Carriers (Qwest, Verizon and BellSouth) have filed a report with the North American Numbering Council complaining about the numbering practices of Voice over IP (VoIP) carriers:

www.nanc-chair.org/docs/Nov/Nov02_VoIP_White_Paper.doc

The paper notes that VoIP carriers will assign their customers a number from any region of the country in which they have a number assignment, and that the number can be retained by the customer even if they move to another location. In fact, VoIP carriers do not insist that their customers get a local number in the first place.

Local Exchange Carriers, by contrast, must be assigned numbering resources from within a rate center (often a very small geographical area) and the phone must be physically within that area. Portability only applies between service providers within that area. LECs also have to fulfill utilization criteria to obtain more numbers within a rate center, and their number blocks may be subject to partial reassignment (Number Pooling) if they are not fully utilizing them.

The LECs have identified a problem, but keeping things the way they are is not the only solution. Even wireless carriers will have a hard time adapting to the Rate Center boundaries necessary for participation in Number Pooling.

Ironically, the LECs profess a concern over number conservation, yet much of the waste of numbers in the U.S. is a direct result of the rate center concept!

Forcing VoIP carriers to adapt to overly stringent geographical restrictions would probably eliminate them from existence. Perhaps regulators will eventually realize the rate center concept is obsolete, leading them to come up with something all carriers can live with.

VoIP carriers, on the other hand, should expect to be accountable for the numbering resources they use. As long as they are small, they can avoid much of the oppressive regulatory regime dictating much of LEC numbering policy. But, this period of benign neglect cannot last forever.

3GPP TSG RAN#17 Update

TSG Radio Access Network (TSG RAN) is responsible for the definition of the functions, requirements and interfaces of the UTRA network in its two modes: FDD and TDD, including:

- Radio performance,
- Physical layer,
- Layer 2 and layer 3 Radio Resource (RR) specification in UTRAN,
- Access network interfaces (Iu, Iub and Iur),
- O&M requirements in UTRAN,
- Conformance testing for Base Stations.

The number of Change Requests (CRs) for Release 1999 (R99) is decreasing, but still significant. It was agreed that new CRs on R99 should be carefully reviewed by WGs to ensure 'forward' compatibility with Release 4.

Work on Release 5 (Rel-5) is almost completed. TSG RAN made the following agreements:

- QPSK-only User Equipment can be kept for High Speed Downlink Packet Access (HSDPA) in Release 5. For Release 6, the issue will be revisited.
- It is too late to introduce new functionality into Rel-5 (e.g. through CRs).
- The 'UTRAN sharing in connected mode' work item has been completed.

The completion date was slipped for several work items for Release 6:

- Improvement of Radio Resource Management (RRM) across Radio Network Subsystem (RNS) and RNS/BSS – December 2002.
- Beamforming Enhancements – March 2003.
- Open interface between the Serving Mobile Location Center (SMLC) and the Serving Radio Network Controller (SRNC) with the UTRAN to support Rel-4 positioning methods – March 2003.
- Introduction to the Multimedia Broadcast Multicast Service (MBMS) in RAN (Report) – June 2003.
- Radio Link performance enhancements – December 2003
- Fast Cell Selection (FCS) for HS-DSCH – March 2003

TSG RAN WG1 – Radio Layer 1

TSG RAN WG1 (RAN1) specifies the physical layer of the radio interface between UE (e.g. wireless phones) and UTRAN. This includes:

- Specification of the physical channel structures,
- Mapping transport channels to physical channels,
- Spreading,
- Modulation,
- Physical layer multiplexing,
- Channel coding,
- Error detection,
- Physical layer procedures,
- Measurements provided to upper layers.

RAN1 proceeds through TSG RAN meetings and email discussions and occasional *ad hoc* meetings on specific topics.

RAN1 has only a limited amount of R99 activity (11 CRs at this meeting). The biggest topic of discussion is High Speed Downlink Packet Access (HSDPA), with only limited discussions on Rel-6 items.

TSG RAN WG2 – Radio Layers 2 and 3

TSG RAN WG2 (RAN2) is responsible for the radio interface architecture and protocols (MAC, RLC, PDCP), the specification of the Radio Resource Control protocol (RRC), the strategies of Radio Resource Management and the services provided by the physical layer to the upper layers.

At TSG RAN#17, RAN2 spent 60% of its time on R99 CRs, trying to ensure they are essential corrections. Much of this included efforts to fully analyze the impact on existing networks. By contrast, they spent little time on Rel-4, as many of the CRs are similar to those being applied to R99.

RAN2 defined a High Speed Download Packet Access (HSDPA) work item, for approval by the TSG. It also completed some minor Rel-5 work items and made progress defining a Rel-6 Multimedia Broadcast/Multicast Service (MBMS) architecture.

Future RAN2 meetings will address two opposing views on the addition of new RABs/RB (Radio Access Bearers/Radio Bearer) into TS 34.108 (a test specification to build test equipment):

1. Freeze the document to avoid load in TSG T WG1.
2. Add references to tests specified in other documents.

Table 1: 3GPP TSG RAN Working Group 1 (RAN1) Specifications

TS/TR	Title	Status
TS 25.201	Physical layer - General description	• Rel-5 version being revised.
TS 25.211	Physical channels and mapping of transport channels onto physical (FDD)	• R99, Rel-4, and Rel-5 versions being revised.
TS 25.212	Multiplexing and channel coding (FDD)	
TS 25.213	Spreading and modulation (FDD)	• Rel-5 version being revised.
TS 25.214	Physical Layer Procedures (FDD)	• R99, Rel-4, and Rel-5 versions being revised.
TS 25.215	Physical Layer Measurements (FDD)	
TS 25.221	Physical Channels and Mapping of Transport Channels onto Physical (TDD)	
TS 25.222	Multiplexing and Channel Coding (TDD)	
TS 25.224	Physical Layer Procedures (TDD)	
TS 25.225	Physical layer Measurements (TDD)	

Table 2: 3GPP TSG RAN Working Group 2 (RAN2) Radio Layer 2 and 3 Specifications

TS/TR	Title	Status
TS 25.301	Radio Interface Protocol Architecture	• R99, Rel-4 and Rel-5 versions being revised.
TS 25.302	Services provided by the physical layer	
TS 25.306	UE Radio Access Capabilities	• Rel-5 version being published.
TS 25.321	MAC protocol	• R99, Rel-4 and Rel-5 versions being revised.
TS 25.322	RLC protocol	
TS 25.323	Packet Data Convergence Protocol (PDCP)	
TS 25.331	RRC protocol	
TR 25.844	Radio Access Bearer (RAB) support enhancements	• Rel-4 version being published.
TS 34.109	Terminal logical test interface; Special conformance testing functions	• R99 version being revised.

TSG RAN WG3 – UTRAN Architecture

TSG RAN WG3 (RAN3) is responsible for the overall UTRAN architecture and for the specification of protocols for the Iu, Iur and Iub interfaces. The use of IP protocol for the transport layer in UTRAN is also studied in this group.

The number of R99 and Rel-4 CRs are decreasing at each meeting. The majority of Rel-5 CRs are detailed corrections to HSD-PAS.

RAN2 asked RAN3 to change the IP version agreement to mandate both IPv6 and IPv4. No company in RAN3 was in favour of this, and a reply was sent to TSG S2 questioning the rationale behind the request.

RAN3 reached an agreement on a solution for UTRAN sharing in Connected Mode, and the necessary CRs were completed.

There has been little activity on Rel-6 Work Items.

Table 3: 3GPP TSG RAN Working Group 3 (RAN3) UTRAN Architecture Specifications

TS/TR	Title	Status
TS 25.401	UTRAN Overall Description	• Rel-4 and Rel-5 versions being revised
TS 25.410	Iu Interface: General aspects and principles	• R99, Rel-4 and Rel-5 versions being revised
TS 25.412	Iu interface Signalling Transport	• Rel-4 and Rel-5 versions being revised
TS 25.413	Iu Interface RANAP Signalling	• R99, Rel-4 and Rel-5 versions being revised
TS 25.414	Iu Interface Data Transport and Transport Signalling	• Rel-5 version being revised
TS 25.415	Iu Interface User Plane Protocols	• R99, Rel-4 and Rel-5 versions being revised

Table 3: 3GPP TSG RAN Working Group 3 (RAN3) UTRAN Architecture Specifications

TS/TR	Title	Status
TS 25.419	Iu-BC Interface: Service Area Broadcast Protocol	• R99, Rel-4 and Rel-5 versions being revised
TS 25.420	Iur Interface General Aspects and Principles	• Rel-5 version being revised
TS 25.422	Iur Interface Signalling Transport	• Rel-4 and Rel-5 versions being revised
TS 25.423	Iur Interface RNSAP Signalling	• R99, Rel-4 and Rel-5 versions being revised
TS 25.425	Iur Interface User Plane Protocols for Common Transport Channel Data Streams	• Rel-5 version being revised
TS 25.426	Iur and Iub Interface Data Transport & Transport Signalling for DCH Data Streams	• Rel-4 and Rel-5 versions being revised
TS 25.430	Iub interface: General aspects and principles	• Rel-4 and Rel-5 versions being revised
TS 25.432	Iub interface: Signalling transport	• Rel-5 version being revised
TS 25.433	Iub Interface NBAP Signalling	• R99, Rel-4 and Rel-5 versions being revised
TS 25.435	Iub Interface User Plane Protocols for COMMON TRANSPORT CHANNEL Data Streams	• Rel-4 and Rel-5 versions being revised
TS 25.442	Implementation-specific O&M transport	• Rel-5 version being revised
TR 25.933	IP Transport in UTRAN	• Rel-5 version being revised

TSG RAN WG4 – Radio Performance and Protocol

TSG RAN WG4 (RAN4) is responsible for the RF aspects of UTRAN. It performs simulations of diverse RF system scenarios, and it derives the minimum requirements for transmission and reception parameters, and for channel demodulation. Once these requirements are set, the group defines the verification test procedures. Requirements for other radio elements, like Repeaters, are also specified in RAN4.

At TSG RAN#17, RAN4 decided to withdraw TR 25.885, the Technical Report on UMTS 1800/1900, because the Change Requests (CRs) have already been implemented, and the TR was merely used as a container for the simulations used to derive the CRs.

The Study Item on Antenna Testing has been suspended, but RAN4 will appoint a rapporteur to monitor the progress of the work in CTIA (www.ctia.org) and COST. These two groups are currently working on 3G User Equipment testing methods.

RAN4 withdrew TR 25.845 (FDD RACH and AICH (Acquisition Indicator Channel) performance requirements) and TR25.886 (Small technical enhancements and improvements work item).

Table 4: 3GPP TSG RAN Working Group 4 (RAN4) Radio Performance and Protocol Specifications

TS/TR	Title	Status
TS 25.101	UE Radio Transmission and Reception (FDD)	• Rel-5 version being revised
TS 25.102	UTRA (UE) TDD; Radio Transmission and Reception	• R99, Rel-4 and Rel-5 versions being revised
TS 25.104	UTRA (BS) FDD; Radio Transmission and Reception	• Rel-5 version being revised
TS 25.105	UTRA (BS) TDD; Radio Transmission and Reception	
TS 25.106	UTRA Repeater Radio Transmission and Reception	• Rel-4 and Rel-5 versions being revised
TS 25.113	Base Station and Repeater Electromagnetic Compatibility (EMC)	• Rel-4 and Rel-5 versions being revised
TS 25.123	Requirements for Support of Radio Resource Management (TDD)	• R99, Rel-4 and Rel-5 versions being revised
TS 25.133	Requirements for Support of Radio Resource Management (FDD)	
TS 25.141	Base Station Conformance Testing (FDD)	• Rel-5 version being revised
TS 25.142	Base Station Conformance Testing (TDD)	• R99, Rel-4 and Rel-5 versions being revised
TS 25.143	UTRAN Iu Interface RANAP Signalling	• Rel-4 and Rel-5 versions being revised

TSG RAN Meetings

The most recent plenary meeting of TSG RAN was held from September 9th – 12th, 2002 in Biarritz, France.

The next TSG RAN plenaries will be held:

- December 3rd – 6th, 2002 in New Orleans,
- March 11th – 14th, 2003 in Jersey, Channel Islands,
- June 3rd – 6th, 2003 in Hammenlinna, Finland,
- September 16th – 19th, 2003 in Berlin,
- December 9th – 12th, 2003 in Hawaii.

Status of IS-41 Rev. C & TIA/EIA-41-D (ANSI-41) Implementations

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Intersystem Operations Capability	Vendor and Radio Technology									
	Alcatel	Ericsson			LG	Lucent			Motorola	
	CDMA	Analog	CDMA	TDMA	CDMA	Analog	CDMA	TDMA	Analog	CDMA
Authentication (CAVE)	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Authentication Enhancements (IS-778)			🕐		🕐					
Circuit Data (IS-737)	✔		✔	✔	✔		✔	✔		✔
CNAP/CNAR (IS-764)		✔	✔	✔	✔			✔		
CNIP/CNIR	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
E911 Phase 1 (J-STD-034)		✔	✔	✔		✔	✔	✔		
E911 Phase 2 (J-STD-036)		✔	✔	✔		✔	✔	✔		
IMSI (IS-751)			✔	✔			✔	✔		
Inter-MSC handoff from analog		✔		✔		✔		✔	✔	
Inter-MSC handoff from CDMA	✔		✔		✔	✔	✔		✔	✔
Inter-MSC handoff from TDMA		✔		✔		✔		✔	✔	
International (IS-807)	✔		✔	✔	🧪		✔	✔		
Hyperband handoff (TSB76)	✔			✔			✔	✔		✔
LNP Phase I (IS-756)	✔	✔	✔	✔		✔	✔	✔	✔	✔
LNP Phase II (IS-756-A)	✔	✔	✔	✔		✔	✔	✔	🕐	🕐
Message Waiting Notification (MWN)	✔	✔	✔	✔	✔		✔	✔	✔	✔
Origination Triggers	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Over-the-air Activation (IS-725-A)	✔		✔	✔	✔		✔			✔
Removable UIM (IS-808)										
Roamer DB Verification (IS-847)										
Segmentation (IS-812)	✔	✔	✔	✔		✔	✔	✔		
SMS – Broadcast (IS-824)			✔	✔			✔	✔		
SMS – MDN-Based (IS-841)	🕐		✔	✔						
SMS – Origination	✔		✔	✔	✔		✔	✔		✔
SMS – Termination	✔		✔	✔	✔		✔	✔	✔	✔
Termination Triggers	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Voice Privacy - basic	✔			✔	✔		✔	✔		
Voice Privacy - EPE										
WIN Phase I (IS-771)	✔	✔	✔	✔	🧪	✔	✔	✔	🕐	🕐
WIN Phase II (Prepaid – IS-826)	✔	✔	✔	✔	🕐	✔	✔	✔	🕐	🕐

Key: ✔ (available), 🧪 (in lab trial), 🕐 (under development). Red/Bold indicates recent change.

Status of IS-41 Rev. C & TIA/EIA-41-D (ANSI-41) Implementations

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Intersystem Operations Capability	Vendor and Radio Technology									
	NEC		Nortel (MSC/BS)			**Telcordia**	Telos			**ZTE**
	Analog	CDMA	Analog	CDMA	TDMA	**(SCP)**	Analog	CDMA	TDMA	**CDMA**
Authentication (CAVE)		✔	✔	✔	✔		✔	✔	✔	✔
Authentication Enhancements (IS-778)										
Circuit Data (IS-737)		✔		✔	✔			🕐		✔
CNAP/CNAR				✔	✔					
CNIP/CNIR	✔	✔	✔	✔	✔		✔	✔	✔	✔
E911 Phase 1 (J-STD-034)			✔	✔	✔					
E911 Phase 2 (J-STD-036)			✔	✔	✔					
IMSI (IS-751)				🕐	🕐					
Inter-MSC handoff from analog	✔		✔		✔		✔			
Inter-MSC handoff from CDMA	✔	✔	✔	✔			✔	✔		✔
Inter-MSC handoff from TDMA			✔		✔		✔		✔	
International (IS-807)				✔	✔			🕐		✔
Hyperband handoff (TSB76)				✔	✔					✔
LNP Phase I (IS-756)			✔	✔	✔		✔	✔	✔	🕐
LNP Phase II (IS-756-A)			✔	✔	✔					🕐
Message Waiting Notification (MWN)	✔	✔	✔	✔	✔			✔	✔	✔
Origination Triggers	✔	✔	✔	✔	✔		✔	✔	✔	✔
Over-the-air Activation (IS-725-A)				✔	✔			✔	✔	
Removable UIM (IS-808)				✔						
Roamer DB Verification (IS-847)										
Segmentation (IS-812)				🕐	🕐					
SMS – Broadcast (IS-824)				🕐						✔
SMS – MDN-Based (IS-841)				✔						✔
SMS Origination		✔		✔	✔			✔	✔	✔
SMS Termination		✔	✔	✔	✔			✔	✔	✔
Termination Triggers	✔	✔	✔	✔	✔		✔	✔	✔	✔
Voice Privacy - basic		✔								✔
Voice Privacy - EPE										
WIN Phase I (IS-771)			✔	✔	✔	✔	✔	✔	✔	✔
WIN Phase II (Prepaid – IS-826)			✔	✔	✔	✔				✔

Key: ✔ (available), 🧪 (in lab trial), 🕐 (under development). Red/Bold indicates recent change.

TIA TR-45.5/3GPP2 TSG-C CDMA Digital Air Interface Standards

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Note:
1. IS - Interim Standard, TSB - Telecommunications Systems Bulletin, PN - Project Number, SP - ANSI Standards Proposal.
2. TSG-C standards are identified as C.[P|R|S]dddd-[0|A..Z] vX.Y where P=Project, R=Report, S=Specification, dddd=Document number, 0,A..Z is the revision number (0 sometimes omitted), X is the publication number (0 for pre-publication) and Y the internal editing revision (which we omit).
3. Published TIA standards can be obtained from Global Engineering Documents at 1-800-854-7179.
4. **Bold Type** indicates a modification since the previous publication of this information.

Thanks to Lisa Collichio (Qualcomm) for her assistance compiling the information in this table.

First Wave - Cellular

Standard	Description	Status
IS-95	CDMA Dual-Mode Air Interface Standard (Authentication Appendix Nov.□1992)	Published 07/93
IS-96	CDMA Option 1: Voice Coder (Speech Service Option)	Published 04/94
IS-97	Base Station minimum performance standards for IS-95-A	Published 12/94
IS-98	Mobile Station (MS) minimum performance standards	Published 12/94
IS-126	Service option 2: Loopback	Published 12/94 Rescinded 08/98

Second Wave - Cellular and PCS

Standard	Description	Status
J-STD-008	IS-95 adapted for 1.8-2.0 Ghz frequency band	Published 07/96 Rescinded 11/99
J-STD-018	Mobile minimum performance standards (for J-STD-008)	Published 07/96 Rescinded 02/01
J-STD-019	Base Station minimum performance standards	Published 07/96 Rescinded 02/01
IS-95-A	IS-95 Revised (Authentication Appendix "A" Nov. 1994)	Published 05/95
IS-96-A	CDMA Voice Coder	Published 05/95
IS-97-A	Base Station minimum performance standards for IS-95-A	Published 07/96
IS-98-A	Mobile minimum performance standards for IS-95-A	Published 07/96
IS-98-A-1	Additional tests for IS-95 mobile stations	Published 09/97
IS-99	Data Services (9.6□bps Fax and Circuit Switched Data)	Published 07/95 Rescinded 10/00
IS-125	Voice coder minimum performance standards	Published 05/95 Rescinded 10/00
IS-126-A	Mobile Station loopback service option	Published 07/96 Rescinded 08/98
IS-637	Short message service (rate set 1)	Published 12/95
TSB58	Parameter value assignments	Published 12/95

Third Wave - Integrated Cellular and PCS

Standard	Project	Description	Status
TIA/EIA-95-B	SP-3693	IS-95 for 800 MHz and 1800 MHz frequencies (including J-STD-008)	Published 03/99
TIA/EIA-96-C	SP-4138	CDMA Voice Coder (8 kbps)	Published 08/98
TIA/EIA-97-B	SP-3814	Minimum performance standards for base stations	Published 08/98
TIA/EIA-97-C	SP-4384	Minimum performance standards for base stations (merges TIA/EIA-97-B and J-STD-019)	Published 09/99
TIA/EIA-98-B	SP-3815	MS minimum performance standards	Published 08/98
TIA/EIA-98-C	SP-4383	Merges TIA/EIA-98-B and J-STD-018	Published 11/99
TIA/EIA-125-A	SP-4682	Correction of errors in speech service option 1	Published 08/00
TIA/EIA-126-B	SP-4136	ANSI version of IS-126 (MS loopback option)	Published 08/98
TIA/EIA-126-C	SP-4578	Mobile Station loopback test	Published 08/00
TIA/EIA-637-A	SP-4391	Short message service (including service negotiation, 14.4 kbps transmission, PCS and TIA/EIA-95 support)	Published 09/99
IS-96-B		CDMA Voice Coder (8 kbps)	Published 07/96
IS-127		Option 3: Enhanced variable rate voice coder (EVRC)	Published 01/97
IS-127-1	PN-4146	Addendum #1 to IS-127	Published 08/98
IS-127-2		Addendum #2 to IS-127: TTY/TDD capabilities	Published 09/99
IS-127-3	PN-3292-AD3	Addendum #3 to IS-127	Published 09/01
IS-657		Packet data services (Internet, CDPD)	Published 07/96 Rescinded 10/00
IS-658	PN-4374	Data Services Interworking Function Interface (e.g. modem pool). Transferred to TR-45.4 for Revision A.	Published 07/96
IS-658-1		Extends the ability to perform interface status exchange at times other than call set-up	Published 04/99
IS-683	PN-3569	Over the air activation (OTA) and service provisioning (Authentication Appendix A published 03/96)	Published 02/97
IS-683-A	PN-3889	OTA update: Roaming system selection and programming lock	Published 06/98
IS-707	PN-3676	14.4 kbps data services (including asynch. data, fax, STU-III and packet data)	Published 02/98
IS-707-A	PN-4145	Revision to IS-707 to be consistent with TIA/EIA-95 capabilities	Published 04/99
IS-718	PN-3648	Minimum performance standards for EVRC voice coder	Published 07/98
IS-733	PN-3972	Option 17: High rate CDMA voice coder (13 kbps)	Published 03/98
IS-733-1		Addendum #1 to IS-733: TTY/TDD capabilities	Published 09/99
IS-733-2	PN-3972-AD2	Addendum #2 to IS-733	Published 09/01
IS-736	PN-3973	Minimum performance specification for IS-733 (13 kbps voice coder)	Published 11/98
IS-736-A	PN-4653	Corrections to testing procedures in IS-736	Published 08/00
TSB58-A	PN-4158	Parameter value assignments for TIA/EIA-95-B	Published 04/99
TSB74		14.4 kbps radio link protocol and inter-band operations	Published 12/95 Rescinded 04/99
TSB79	PN-3823	IS-637 update for 14.4 kbps SMS, service negotiation and Y2K	Published 02/97

3G Version (cdma2000, IS-2000, 1xRTT, 1xEVDO)

Standard	Project	Description	Status
TIA/EIA-97-D		Minimum performance standards for IS-2000 base stations	Published 06/01
TIA/EIA-97-E	**SP-4384-RV5**	**Minimum performance standards for IS-2000 base stations**	**Ballot 09/02**
TIA/EIA-98-D		MS minimum performance standards	Published 06/01
TIA/EIA-98-E	**SP-4383-RV5**	**MS minimum performance standards**	**Ballot 09/02**
TIA/EIA-99	PN-4617	9.6 kbps data service option for IS-2000	Published
TIA/EIA-126-D	SP-4578-RV4	Mobile Station loopback test	Published 06/01
TIA/EIA-637-B	SP-4391-RV2	Short message service	Published 01/02
TIA/EIA-864	PN-4913	Minimum performance standards for cdma2000 high rate packet data access network	Published 02/02
TIA/EIA-866	PN-4916	Minimum performance for cdma2000 high rate packet data access terminal (TSG-C.P9012)	Published 02/02
IS-683-B	SP-4742	OTA update, including preferred user zone list	Published 12/01
IS-707-A-1	PN-4541	Adds cdma2000 radio link protocol 3E support to 14.4kbps data	Published 12/99
IS-707-A-2	PN-4692	Data support for IS-2000-A	Published 03/01
IS-707-A-3		**Addendum 3 for IS-707 (High speed packet data service option 33). Only chapter 12 is being modified.**	**Ballot 12/02**
IS-801	PN-4535	Position determination services (e.g. for E911 Phase II)	Published 11/99
IS-801-1	PN-4535-AD1	Addendum to position determination	Published 03/01
IS-834	PN-4707	Direct Spread Specification for CDMA on ANSI-41 (DS41) Upper Layers Air Interface	Published 03/00
IS-856	PN-4875	High Rate Packet Data Air Interface Specification (1XEV DO)	Published 11/00
IS-856-1	PN-4875-AD1	Addendum 1 to cdma2000 High Rate Packet Data Air Interface Specification (1XEV DO)	Published 01/02
IS-856-2	**PN-4875-AD2**	**Addendum 2 to cdma2000 High Rate Packet Data Air Interface**	**In press**
IS-870	PN-4877	Test Data Service Option (TDSO) for cdma2000 spread spectrum systems	Published 04/01
IS-870-1	**PN-4877-AD1**	**Test Data Service Option (TDSO) for cdma2000 spread spectrum systems**	**In press**
IS-871	PN-4876	Markov Service Option (MSO) for determining frame error rates	Published 04/01
IS-889	**PN-4905**	**Minimum Performance Specification for Text Telephone (TTY) Signal Detector and Regenerator**	**Published 08/02**
IS-890	PN-0018	Test application specification for high rate packet data air interface (HRPD)	Published 07/01
IS-890-1	**PN-0018-AD1**	**Test application specification for high rate packet data air interface**	**In press**
IS-893	PN-4575	Selectable mode voice coder (speech and capacity-sensitive, formerly known as EVRC)	Ballot 07/01
IS-894	PN-0029	Selectable mode voice coder minimum performance	Ballot 01/02
IS-2000.1-0	PN-4427	cdma2000 Introduction and Overview	Published 08/99

IS-2000.2-0	PN-4428	cdma2000 Physical Layer	Published 08/99
IS-2000.3-0	PN-4429	cdma2000 Media Access Control (MAC) layer	Published 08/99
IS-2000.4-0	PN-4430	cdma2000 Signaling Layer 2 Link Access Control (LAC)	Published 08/99
IS-2000.5-0	PN-4431	cdma2000 Signaling Layer 3	Published 08/99
IS-2000.6-0	PN-4432	cdma2000 Analog Operation	Published 08/99
IS-2000.X-A	PN-4693	cdma2000 (all 6 (X=1-6) parts revised)	Published 03/00
IS-2000.X-A-1	PN-4698-AD1	Addendum for IS-2000-A. Revised parts 2 through 5	Published 11/00
IS-2000.X-0-2	PN-4698-AD2	Addendum for IS-2000. Revises all 6 parts	Published 08/01
IS-2000.X-B		**cdma2000. All 6 parts being revised (X=1..6)**	**Published 05/02**
IS-2000.X-A-2		**Second addendum for IS-2000-A. Revises all 6 parts.**	**Published 04/02**
IS-2000.X-0-1	**PN-4698-AD2**	**First addendum for IS-2000. Revises all 6 parts**	**Published 05/00**
IS-2000.X-C		**cdma2000. All 6 parts being revised (X=1..6)**	**Published 05/02**
TIA-898	PN-0031	Signaling conformance tests for cdma2000	Published 12/01
TIA-907	PN-0046	Video streaming	Development
TIA-916	**PN-0058**	**Minimum performance recommendations for IS-801-1 (GPS) CDMA mobiles (e.g. test specifications)**	**Published 04/02**
TIA-918	**PN-0056**	**Signaling conformance tests for cdma2000 wireless IP networks**	**Published 05/02**
TIA-919	**PN-0057**	**Signaling conformance for cdma2000 high rate packet data networks (1XRTT)**	**Published 05/02**
TIA-923	**PN-0069**	**Link Layer Assisted Robust Header Compression Service Option for Voice**	**Ballot 10/02**
TIA-924	**PN-0070**	**Packet Based Video Conferencing**	**Development**
TIA-925	**PN-0071**	**Enhanced Subscriber Privacy for cdma2000 High Rate Packet Data**	**Published 09/02**
TIA-926	**PN-0072**	**Circuit Switched Video Conferencing Services**	**In press**
TSB58-B	PN-4691	Parameter value assignments for IS-2000	Published 12/99
TSB58-C		Parameter value assignments for IS-2000-A	Published 05/00
TSB58-D	PN-4691-RV4	Parameter value assignments for IS-2000-B	Published 05/01
TSB58-E	PN-4619-RV5	Parameter value assignments for IS-2000-C	Published 01/02
TSB58-F	**PN-4691-RV6**	**Parameter value assignments**	**Ballot 10/02**
TSB2000	PN-4534	Capabilities requirements mapping for cdma2000 standards	Published 09/99
	PN-4651	EVRC simulation (TTY/TDD update)	Development

GSM MAP and Smart Card Support

Standard	Project	Description	Status
IS-820	PN-4690	R-UIM (Removable "Smart Card")	Published 05/00
IS-820-1	PN-4690-AD1	CDMA Removable UIM Addendum 1	Published 06/01
IS-820-A	**PN-4690-RV1**	**R-UIM (Removable "Smart Card")**	**Published 09/02**
IS-833	PN-4706	Multi-carrier specification for CDMA systems on GSM MAP (MC-MAP) lower layers air interface	Published 03/00
IS-915	PN-0051	CDMA Card Application Toolkit	Ballot 12/01

TSG-C Specification Cross-Reference

Specification	Description	Status
C.R1000-0	Requirements Mapping for cdma2000	See TSB2000
C.R1001-0	Parameter value assignments	See TSB58-B
C.R1001-A	Parameter value assignments	See TSB58-C
C.R1001-C	**Parameter value assignments**	**See TSB58-F**
C.S0007-0	Direct spread spectrum specification for spread spectrum systems on ANSI-41 (DS-41)	See IS-834
C.S0008-0	Multi-carrier specification for spread spectrum systems on GSM MAP (MC-MAP)	See IS-833
C.S0009-0	Speech service option	See TIA/EIA-96-C
C.S000X-0	cdma2000 (parts identified as C.S0001-C.S0006)	See IS-2000.X
C.S000X-1	cdma2000 Revision A	See IS-2000.X-A
C.S0010-0	Base Station minimum performance	See TIA/EIA-97-C
C.S0010-A	Base Station minimum performance	See TIA/EIA-97-D
C.S0010-B	**Base Station minimum performance**	**See TIA/EIA-97-E**
C.S0011-0	Mobile Station minimum performance	See TIA/EIA-98-C
C.S0011-A	Mobile Station minimum performance	See TIA/EIA-98-D
C.S0011-B	**Mobile Station minimum performance**	**See TIA/EIA-98-E**
C.S0012-0	Minimum performance	See TIA/EIA-125-A
C.S0013-0	MS loopback test	See TIA/EIA-126-C
C.S0013-A	MS loopback test	See TIA/EIA-126-D
C.S0014-0	Enhanced Variable Rate Voice Coder (EVRC)	See IS-127
C.S0014-0-1	EVRC addendum to remove 'bit exact'	See IS-127-1
C.S0014-0-2	EVRC addendum to add TTY/TDD symbol support	See IS-127-2
C.S0014-0-3	EVRC addendum 3	See IS-127-3
C.S0015-0	Short Message Service (SMS)	See IS-637-A
C.S0016-0	Over-the air service provisioning (OTASP)	See IS-683-A
C.S0016-A	Over-the air service provisioning (OTASP)	See IS-683-B
C.S0016-B	**Over-the-air service provisioning (OTASP)**	**See IS-683-C**
C.S0017-0	14.4 kbps data, without STU-III	See IS-707-A
C.S0017-0-1	Radio link protocol (RLP) modifications and additional packet data support	See IS-707-A-1
C.S0017-0-2	64kbps data, plus TTY/TDD support	See IS-707-A-2
C.S0017-0-3	**Addendum 3 for IS-707 (High speed packet data service option 33)**	**See IS-707-3**
C.S0018-0	Minimum performance for EVRC	See IS-718
C.S0019-0	Bit exact specification for EVRC	See IS-719
C.S0020-0	High rate (13 kbps) speech coder	See IS-733
C.S0020-0-1	TTY/TDD support for high rate speech coder	See IS-733-1
C.S0020-0-2	TTY/TDD support for high rate speech coder	See IS-733-2
C.S0021-0	Minimum performance for high rate speech coder	See IS-736-A

C.S0022-0	Location services	See IS-801
C.S0022-0-1	Location services addendum	See IS-801-1
C.S0023-0	Removable user identity module (R-UIM)	See IS-820
C.S0023-0-1	Removable user identity module (R-UIM)	See IS-820-1
C.S0023-A	**Removable user identity module (R-UIM)**	**See IS-820-A**
C.S0024-0	High rate packet data air interface	See IS-856
C.S0024-0-1	High rate packet data air interface (addendum 1)	See IS-856-1
C.S0024-0-2	**High rate packet data air interface (addendum 2)**	**See IS-856-2**
C.S0025-0	Markov service option (MSO) for determining frame error rates	See TIA/EIA-871
C.S0026-0	**Test data service option (TDSO)**	**See IS-807**
C.S0026-0-1	**Test data service option (TDSO)**	**See IS-807-1**
C.S0028-0	TTY/TDD minimum performance specification	
C.S0029-0	Test application specification for high rate packet data air interface (HRPD)	See IS-890
C.S0029-0-1	**Test application specification for high rate packet data air interface**	**See IS-890-1**
C.S0030-0	Selectable mode voice coder	See IS-893
C.S0031-0	Signaling conformance tests	See IS-898
C.S0032-0	Minimum performance standards for cdma2000 HRPD	See TIA-864
C.S0033-0	Minimum performance for cdma2000 HRPD access terminal	See TIA-866
C.S0035-0	**CDMA Card Application Toolkit**	**See TIA-915**
C.S0036-0	Minimum performance standards for GPS equipped CDMA mobiles	Published
C.S0037-0	**Signaling conformance for CDMA2000 wireless IP networks**	**See TIA-918**
C.S0038-0	**Signaling conformance for HRPD air interface**	**See TIA-919**
C.S0039-0	**Enhanced subscriber privacy for CDMA2000 high rate packet data**	**See TIA-925**
C.S0042-0	**Circuit-switched video conferencing services**	**See TIA-926**
C.P-0021	**Link Layer Assisted Robust Header Compression Service Option for Voice**	**See TIA-923**