Cellular Networking Perspectives

Editor: David.Crowe@cnp-wireless.com Vol. 12, No. 9 September, 2003

In This Issue . . .

Next Issue: October 1st, 2003

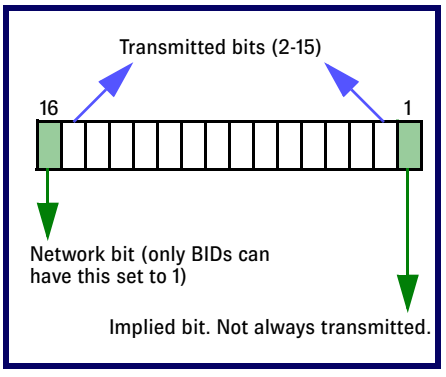
SID – The System ID

The SID (System Identification number) is an important numeric identifier for CDMA, TDMA and analog cellular or PCS systems. It acts like the call sign of a radio or television station, identifying the system to which one or more cellular base station belong. The SID is the mirror image of the MSID (MIN or IMSI) which is used to identify a subscription to a wireless network.

SID codes were initially assigned by the FCC (starting at 1) for the original cellular markets (MSAs and RSAs) but with the spread of analog cellular, and then TDMA and CDMA, they were assigned to cellular systems in many other countries.

The SID is a 15 bit number (0-32,767) transmitted by every AMPS, N-AMPS, TDMA (IS-54, TIA-136 etc.) and CDMA (TIA-95, IS-2000 etc.) base station. Note that only 14 bits may actually be transmitted, the least significant bit may be inferred from the frequency band being used (e.g. in analog). Billions of bits have been saved in this way, although it does result in some wastage.

Figure 1: SID Structure



Broadcast SID

The SID was originally used in analog cellular to optimize signaling for home subscribers, and also to turn the 'roam' light on when any SID other than the mobile's single home SID was received from a base station.

Digital systems have more sophisticated roaming capabilities, and mobiles generally have a list of SIDs (PRL) classified according to the desirability of each system. A phone that picks up more than one signal can use their list to pick one that will offer the customer and the carrier the best rates and service. The list can also prevent a mobile from accessing systems with which their carrier has no roaming arrangement.

There has been some consolidation of assigned SID codes being broadcast over time as carriers consolidated. Particularly with analog systems, it was useful to broadcast the same SID code over a large area to avoid the 'roam' light going on, which often caused customers to avoid making calls, fearing high roaming charges.

SID for Billing

SID codes are also crucial in billing operations to identify the carrier. Every CIBER billing record, for example, contains the SID code of the serving carrier. Information on the CIBER record format, including a complete list of SID codes used by carriers compliant with CIBER can be purchased from CIBERNET as part of the CIBER manual.

Billing requirements are often more granular than SID signaling requirements. To support a single broadcast SID with multiple billing SIDs the concept of the BID (Billing ID) was invented. This identifier is similar to a SID, but is not transmitted over the radio interface, and can be used to divide a system broadcasting a single SID into multiple regions for accounting purposes. Because it is not transmitted over

Editor: David Crowe.
Accounts: Evelyn Goreham.
Distribution: Debbie Brandelli.
Production: Doug Scofield.

Cellular Networking Perspectives (issn 1195-3233) is published monthly by Cellular Networking Perspectives Ltd, 2636 Toronto Crescent NW, Calgary AB, T2N 3W1, Canada. Phone: 1-800-633-5514 (+1-403-274-4749) Fax: +1-403-289-6658 **Email:** cnpsales@cnp-wireless.com **Web:**www.cnp-wireless.com **Subscriptions:**CDN$350 in Canada (incl GST), US$350 in the USA and US$400 elsewhere. Payment by cheque, bank transfer, American Express, Diners Club, MasterCard or Visa. **Delivery:**Email or 1st class mail. **Back Issues:**Single issues are $40 in the US and Canada and $45 elsewhere, or in bulk at reduced rates. **Discounts:**Educational and small businesses: 25% off any order. **Copies:**Each subscriber is licensed to make up to 10 copies of each issue. Contact us for rates to allow more.

radio interfaces, the BID can be 16 bits in length (i.e. including the range 32,768-65,535). BID codes are assigned by Cibernet Corporation (www.cibernet.com).

SID Assignment

SID codes are supposed to be assigned to carriers by national regulatory authorities. In the United States, for example, this is (until late 2003) the Federal Communications Commission. In July, 2003 the FCC signed agreements with six competitive SID administrators: CIBERNET, Entricom, Hammett & Edison, Kurtis & Associates, NECA Services and PCIA. The transition is scheduled to be completed by October 1st 2003, even though at this time the details of the transfer, and the competitive assignment process have not yet been fully defined.

impacted, and sometimes SID-code translation is required to ensure that revenue is shared between the right carriers. This translation (e.g. from a conflicting transmitted SID to a globally unique BID) solves billing problems, but not roaming problems.

In the 1980's TIA (Telecommunications Industry Association) subcommittee TR-45.2 attempted to solve the global SID coordination problem by defining ranges of SID codes for every country then in existence within TSB-29. This responsibility was transferred to IFAST in the late 1990's.

Since most countries have an adequate SID range, requests for new SID ranges are infrequent. However, it is still important that the SID database be maintained, with SID conflicts documented as soon as they are discovered, in the hope that they can be resolved over time.

Conclusions

Maintaining a set of unique SIDs is crucial to the operations of carriers using CDMA, TDMA or analog cellular protocols. Avoiding SID conflicts is a shared responsibility. Carriers should ensure they only use SID codes that are unique within their assigned national range, and national regulatory authorities should coordinate with IFAST when additional SID codes are required. Initial assignment of SID codes to a country or other international entity must also be coordinated by IFAST.

About the Author. David Crowe is editor of *Cellular Networking Perspectives* and also the IFAST SID administrator.

"In July, 2003 the FCC signed agreements with six competitive SID administrators…The transition is scheduled to be completed by October 1st 2003, even though details of the transfer and the competitive assignment process have not yet been fully defined."

SID Conflicts

Government regulatory agencies still assign SID codes in most other countries, although in the early days of international cellular SID codes were sometimes assigned by carriers or their equipment vendors without coordination, resulting in SID conflicts. These are documented, where known, at www.ifast.org.

Most SID conflicts involve the transmission of a US SID code by a carrier in another country. This is due to the US occupying the lowest part of the SID range (1-7679).

Countries that are believed to have the greatest potential for undocumented conflicts are Brazil and Russia. In Brazil, this is due to the assignments mandated by Anatel, the Brazilian regulator. In Russia problems may have occurred due to assignments from the USSR range to republics that are now independent and should obtain their own SID range. IFAST, acting as the global SID coordinator, is currently attempting to document the problem so that long-term solutions can be considered.

SID conflicts can create difficulties for international roaming, although not as great as those due to IRM conflicts. If signaling optimization is turned on, call attempts will fail when a roamer (thinking it is in its home system) transmits only a partial MIN. On digital systems, a phone may attempt to register with a system that will not give it the best rate, and may not even give it service. Billing will also be

IFAST not only assigns ranges of SID codes to countries, but also assigns them to international entities, such as mobile satellite carriers. These companies may also broadcast a SID code, and may need a SID code to exchange CIBER billing records.

Until recently the SID resource was close to exhaustion. This occurred because of the initial assignment by the TIA to every country in the world. Since then, additional countries have arisen, and the number of available SID codes was inadequate for their needs, while many SID codes languished in countries that only had GSM systems, or had an assignment that was unnecessarily large.

IFAST has tried to reclaim some SID code ranges by writing to every national SID administrator and requesting the return of any unneeded SID codes. This effort was modestly successful, with SID codes being returned from Poland, Sweden, Ireland, Finland, Malta, Saint Vincent and the Grenadines, Belize, Mexico, Chile and Denmark. Consequently, about 15% of the transmissible SID codes are now available for assignment. This should provide enough SID codes for many years to come.

IFAST maintains the list of international SID code ranges at www.ifast.org (click on the 'System Identification Number' link on the home page). One list is sorted numerically, another is sorted by country name and a third contains all known SID conflicts.

3GPP TSG RAN Update

3GPP 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. This includes radio performance, physical layer specification, layer 2 and layer 3 RR specification in UTRAN; specification of the access network interfaces (Iu, Iub and Iur); definition of the O&M requirements in UTRAN and conformance testing for Base Stations.

Highlights of discussions at the most recent RAN meeting include:

- Re-organizing or merging of the 3GPP working groups, and possibly even the merger of TSG GERAN and TSG RAN is still under discussion, although no conclusion has yet been reached.
- The Early User Equipment (Early UE) topic, carried forward from a previous meeting, was resolved without the need of a vote. Early UE protocol provides a method to help networks determine which UEs have limited capabilities based on earlier releases. Of the two approaches presented in the previous meeting, a clear majority supported the definition of a bitmap of capabilities to be carried over the Iu interface, rather than the classification of mobiles by International Mobile Station Equipment Identity-Software Version (IMEI-SV).

- The meeting discussed how the UE should behave when it loses coverage: how long (if at all) should it keep the Radio Resource Control (RRC), should it camp on a different Public Land Mobile Network (PLMN) for emergencies only, or both? An ad hoc meeting held between RAN2, CN1 and SA2 in April 2003 concluded that two interpretations are possible for UE behavior based on the GPRS Mobility Management (MM) protocol. TSG CN will not change MM specifications in Release 5, but they will be revisited as part of release 6, whereas Radio Resource Control (RRC) may be modified in TSG RAN to specify that, when camping on a PLMN to allow for an emergency call, the UE can either keep the old RRC connection or go idle. The final decision for Rel 5 will be taken in TSG RAN #21. For the time being the decision is for Rel 99 and Rel 4 to allow for the two behaviors.
- High Speed Downlink Packet Access (HSDPA) work was completed in RAN4 with the approval of the pending requirements and test cases.

TSG RAN Working Group 1: (Radio Layer 1)

TSG RAN Working Group 1 (RAN1) specifies the physical layer of the radio interface for UE and UTRAN. This includes the specification of the physical channel structures, the mapping of transport channels to physical channels, spreading, modulation, physical layer multiplexing, channel coding and error detection. The physical layer procedures and the measurements provided to upper layers are specified in RAN1 as well. It has created specific topic email distribution lists, and sometimes a special topic may have its own ad hoc meeting in order to speed progress.

Major discussion items at the most recent meeting included:

- Enhanced Uplink Dedicated Channel (DCH) was the biggest topic in RAN1 both in term of number of contributions and contributing companies. Discussion topics were Scheduling, Channel Structure, fast DCH setup, and TCP modeling. Several proposals were agreed for inclusion in TR 25.896.
- On the Beamforming Enhancements work item, lacking measurement and signaling support for Secondary Common Pilot Channel (S-CPICH) based beamforming is a concern for UE manufacturers, since S-CPICH is mandatory for Rel 99 UEs, the work to produce the test has been done, but the feature cannot be implemented in the network. It seems clear that it will not work in soft handoff. It seems a bit absurd to introduce requirement that cannot be used.

Table 1: 3GPP TSG RAN Working Group 1 Specification Update: Radio Layer 1

Document	Title	Status
tbd	Feasibility Study on Uplink Enhancements for UTRA TDD	New Work Item
TS 25.211	Physical Channels and Mapping of Transport Channels onto Physical Channels (FDD)	Rel 5 version being revised.
TS 25.212	Multiplexing and Channel Coding (FDD)	Rel 5 version being revised.
TS 25.214	Physical Layer Procedures (FDD)	Rel 5 version being revised.
TS 25.215	Physical Layer – Measurements (FDD)	Rel 99, Rel 4, and Rel 5 versions being revised.
TS 25.221	Physical Channels and Mapping of Transport Channels onto Physical Channels (TDD)	Rel 5 version being revised.
TS 25.222	Multiplexing and Channel Coding (TDD)	Rel 5 version being revised.
TS 25.224	Physical Layer Procedures (TDD)	Rel 5 version being revised.
TS 25.225	Physical Layer – Measurements (TDD)	Rel 99, Rel 4, and Rel 5 versions being revised.

TSG RAN Working Group: Radio Layers 2 and 3

3GPP TSG RAN Working Group 2 (RAN2) specifies the Radio Interface architecture and protocols (MAC, RLC, PDCP), the Radio Resource Control protocol, the strategies of Radio Resource Management and the services provided by the physical layer to the upper layers.

Highlights of the most recent meeting include:

- Resolving Release 99 problems is still an important part of RAN2 activities, consuming a lot of meeting time. RAN2 is trying to find acceptable corrections with minimal (or no) impact on current UE implementations.
- TR 25.993 is a release independent Technical Report. The actual release for which a Radio Bearer applies is specified in the text.
- There has been a significant increase in Multimedia Broadcast and Multicast Service (MBMS) activity. Stage 2 was approved in TS 25.346 and work has begun on stage 3.
- A new CR was approved to allow a new value for Timer T317 to reduce the risk of UE de-synchronization with the network. Timer T318 will be removed, but for Rel 99 and Rel 4 its value should be considered infinity, as the timer must be kept for backwards compatibility reasons.

Table 2: 3GPP TSG RAN Working Group 2 Specification Update: Radio Layers 2 and 3

Document	Title	Status
TS 25.302	Services Provided by the Physical Layer	Rel 5 version being revised.
TS 23.304	UE Procedures in Idle Mode and Procedures for Cell Reselection in Connected Mode	Rel 99, Rel 4, and Rel 5 versions being revised.
TS 25.305	Stage 2 Functional Specification of User Equipment (UE) Positioning in UTRAN	Rel 4 and Rel 5 versions being revised.
TS 25.306	UE Radio Access Capabilities	Rel 99, Rel 4, and Rel 5 versions being revised.
TS 25.321	MAC Protocol Specification	Rel 5 version being revised.
TS 25.322	RLC Protocol Specification	Rel 99, Rel 4, and Rel 5 versions being revised.
TS 25.331	RRC Protocol Specification	Rel 99, Rel 4, and Rel 5 versions being revised.
TR 25.993	Typical examples of RABs and RBs supported by UTRA	Rel 6 version being revised.

TSG RAN Working Group 3: UTRAN Architecture

3GPP TSG RAN Working Group 3 (RAN3) specifies the overall UTRAN architecture, protocols for the Iu, Iur and Iub interfaces and the use of IP protocol for the transport layer in UTRAN.

Highlights of the most recent meeting include:

- Approval of 'early UE' Change Requests for the bitmap solution for RANAP specifications.
- Many contributions were submitted for High Speed Downlink Packet Access (HSDPA) modifications for the Iub/Iur interfaces. RAN3 agreed on Radio Resource Management (RRM) Measurement for Guaranteed Bit Rate Resource Handling and an indication of a list of UEs with bad radio conditions (known as 'costly' UEs). Other open issues for this topic are:
  - » Multiple MAC-d Flows per Transport Bearer (a possible enhancement for Rel 6)
  - » CRs have been sent to SA4, SA2 and RAN2 for the Discard Timer for expired MAC-d Packet Data Units (PDU).
  - » RRM Measurements – Code Utilization will be included in Rel 6.
- Three ATM–IP interworking options have been accepted for Rel 5 in TR 25.933:
  - » Dual stack for IP node – IETF Pseudo-Wire Emulation E2E (PWE3) will be considered in TR25.933 as an alternative for dual stack operation.
  - » Transport Network Layer (TNL) interworking function as a logical part of UTRAN node.
  - » External TNL interworking function.
- RAN3 has agreed on a set of requirements and a list of open issues for the feasibility study on the evolution of the UTRAN architecture. This is documented in TR25.897.
- RAN3 made significant progress on the Feasibility on Improved Access to UE Measurement Data for Controlling Radio Network Controller (CRNC) to support Time Division Duplex (TDD) Radio Resource Management (RRM). Three possible solutions including a complexity analysis are documented in TR 25.801, of which one will later be chosen.

Table 3: 3GPP TSG RAN Working Group 3 Specification Update: UTRAN Architecture

Document	Title	Status
tbd	Subscriber and Equipment Trace support in UTRAN	New work item.
TS 25.401	UTRAN Overall Description	Rel 6 version being revised.
TS 25.402	Synchronization in UTRAN Stage 2	Rel 5 version being revised
TS 25.413	UTRAN Iu Interface RANAP Signalling	Rel 99, Rel 4, and Rel 5 versions being revised.
TS 25.419	UTRAN Iu-BC Interface: Service Area Broadcast Protocol	Rel 99, Rel 4, and Rel 5 versions being revised.
TS 25.423	UTRAN Iur Interface RNSAP Signalling	Rel 4 and Rel 5 versions being revised
TS 25.425	UTRAN Iur Interface User Plane Protocols for Common Transport Channel Data Streams	Rel 5 version being revised
TS 25.433	UTRAN Iub Interface NBAP Signalling	Rel 4 and Rel 5 versions being revised
TS 25.435	UTRAN Iub Interface User Plane Protocols for Common Transport Channel data streams	Rel 5 version being revised
TS 25.453	UTRAN Iupc interface Positioning Calculation Application Part (PCAP) signalling	Rel 4, Rel 5 and Rel 6 versions being revised.
TR 25.933	IP transport in UTRAN	Rel 5 version being revised

TSG RAN Working Group 4: Radio Performance and Protocol

3GPP TSG RAN Working Group 4 (RAN4) specifies the RF aspects of UTRAN, including simulation of diverse RF system scenarios, channel demodulation and the minimum requirements for transmission and reception parameters. Once the requirements are set the group defines the test procedures that will be used to verify them. Requirements for other radio elements, such as repeaters, are specified in RAN4 as well.

Highlights of the most recent meeting were:

- RAN4 has started work on Release 6 features and is making good progress on them, including the following:
  - » HSDPA – RF Radio Transmission/ Reception, System Performance Requirements and Conformance Testing.
  - » A feasibility study for the viable deployment of UTRA in additional and diverse spectrum arrangements.

Table 4: 3GPP TSG RAN Working Group 4 Specification Update: Radio Performance and Protocol

Document	Title	Status
tbd	A-GPS minimum performance specification.	New Work Item.
TS 25.101	UE Radio Transmission and Reception (FDD)	Rel 99, Rel 4, Rel 5 and Rel 6versions being revised.
TS 25.102	UTRA (UE) TDD; Radio Transmission and Reception	Rel 5 version being revised.
TS 25.104	UTRA (BS) FDD; Radio Transmission and Reception	Rel 5, and Rel 6 versions being revised.
TS 25.106	UTRA Repeater Radio Transmission and Reception	Rel 4 and Rel 5 versions being revised.
TS 25.123	Requirements for Support of Radio Resource Management (TDD)	Rel 99, Rel 4, and Rel 5 versions being revised.

Table 4: 3GPP TSG RAN Working Group 4 Specification Update: Radio Performance and Protocol

Document	Title	Status
TS 25.133	Requirements for Support of Radio Resource Management (FDD)	Rel 99, Rel 4, Rel 5, and Rel 6 versions being revised.
TS 25.141	Base Station Conformance Testing (FDD)	Rel 5, and Rel 6 versions being revised.
TS 25.142	Base station Conformance Testing (TDD)	Rel 5 version being revised.
TS 25.143	UTRAN Iu Interface RANAP Signalling	Rel 4 and Rel 5 versions being revised.
TR 25.951	FDD Base Station (BS) classification	Rel 6 version being revised.

Meeting Schedule. The most recent plenary meeting of TSG RAN was held from June 3–6, 2003 in Hammenlinna, Finland. Future meetings will be held on September 16–19, 2003 in Berlin and December 9–12, 2003 in Hawai'i.

For a complete schedule of 3GPP meetings consult:

www.3gpp.org/Meetings/meetings.htm

Comments

We welcome comments on the format or contents of *Cellular Networking Perspectives*. We can be reached via email at:

cnpsales@cnp-wireless.com

TIA TR-45.4/3GPP2 TSG-A Radio Access Network Interface Standards

Cellular Networking Perspectives

Editor: David.Crowe@cnp-wireless.com

Last published October, 2002

Note:
1. IS- Interim Standard, TSB- Telecommunications Systems Bulletin, PN- Project Number, SP- ANSI Standards Proposal, A.Pxxxx - TSG-A project, A.Rxxxx - TSG-A report, A.Sxxxx - TSG-A specification. Due to space considerations projects of the format PN-3-xxxx are shown without the "-3" (which means 'TIA').
2. Bold Type indicates a modification since the previous publication of this information.
3. Published TIA standards can be obtained from TIA at www.tiaonline.org/standards/search_n_order.cfm.

Thanks to David Ott and Lisa Collichio (Qualcomm) for their assistance compiling the information in this table.

TR-45.4 Projects and Standards

Standard	Project	Title	Status
TIA/EIA-828	**SP-4604**	**Abis interface specification for CDMA2000**	**Published 12/01**
TIA/EIA-829	**PN-4683**	**Tandem free operation (bypasses intermediate vocoders in mobile-to-mobile calls with compatible vocoders)**	**Published 08/01**
TIA/EIA-895	**SP-0030**	**CDMA tandem free operation**	**Published 03/02**
IS-658	**PN-4374**	**Data Services Interworking Function Interface (e.g. modem pool). This version developed by TR-45.5**	**Published 07/96**
IS-658-1	PN-4385	Extends the ability to perform interface status exchange at times other than call setup	Published 02/99
TIA-878	**PN-0009**	**HRPD interoperability specification (IOS) for CDMA2000 "A" interface**	**Published 12/01**
TIA-878-1	**PN-0009-AD1-A**	**Addendum to HRPD IOS**	**Published 05/03**
TIA-895-A	**SP-0030-RV1**	**CDMA tandem free operation**	**Published 10/02**
TIA-1878	**PN-0091**	**IOS for high rate packet data (HRPD) - Alternative architecture**	**Published 05/03**
TSB-80		IS-634-0 Addendum (corrections, SMS, subrate voice frame format)	Published 11/96
TSB-104		PCS Service Description (now IS-104 in committee TR-46)	Published 06/94
IS-2001	PN-4545	CDMA2000 Access Network Interface ("A" Interface) based on 3GPP2 TSG-A IOS V4.1	Published 12/00
IS-2001-1	PN-4545-AD1	Errata sheet for IS-2001	Published 05/01
IS-2001-A	PN-4545-RV1	CDMA2000 Access Network Interface based on IOS v4.2	Published 08/01
TIA-2001-B	**SP-4545-RV2**	**CDMA2000 Access Network Interface based on IOS v4.2**	**Published 05/02**
TIA-2001-C	**SP-4545-RV3**	**CDMA2000 Access Network Interface based on IOS v4.3**	**In press**
TIA-2001-C-1	**SP-4545-RV3-1**	**Supplment to IOS v4.3**	**Ballot 08/03**
IS-634-0	PN-3296	MSC-BS "A" Interface Standard	Published 12/95
IS-634-A	PN-3539	MSC-BS Interface, including support for IS-95-A, EIA/TIA-553-A, IS-41-C, SMS, data and frame relay	Published 10/98
TIA/EIA-634-B	SP-4277	ANSI version of IS-634-A	Published 04/99
TIA/EIA-634-C	SP-4377	Revision of BS-MSC "A" interface	Project cancelled

3GPP2 TSG-A Projects (P.xxxx), Specifications (S.xxxx) and Reports (R.xxxx)

Standard	Title	Status
A.R0003	Abis interface technical report for CDMA2000 systems. Refer to A.S0003	Completed 12/99
A.R0006	**Study of IP-based RAN architecture for CDMA2000**	**Completed 07/01**
A.R0011	**Report on issues identified with IOS V4.1**	**Completed 08/02**
A.S0001	**Interoperability specification (IOS) for CDMA2000**	**Published 06/00**
A.S0001-A	**Interoperability specification (IOS) for CDMA2000**	**Published 06/01**
A.S0003	BTS-BSC interoperability (Abis interface) for CDMA2000	Published 03/00
A.S0003-A	BTS-BSC (Abis) interface for CDMA2000	Published 07/01
A.S0004	**CDMA/TDMA Tandem free operation - Refer to TIA/EIA-829**	**Published 05/01**
A.S0004-A	CDMA/TDMA Tandem free operation - Refer to TIA/EIA-895	Published 03/02
A.S0004-B	**CDMA tandem free operations. Refer to TIA/EIA-895-A**	**Published 08/02**
A.S0007	HRPD Interoperability specification (IOS) for CDMA2000 (Phase 1). Refer to TIA-878	Published 11/01
A.S0007-A	**HRPD IOS (Phase 2). Session Control/Mobility Management in PCF. Refer to TIA-1878**	**Published 05/03**
A.S0008	**HRPD IOS. Refer to TIA-878-1**	**Published 05/03**
A.S0011~17	**Interoperability specification (IOS) for CDMA2000 Refer to TIA-2001-B**	**Published 05/02**
A.S0011	**Part 1 - Overview**	
A.S0012	Part 2 - Transport	
A.S0013	Part 3 - Features	
A.S0014	Part 4 - A1, A2, A5 interfaces	
A.S0015	Part 5 - A3, A7 interfaces	
A.S0016	Part 6 - A8, A9 interfaces	
A.S0017	Part 7 - A10, A11 interfaces	
A.S0011~17-A	**Interoperability specifications (IOS v4.3) for CDMA2000 in 7 parts. Refer to TIA-2001-C**	**In press**