



# Standards for MEID and Expanded UIMID (E-UIMID)

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Version 2.1

Contact

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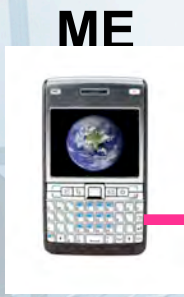
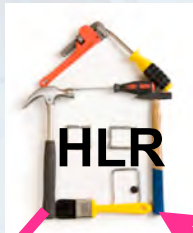
# Background

*Changes in this revision (v2.1) are shown in green.*

- Mobile devices and R-UIMs (Removable User Identity Modules) must be identified by a unique code for a variety of reasons.
- Applications for new assignments of the original 32 bit identifiers known as ESN and UIMID have not been accepted since June 2010. Previously received yet unfulfilled requests are still being processed.
- Replacement identifiers are standardized and available –
  - MEID: Mobile Equipment Identity
  - EUIMID: Expanded UIM Identity
- This presentation describes the standards to support the migration to MEID and EUIMID.
- See <http://cdg.org/meid> for other resources, including descriptions of the ESN, UIMID, MEID and EUIMID numbering resources.



# Your Network





**Star Ranking: 3 Stars=Critical; 2 Stars=Important; 1 Star=Useful; No Stars=Ignorable.**

# Standards Summary

 A summary of the major standards that have been or will be modified to support MEID or EUIMID...

# Key Specifications

Specification	Purpose
A.S0008~9	Base Station Interfaces for HRPD/EVDO
A.S0011~17	Base Station/MSC Interface (IOS)
C.S0001~6-E	CDMA2000 radio interface, allowing StatusRequest for all IDs.
C.S0016-C v2.0	Over-the-Air Service Provisioning (OTASP)
C.S0023-C v2.0	R-UIM with SF_EUIMID Support (storage of SF_EUIMID, storage of MEID from mobile, UsgInd bit 2)
C.S0024-A	EVDO with MEID Support (Hardware ID set to MEID instead of ESN)
C.S0066	OTA Support Modifications for MEID (new <i>Extended Protocol Capability Response</i> message containing MEID)
C.S0072-0	Air Interface Modifications for MEID and BS-Assigned PLCM (SCM bit 4 = '1', new PLCM assignment types, transmission of MEID in <i>Status Request</i> and <i>Extended Protocol Capability Response</i> messages)
C.S0073	Test specification for MEID-equipped mobiles. Revision A also includes EUIMID test cases. <b>Revision B tests access to new Status Request types.</b>
X.S0008-0 v3.0	ANSI-41 Modifications for MEID. Defines the display formats and check digit calculations for MEID and SF_EUIMID as well as the new <i>CheckMEID</i> and <i>StatusRequest</i> messages. Allows many existing messages to carry MEID.
X.S0011-005-D	Accounting records from RAN to PDSN to AAA may contain MEID.
X.S0033	Modified OTASP network protocol including MEID at ANSI-41 level.
3GPP2 specifications are freely available at: <a href="http://www.3gpp2.org/Public_html/specs/index.cfm">http://www.3gpp2.org/Public_html/specs/index.cfm</a> . <b>Versions more recent than those shown here can be used.</b>	



# R-UIM and CSIM Standards



- The R-UIM and CSIM are known informally as “smart cards” and are used in most cdma2000 networks outside the Americas.
- R-UIM is a card designed solely for cdma2000.
- CSIM is an application on a UICC card that can also host other protocols such as GSM and W-CDMA.



# C.S0023 (TIA-820) R-UIM Specification

- **Revision C (published 06/2006) provides:**
  - SF\_EUIMID storage
  - Service n8 (SF\_EUIMID)
  - Service n9 (storage of MEID)
- **Version 2.0 (published 10/2008) clarifies:**
  - Ordering of ICCID into SHA-1 algorithm to calculate pUIMID.
  - Transmission of all 20 digits from ICCID EF outside R-UIM.
  - Ordering of digits in SF\_EUIMID field.
  - Number of bits in ESN/UIMID (text currently implies they can be 32 or 56 bits, not just 32).



# C.S0065 (TIA-1080) CSIM Specification

- CSIM is an application running on the UICC (Universal Integrated Circuit Card) platform.
- C.S0065-0 v1.0 has same changes as C.S0023-C v1.0 for this card type.
- C.S0065-0 v2.0 (published 07/2008) has the same changes as C.S0023-C v2.0.
- The standard was published with one editorial error. The example of a pUIMID calculated from LF\_EUIMID is not correct. A corrected version was published in December, 2008.

# 1X Radio Interface



- cdma2000 '1X' radio interface provides voice services, validation and authentication services and medium speed data.
- The **EVDO (HRPD)** radio interface is discussed under Packet Data.



# C.S0072 (TIA-1082) – MEID in Air Interface

- Revision 0 of this specification (published 08/2005) provides:
  - Use of previously unused SCM bit 4 to indicate MEID support in device.
  - New PLCM derivation types including BS-assigned at call setup and handoff.
  - Access to MEID (or SF\_EUIMID) via Status Request.
  - Transmission of MEID vs. SF\_EUIMID is controlled by the **Usglnd** setting in the R-UIM.
  - Compatibility with older air interface protocol versions (as P\_REV is unaffected by this new capability).
- Largely superseded by Revision E of the air interface.



# C.S000x-D (TIA-2000-D) – MEID Replaces ESN

- It is important to note that this suite of standards has not been commercialized and there are no plans to do so.
- This standard allowed MEID in LAC addressing, replacing or supplementing ESN.



# C.S000x-E – 1X Advanced

- A revision of the CDMA2000 air interface.
- Published September, 2009.
- This version is more modular than Release D, new functionality is designed to be supported independently:
  - Many capabilities (such as new StatusRequest types) can be accessed without moving to a higher PREV.
- This specification supports StatusRequest messages to provide access to the following identifiers:
  - EUIMID (SF\_EUIMID or LF\_EUIMID).
  - MEID\_ME (the MEID **of the ME** even when Usglnd bit 2 indicates that SF\_EUIMID displaces MEID **in signaling**).
  - ESN\_ME (the ESN **of the ME** even when Usglnd bit 1 indicates that UIMID displaces ESN **in signaling**).

# IOS – MSC/BSC Interface



- IOS provides a number of interfaces centered on the BSC and BS.
- For MEID/EUIMID purposes, it is the BSC–MSC interface that is **most** relevant.
- **A.S0011 through A.S0017 support 1X services and may need to be updated to support C.S0072 (e.g. hard handoff).**
- **A.S0008 and A.S0009 support HRPD/EVDO services and may need to be updated to support MEID (e.g. as Hardware ID).**



## A.S0011-17 (TIA-2001) IOS

- Revision B v1.0 of this specification (IOS 4.3.1) supported new PLCM assignment types.
- Revision C v1.0 of this specification (IOS 5.0) supported MEID in Release D systems.
- Revision C v2.0 of this specification (IOS 5.0.1) supported MEID in systems supporting C.S0072 (TIA-1082).
- Release D of the air interface is not implemented, and the major application for new PLCM assignment types is MEID, therefore IOS 5.0.1 is the most likely requirement.
- Transmission of MEID, EUIMID and other identifiers in Status Request messages is transparent to these specifications.

# PDN – Packet Data Network



- Packet Data Network in cdma2000 systems includes 1X base stations, EVDO (HRPD) RAN, PDSN and AAA



## C.S0024-A (TIA-856-A) – EVDO/HRPD

- A high speed data standard within the cdma2000 family.
- Most EVDO (HRPD) devices also operate in 1X mode, and thus most impacts from MEID and EUIMID are restricted to that mode.
- It is important to recognize that the EVDO “Hardware ID” parameter is now either:
  - ESN, or
  - MEID
- This parameter is *never* UIMID or EUIMID:
  - NAI (user name) is the accessible unique card identifier.
- C.S0024-A v3.0 clarified that Hardware ID is never an R-UIM identifier (September, 2009).
- Rev. 0 systems may need to be updated to accept MEID as Hardware ID.



# X.S0011-005-D (TIA-835-D) – AAA

- MEID is added as a possible element in RADIUS accounting messages.
- MEID is not as critical as NAI and MIN/IMSI in billing for packet data, but may be useful.
- The parameters provided will vary depending on whether a session is a 1X or EVDO data mode, especially on R-UIM systems:
  - EVDO systems provide MEID or ESN, not both (e.g. pESN is not provided).
  - 1X systems may provide UIMID instead of ESN and SF\_EUIMID instead of MEID (depending on network, MS and R-UIM configuration).
  - 1X systems will usually provide a pseudo-identifier along with MEID or SF\_EUIMID.



# OTASP - Over-the-Air Service Provisioning

- OTASP and other provisioning systems are affected when they currently use ESN or UIMID as unique identifier.
- Likely *not* affected when MIN/IMSI is pre-provisioned.
- SF\_EUIMID is transmitted instead of MEID if card's UsgInd bit 2 is '1'.
- OTAF cannot determine reliably if mobile is MEID capable (SCM bit is not sent to OTAF).
- Biggest problem is the provisioning of an EUIMID card in an ESN mobile – no unique provisioning identifier unless cards are pre-provisioned.



# C.S0016 (TIA-683) – OTASP

- Revision C (published November, 2004) provided:
  - Ability to obtain MEID (or SF\_EUIMID with Usglnd bit 2=1)
- Revision C Version 2.0 (published October, 2008) provides:
  - Access to both MEID, EUIMID and ICCID during OTASP session.
  - Resolution of band class/MEID interaction.
  - When ICCID is transmitted, all 20 digits should be transmitted (not just 18, as originally proposed).



# C.S0066 (TIA-158) – OTASP for MEID

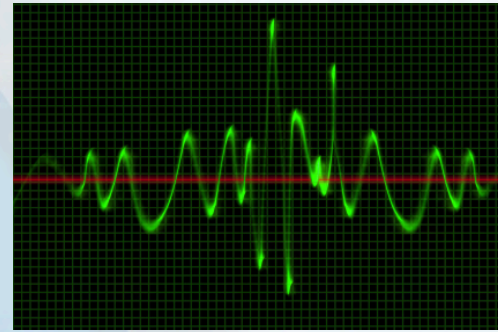
- This specification was designed to provide MEID support to previously published versions of C.S0016.
- Revision 0 (September, 2004) provides:
  - Access to MEID (or SF\_EUIMID) during OTASP session.
- Version 2.0 (July, 2008) provides:
  - Access to EUIMID and ICCID as well as MEID during OTASP session.
  - Resolution of band class problem.
  - When LF\_EUIMID is transmitted it will be the 20 digit contents of EF(ICCID) not just the (usually) 18 digit ICCID.



# X.S0033 (TIA-1074) – OTASP in ANSI-41

- Revision 0 of this standard (published in November, 2005 and revised March, 2006) provides:
  - Inclusion of MEID in ANSI-41 messages supporting OTASP, providing an alternative to transmitting MEID in the OTASP signaling layer.
  - This is less desirable than implementation of C.S0016-C or C.S0066 because more widespread network changes are required.

# Testing



- **Testing of MEID and EUIMID capabilities is important when initially migrating, and ongoing when accepting new phones, infrastructure upgrades and so on.**



# C.S0073 (TIA-1084) – MEID Test Spec'n

- Revision 0 of this specification (October, 2005) provided:
  - An extensive sequence of test cases for MEID-equipped mobiles.
- Revision A (April, 2008) provides:
  - Test cases for MEID-equipped mobile with R-UIM with either SF\_EUIMID or LF\_EUIMID.
  - A note indicating that testing R-UIMs equipped with EUIMID in ESN-based mobiles should use C.S0043 and C.S0044, such tests are outside the scope of this specification.
- Revision B (August, 2009) defines tests for:
  - Access to all identifiers (MEID, SF\_EUIMID, LF\_EUIMID etc.) via OTASP.
  - Access to all identifiers via Status Request (via Release E of the air interface).

# Core Network

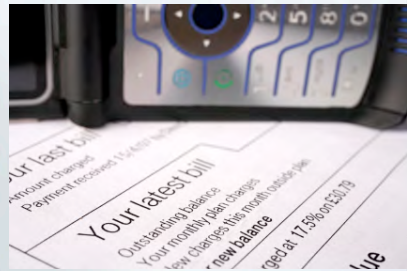
- Core Network modifications are, perhaps surprisingly, not required to support MEID.
- Some HLRs and VLRs are known to (unnecessarily) require ESN uniqueness. If present, this restriction will need to be removed.
- Some systems have not allowed decimal MEID codes (e.g. RR=99 or other IMEI ranges). This restriction also needs to be removed.
- Other network elements, **such as back office systems for provisioning and billing**, may have similar restrictions. This is a characteristic of individual equipment, not based on standards.



# X.S0008 (TIA-928) – MEID in ANSI-41

- Revision 0 of this specification (published 07/2004) provided:
  - Transmission of MEID from MSC to VLR to EIR.
  - Optional inclusion of MEID in most ANSI-41 messages.
  - MEID check digit calculations.
  - 14 digit ('hex') and 18 digit ('decimal') display formats.
- Addendum 1 of Revision 0 (published 11/2005) provided:
  - MEID validation at the HLR (verifying that the MEID being used by a subscriber does not change). This capability **may not be** applicable to systems utilizing R-UIM.

# Billing



- Some billing protocols (e.g. CIBER) allow only one hardware identifier (ESN or pESN or UIMID or pUIMID or MEID or SF\_EUIMID) to be transmitted.
- Some billing systems perform MIN/ESN validation (checking that the subscriber record identified by MIN is associated with received ESN).
- This validation is not applicable when MEID is transmitted.
- There is no risk of fraud and only a small risk of billing errors if validation is removed.
- Carriers can continue to include 32-bit identifier (e.g. pUIMID) or not validate when MEID is received.
  - Inclusion of the 32-bit identifier is probably safest.
  - Billing systems should accept either 32 or 56 bit formats.

# Resources

- A glossary. Also see <http://cdg.org/MEID>

# Glossary

Term	Definition	Term	Definition
3GPP2	Third Generation Partnership Project	PLCM	Public Long Code Mask
ESN	Electronic Serial Number	R-UIM	Removable UIM
EUIMID	Expanded UIMID	SCM	Station Class Mark
IMEI	International Mobile Equipment Identity	TIA	Telecommunications Industry Association
IMSI	International Mobile Subscription Identity	UIM	User Identification Module
IOS	Inter-Operability Standard ('A' Interface)	UIMID	R-UIM Identifier
MEID	Mobile Equipment Identifier		



**Thank You**