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Harmonized Global 3G

(G3G)

Technical Framework

for

ITU IMT-2000 CDMA Proposal

OHG Technical Framework

Version May 28th 1999

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1. Introduction

The Operators Harmonization Group (OHG) Technical Framework document outlines the key technical parameters which can meet the requirements of commercial wireless operators from around the world, who desire a common global specification for 3G CDMA systems. The harmonization framework draws heavily on the Wideband Code Division Multiple Access (WCDMA) and cdma2000 submissions made to ITU for IMT-2000 and described in an earlier OHG document entitled "Beijing Output 2".

The majority of operators and manufacturers worldwide support this goal. The technical framework proposed for achieving a common global specification seeks to:

- Provide the foundation for accelerated growth in the mobile industry in the 3G millennium and to create a single integrated 3G CDMA specification and process from the seperate WCDMA and cdma2000 proposals being developed by 3GPP and 3GPP2.

The technical parameters contained in this document build upon the very successful CDMA harmonization activities undertaken to date between TIA, ARIB, ETSI, TTA, and TTC. However, the proposal contained herein is strongly focused on a solution that would meet operator needs based on available technical information on the merits of the various techniques without regard to IPR. The wireless operators have been assured that the manufacturing community will cross license intellectual property on fair, reasonable and non-discriminatory terms for the good of the wireless industry. This assurance was exemplified by the recent agreement on IPR cross licensing between Ericsson and Qualcomm.

Greatest care has been taken in selecting technical parameters that protect every operator's present infrastructure investment and enable their 2nd generation systems evolve towards 3rd generation services to the greatest extent possible. It is recognized that high speed multi-media services will place different requirements on the infrastructure which will drive the development of new capabilities in both the radio access and core network systems.

The philosophy behind the development of this OHG technical proposal is to allow each operator the choice of implementing a subset of a harmonized global specification depending on their market and business needs. This document specifies several key radio parameters which form the basis for a harmonized Global 3G CDMA standard.

This document does not address either the UWC-136 or DECT IMT 2000 RTT submissions. Their architectures are significantly different as to fall outside of the scope of harmonization addressed in this document. Their omission should not be construed as to reflect negatively on their suitability for IMT 2000 systems.

2. Technical Parameters

The operators are interested in having a harmonized Global 3G CDMA standard consisting of three modes: Multi Carrier (MC), Direct Spread (DS) and Time Division Duplex (TDD).

2.1 Global 3G (G3G) Specification

A harmonized G3G specification should:

1. Be focused on customer needs for widespread availability of voice and high speed non-voice services.

2. Maximize ability of customers to roam with their services across regions, countries and systems.

3. Minimize 3G costs for the mobile industry.

4. Maximize the ability of the Information Technology, Internet and Personal Computer industries to provide mobile applications, solutions, and subscriber devices.

5. Provide a smooth and compatible evolution path from existing infrastructure.

6. Be completed in time to meet the commercialization plans of all countries/regions.

7. Recognize that there are two well established core network architectures.

8. Minimize the IPR impact on the industry.

9. Promote the free flow of IPRs to accelerate innovation and create greater customer choice.

10. Accommodate regional needs for different spectrum allocations.

11. Use technical approaches and parameters that meet customer requirements.

2.2 Global 3G (G3G) Technical Specification

The key parameters are outlined below:

*   The harmonized standard for DS will be based on the W-CDMA proposal.

*   The harmonized standard for MC will be based on the cdma2000 proposal.

*   The key parameters for the harmonized standard for the TDD mode have not been considered in detail with the exception of a recommendation on the chip rate.

2.2.1 Inter Base Station Synchronization

The inter base station synchronization will be as follows:

*   The W-CDMA asynchronous and synchronous approach shall be used for the DS mode. This

approach uses different codes to identify base stations.

- The cdma2000 approach shall be used for the Multi-Carrier mode.

2.2.2 Forward Link Pilot Structure

The structure for the MC mode shall be as defined in cdma2000.

The operators support the harmonized forward link pilot structure described below for the DS mode.

2.2.2.1 Common Pilots and Common Channels

Figure 1 presents the common channel structure. The objective is to introduce a common CDM pilot in the current W-CDMA channel structure and in particular on how to multiplex the pilot, primary common control channel (PPCCH) and SCH streams. Consensus was reached on the following structure:

- · 100% duty cycle common CDM pilot channel (CPICH) on one code
- · 90% duty cycle PCCPCH on a separate code without TDM pilot symbols
- · 10% duty cycle SCH codes are transmitted during the PCCPCH idle period

Due to the revised chip rate, some parameters indicated in Figure 1 may need to be adjusted, for example the slot time.

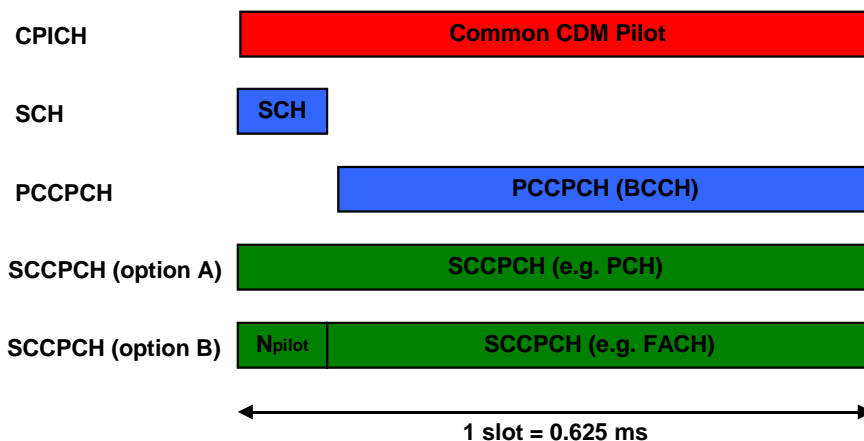**Figure 1: Proposed common channel structure (position of pilot bits to be in accordance with WCDMA requirements)**

2.2.2.2 Common CDM Pilot

A common CDM pilot is broadcast throughout a cell or sector on a code multiplexed channel with 100% duty cycle. Additional common CDM pilot channels may be broadcast, also with 100% duty cycle, to support scenarios where multiple shall also be specified which share an

additional pilot reference. These additional common CDM pilots could be used to support transmit diversity techniques and spot beams.

2.2.2.3   SCCPCH structure

Due to the Common CDM Pilot, the SCCPCH requires modification. At this time there are two cases to consider:

· the SCCPCH does not always require TDM pilot bits,

· the SCCPCH requires TDM pilot bits when beam forming techniques (FACH) are employed.

Thus the recommendation is optional insertion of TDM pilot bits, where the pilot bits (when applied) are to be used for support of beam forming techniques. Consequently, the SCCPCH would support 0 to 16 pilot bits (Npilot $\in \{0,2,\ldots,16\}$).

2.2.2.4.   Dedicated Pilots

In order to efficiently support low rate data services (e.g., 8kbps voice services, with a rate 1/3 FEC code and a spreading factor of 256 the number of pilot bits applied to the dedicated traffic channel is under consideration.

Two proposals are under consideration:

- the DCH shall support insertion (TDM) of 0 to 16 pilot bits (Npilot $\in \{0,2,\ldots,16\}$),

- the DCH shall support insertion (TDM) of 2 to 16 pilot bits (Npilot $\in \{2,4,\ldots,16\}$).

Two potential issues have been raised regarding the case of no pilot bits (Npilot = 0). One possible issue regards the power control algorithm design and another regards timing. The operators supporting this document request that 3GPP and 3GPP2 resolve this issue.

2.2.3 Chip Rate

The chip rate will be 3.84 Mcps for Direct Spread, 3.6864 Mcps for Multi Carrier and 3.84 Mcps for Time Division Duplex for the CDMA radio access modes.

2.2.4 RF Parameters

The RF parameters should be harmonized between the modes to the greatest extent possible to encourage economy of scale in RF components that could significantly reduce overall costs.

3. CDMA Harmonization (G3G) Proposal for Protocol Layers

The first Operators Harmonization Group (OHG) meeting agreed to the following modular system block diagram (see Figure 2.). This modular system was subsequently also supported by Trans-Atlantic Business Dialogue (TABD) meeting held in Washington D.C. during February 1999.
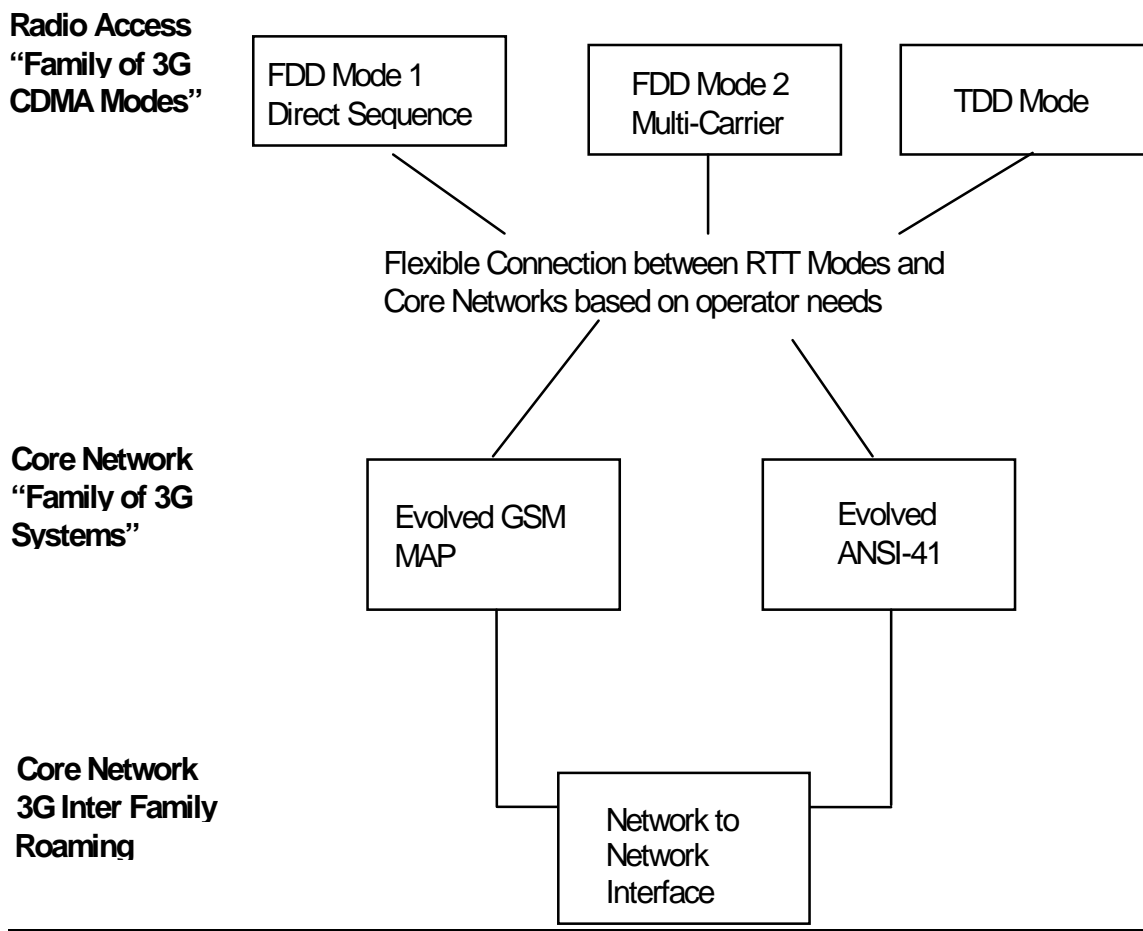
Radio Access "Family of 3G CDMA Modes"

FDD Mode 1 Direct Sequence	FDD Mode 2 Multi-Carrier	TDD Mode

Flexible Connection between RTT Modes and Core Networks based on operator needs

Core Network "Family of 3G Systems"

Evolved GSM MAP	Evolved ANSI-41

Core Network 3G Inter Family Roaming

Network to Network Interface

Figure 2: MODULAR 3G HARMONIZATION PROPOSAL

A 3G Operator may select one or more radio access modules together with one or more core network modules to implement a G3G system subject to the regulatory requirements of their nation or region.

The global ITU specification for G3G must be sufficiently detailed to enable 3G operators to implement systems incorporating various harmonized radio access modes and core networks. As

a consequence, it will be necessary to define the protocol layers associated with interconnecting the radio access modes and core networks: each community of interest will determine combination(s) in which they are interested and take on the task to specify them.

3.1   Harmonization Requirements

The requirements for harmonization are listed below.

1. ANSI 41 and GSM MAP based services should be fully supported in the Radio Access Network associated with all three 3G CDMA modes.

2. Supports functionality based on synchronous operation such as location calculation, etc.

3. Supports seamless handoff between the harmonized DS and MC including IS-95 for ANSI 41 and the equivalent to this for UMTS/GSM.

4. Minimize the complexity of dual-mode and muti-band terminals and equipment

3.2   Harmonization Approach

A conceptual diagram of the harmonization required to achieve these requirements for the DS and MC modes is shown in Figure 3. Note that this figure includes potential changes to the physical layer L1 needed to support the requirements outlined in Section 3.1

The harmonization approach shown in Figure 3 has the following components:

a) For the DS mode the baseline starting point for supporting both core networks is:
    - L1 as per Section 2
    - W-CDMA L2
    - W-CDMA L3 Radio Resource Control (RRC)

b) For the MC mode the baseline starting point for supporting both core networks is:
    - L1 as per Section 2
    - cdma2000 L2
    - cdma2000 L3 Radio Resource Control (RRC)

c) For the TDD mode the baseline starting point for supporting both core networks is:
    - TDD Mode L2 as per 3GPP
    - TDD L3 Radio Resource Control (RRC) as per 3GPP

d) The concept of "Hooks" as shown in Figure 3 is defined as any functionality that is specified for the initial release of the standards so that the extensions needed to satisfy the requirements Section 3.1above can be defined in detail. These Hooks are defined using the guiding principles in the Section 3.3.

e) The concept of "Extensions" as shown in Figure 3 is defined as any additional functionality at any layer which needs to be specified in detail to meet the Section 3.1 requirements above, assuming the appropriate "Hooks" are in place to enable the Extensions to be defined without major changes to the baseline protocols. These Extensions are defined using the guiding principles in the following Section 3.3.

3.3   Phased Approach

Given the events to date and current commercialization time schedule it is not possible to completely harmonize all aspects of the upper layers for a unified Global Specification. Protocol Layers 2&3 for Direct Spread, Multi-Carrier, and TDD will be developed in two phases outlined below (including any consequential impacts on the physical layers). The timing of Phase 1 and 2 may be different depending for a particular mode depending on market requirements. The timing goals agreed by the operators is outlined in Section 4.

Phase 1
The baseline parameters in all three radio layers including the hooks as defined above will be completed to meet the Release 99 timeframes of 3GPP and 3GPP2.

Phase 2
Completion of all the detailed specification of all the extensions to Phase 1 necessary to fully support of ANSI 41 and GSM core networks.
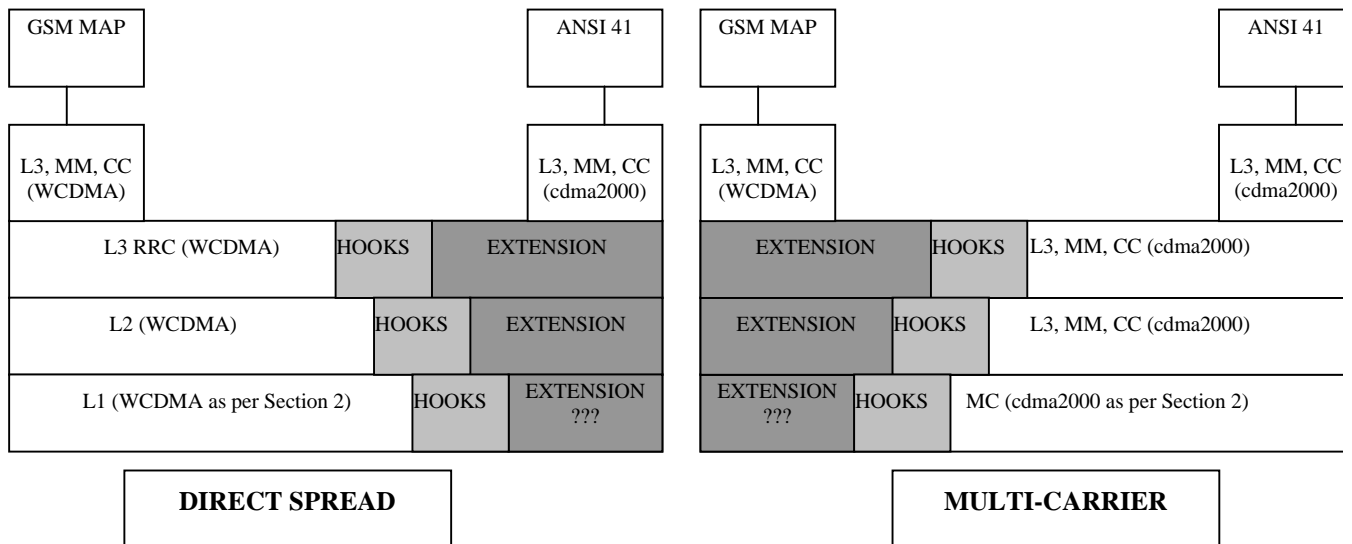
Note: ?? – Areas for further analysis

Figure 3: Protocol Structure for Implementing the Modular Concept

A more detailed view of the protocol architecture for the DS mode connected to an ANSI 41 network based on the principles of Figure 3 is shown in Figure 4.
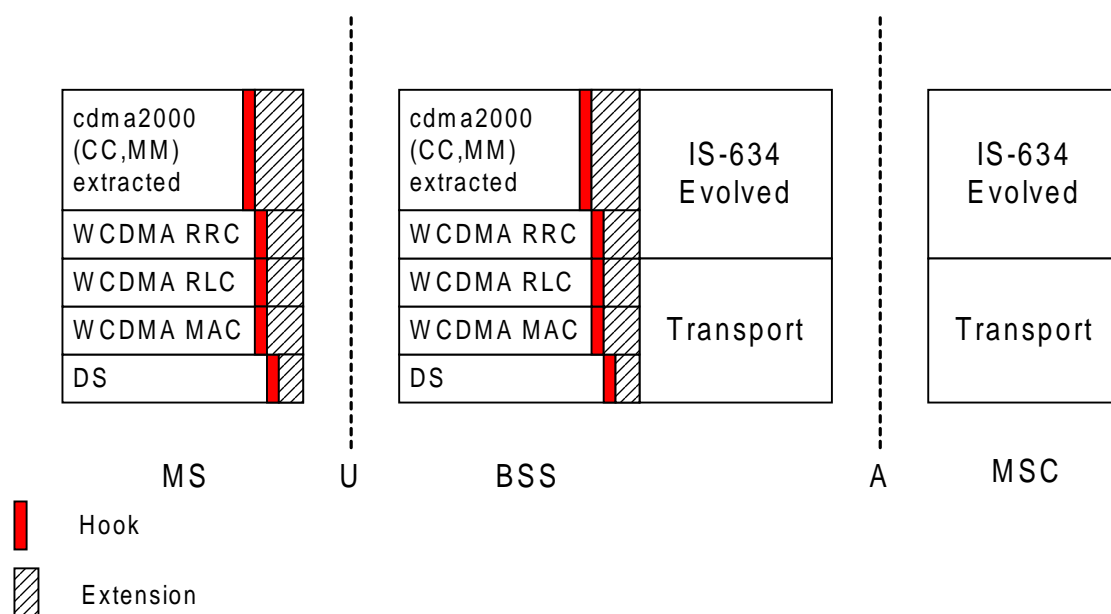
Figure 4: Detail of Direct Spread Protocol Stack

A 3G Operator may select combinations of the above protocol stacks subject to the requirements of their nation or regions. The global specification for G3G must be sufficiently detailed to enable operators to flexibly choose between the various harmonized radio access and core networks.

ITU and SDOs are advised that maximum commonality is required between these protocols. The mobile terminal will have the ability to determine the network environment it is accessing or operating in.

4. Guidelines and Principles

In developing the harmonized Global CDMA 3G standard, the following principles and guidelines must be followed:

- 3GPP and 3GPP2 shall maintain their 1999 release schedules.
- The Hooks required to implement the harmonized CDMA standard must be identified as soon as possible to allow prioritization of work for inclusion in Release 99 and to ensure completion of the work in Phase 2 is facilitated.

- The objective is for all Hooks to be specified by the end of 99.

- All Hooks specified by the end of 1999 should be included in Release 1999.

- Changes to L1 should be minimized.

- Changes to the core networks (see Figure 4) should be minimized.

- The location of each change should be based on engineering judgment on a case by case

basis taking into consideration the full set of guidelines.

The operators recommend the timing goals in Figure 5 below for the availability of the Harmonized Global CDMA 3G standard based on the current market needs.

Harmonized DS and TDD Mode	Timing Goals
• Specification completed with Hooks required for implementation of Phase 2.	Dec 1999
• Extensions specified to support ANSI-41 core networks.	Feb 2000

Harmonized MC Mode	Timing Goals
• Specification completed with Hooks required for implementation of Phase 2.	March 2000
• Extensions specified to support GSM core networks.	June 2000

Figure 5: G3G Standards Timetable

5. Process

The objective of the process is to ensure the OHG Harmonization Agreement can be implemented in a timely manner.

The OHG Toronto Output Documents to be submitted to the following**:**

TG8/1	Beijing Meeting	May 31st
3GPP	RAN WG 1	June 1 - 4
3GPP2	TSG-R, San Diego	June 22
ARIB		
ETSI		
TTA		
TTC		
TIA	TR45, Kansas City	June 2
TIP1		

OHG requests that Layer 1 – 3 experts within 3GPP and 3GPP2 jointly determine the Hooks in the 1999 release of the 3GPP specifications needed for the extensions to meet the service requirements specified in the OHG Technical Framework Document. A similar process should be carried out for Multi-Carrier. It will also help the valuable human resource to work together to achieve common goal as opposed to working on two separate directions.

OHG further request that there should be minimal delay in achieving this goal.
To support these efforts, the OHG and the manufacturers are be willing to host extra 3G standard meetings and provide the necessary resources. Progress reports should be given to OHG after every 3GPP/3GPP2 meeting.

OHG has carried out its primary mission and therefore does not see a need for further meetings at this time. However, operators want to ensure that their recommendations are implemented in 3GPP & 3GPP2.

The OHG & MHG (Manufacturers Harmonization Group)Ad-Hoc plans to form transition teams to support this document and navigate it through the standard bodies. The members of this transition team is still to be finalised but a proposed list is shown in Appendix A.

OHG also feels that for complete harmonization, 3GPP & 3GPP2 should consider merging into a single body no later than December 2000. This merger will provide focus in developing a unified core network for the future as well as ensuring that Air Interfaces and the associated protocol layers in the future will be completely harmonized. To achieve this goal, the OHG will assist in the merger process. OHG is willing to sponsor a meeting between the two 3GPP leadership to facilitate the merger discussions.

The following Service Providers and Manufacturers support this document:

May 25th, 1999

Appendix A – OHG Transition Team

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Peter Barry	AirTouch
Romano Giovanni	TIM
Siezo Ono	NTT DoCoMo
Thomas Beier	Telia
Vino Vinodrai	Bell Mobility
YK Kim	LG Telecom