PROPOSED EIA/TIA INTERIM STANDARD

Wideband Spread Spectrum Digital Cellular System Dual-Mode Mobile Station - Base Station Compatibility Standard

---

April 21, 1992

PATENT/COPYRIGHT: Contributor's company has not made a determination as to whether it holds one or more patents or copyrights that cover information contained in this contribution but agrees that a license under those rights on reasonable and nondiscriminatory terms and conditions will be made available if such patents or copyrights are later found to exist.

GRANT OF LICENSE: Contributor's company grants an irrevocable royalty-free and compensation-free license to the Telecommunications Industry Association to use any or all material contained in this contribution in any TIA publication.

NOTICE: The information contained in this document is provided for the sole purpose of promoting discussion in the TIA Subcommittee in the development of standards and is not binding on QUALCOMM Inc. QUALCOMM Inc. reserves the right to amend the statements contained herein.

DISTRIBUTION: TR45.5

Copyright © 1992 QUALCOMM Incorporated. All rights reserved. Printed in the United States of America.

Document Number: 80-7814 Rev - DCR 03567

PREFACE

These technical requirements form a compatibility standard for cellular mobile telecommunications systems. They ensure that a mobile station can obtain service in any cellular system manufactured according to this standard. These requirements do not address the quality or reliability of that service, nor do they cover equipment performance or measurement procedures.

To ensure compatibility (see Note 1), both radio-system parameters and call-processing procedures must be specified. The equipment and interface parameters commonly encountered in two-way radio systems have been updated and expanded to reflect the unique radio plan upon which cellular systems are based. The sequence of call-processing steps that the dual-mode mobile stations and base stations execute to establish calls has been specified along with the digital control messages and analog signals that are exchanged between the two stations.

The base station is subject to fewer compatibility requirements than the dual-mode mobile station. Radiated power levels, both desired and undesired, are fully specified for dual-mode mobile stations to control the RF interference that one mobile station can cause another. Base stations are fixed in location and their interference is controlled by proper layout and operation of the system in which the station operates. Detailed call-processing procedures are specified for mobile stations to ensure a uniform response to all base stations. Base station call procedures are not specified in detail because they are a part of the overall design of the individual land system. However, the base station call-processing procedures must be compatible with those specified for the mobile station. This approach to writing the compatibility specification provides the land system designer with sufficient flexibility to respond to local service needs and to account for local topography and propagation conditions.

The basic radio-system parameters and call-processing procedures for the analog mode of operation embodied in the compatibility specification were originally derived from the Chicago and Baltimore-Washington developmental cellular systems and include certain additions and modifications gained by experience with the operation of commercial systems.

The basic radio-system parameters and call-processing procedures for the wideband spread spectrum (CDMA) mode of operation embodied in the compatibility specification were originally derived from the San Diego developmental cellular system. Most functions have been verified by field trial.

This specification includes provisions for future service additions and expansion of system capabilities. The architecture defined by this specification permits such expansion without the loss of backwards compatibility to older mobile stations.

SECTION SUMMARY

1. General. This section defines the terms and numeric indications used in this document. This section also describes the time reference used in the CDMA system and the tolerances used throughout the document.

2. Requirements for Mobile Station Analog Operation. This section describes the requirements for CDMA-analog dual-mode mobile stations operating in the analog mode. A mobile station complying with these requirements will be able to operate with analog base stations complying with EIA/TIA-553, EIA/TIA/IS-54, and this document.

3. Requirements for Base Station Analog Operation. This section describes the requirements for analog base stations. A base station complying with these requirements will be able to operate in the analog mode with mobile stations complying with EIA/TIA-553, EIA/TIA/IS-54, and this document.

4. Requirements for Mobile Station Analog Options. This section describes the requirements for CDMA-analog dual-mode mobile stations which use the 32-digit dialing option on the reverse analog control channel. In addition, this section describes mobile station requirements for use of the optional extended protocol.

5. Requirements for Base Station Analog Options. This section describes the base station requirements for using the 32-digit dialing option on the reverse analog control channel. In addition, this section describes base station requirements for use of the optional extended protocol.

6. Requirements for Mobile Station CDMA Operation. This section describes the requirements for CDMA-analog dual-mode mobile stations operating in the CDMA mode. A mobile station complying with these requirements will be able to operate with CDMA base stations complying with this document.

7. Requirements for Base Station CDMA Operation. This section describes the requirements for CDMA base stations. A base station complying with these requirements will be able to operate in the CDMA mode with mobile stations complying with this document.

Appendix A. Requirements for CDMA Service Options. This appendix describes the requirements for specific CDMA service options. Service Option 1, described herein, supports two-way voice using a variable-rate vocoder.

Appendix B. CDMA Call Flow Examples. This appendix provides examples of simple call flow in the CDMA system.

Appendix C. CDMA System Layering. This appendix describes the layers of the CDMA system: the physical layer (layer 1), the link layer (layer 2), the multiplex sublayer, and the control process layer (layer 3).

Appendix D. CDMA Constants. This appendix contains tables that give specific values for the constant identifiers found in Section 6 and Section 7. These identifiers take the forms T_{20m} and N_{5m}. The subscripted numbers vary to identify the particular constant.

SECTION SUMMARY

Appendix E. CDMA Retrievable and Settable Parameters. This appendix describes the parameters that the base station can set and retrieve in the mobile station.

Appendix F. Mobile Station Database. This appendix describes a database model that can be used for dual-mode mobile stations complying with this document.

NOTES

1. Compatibility, as used in connection with this standard, is understood to mean: Any dual-mode mobile station is able to place and receive calls in any cellular system. Conversely all systems are able to place and receive calls for any mobile station. In a subscriber's home system, all call placement must be automatic. Call placement preferably should be automatic when a mobile station is in roam status.
2. The term "dual-mode mobile station" indicates a mobile station capable of both analog (FM) and wideband spread spectrum (CDMA) operation. The term "wideband spread spectrum dual-mode mobile station" is used when a confusion might arise between a dual-mode mobile station complying with this document and EIA/TIA/IS-54.
3. This compatibility specification is based on the specific United States spectrum allocation for cellular systems.
4. Technical details are included for the operation of two systems in a geographic area, System A and System B, each with a separate set of control channels.
5. "Recommended Minimum Performance Standards for 800 MHz Wideband Spread Spectrum Dual-Mode Mobile Stations" and "Recommended Minimum Performance Standards for 800 MHz Base Stations Supporting Wideband Spread Spectrum Dual-Mode Mobile Stations" provide specifications and measurement methods for cellular equipment.
6. Each cellular system is identified by a unique 15-bit digital code, the SID code (see 2.3.8). The Federal Communications Commission assigns SID codes when cellular system construction permits are issued.
7. Each dual-mode mobile station is assigned a unique 32-bit binary serial number (ESN) which cannot be changed by the subscriber without rendering the mobile station inoperative (see 2.3.2).
8. In the message formats used between the dual-mode mobile stations and base stations, some bits are marked as reserved (RSVD or RESERVED). Some or all of these reserved bits may be used in the future for additional messages. Therefore, all dual-mode mobile stations and base stations must set all bits that they are programmed to treat as reserved bits to '0' (zero) in all messages that they transmit. All mobile stations and base stations must ignore the state of all bits that they are programmed to treat as reserved bits in all messages that they receive.

NOTES

9. Reserved.

10. RF Emissions. Minimum advisory standards of ANSI and the processing guidelines of FCC are contained in ANSI C95.1-1982 Advisory Standards and FCC Rules and Regulations respectively. Members should also take notice of the more stringent exposure criteria for the general public and for radio frequency carriers with low frequency amplitude modulation as given in NCRP Report No.86.

11. For the optional analog extended protocol feature (see 4.2 and 5.2), the assignment of message type codes (MST words) will be made using procedures developed under authority of the Engineering Department of the EIA. This will ensure that the feature will be implemented in an orderly manner.

12. Reserved.

13. The allocation of SID numbers is under review by EIA/TIA TR45 for potential revision to accommodate international requirements. Utilization of SID numbers must be coordinated.

14. Although the analog mode of operation (Sections 2, 3, 4, and 5) draws upon EIA/TIA/IS-54-B, some modifications have been made. These modifications are denoted by a single vertical bar (|) in the left-hand margin.

15. “Base station” refers to the functions performed on the land side, which are typically distributed among a cell, a sector of a cell, and the mobile telephone switching office.

16. Section 6, Section 7, and the appendices use the following verbal forms: “Shall” and “shall not” identify requirements to be followed strictly to conform to the standard and from which no deviation is permitted. “Should” and “should not” indicate that one of several possibilities is recommended as particularly suitable, without mentioning or excluding others; that a certain course of action is preferred but not necessarily required; or that (in the negative form) that a certain possibility or course of action is discouraged but not prohibited. “May” and “need not” indicate a course of action permissible within the limits of the standard. “Can” and “cannot” are used for statements of possibility and capability, whether material, physical, or causal.

17. Footnotes appear at various points in this specification to elaborate and further clarify items discussed in the body of the specification.

18. Unless indicated otherwise, this document presents numbers in decimal form. Binary numbers are distinguished in the text by the use of single quotation marks.

NOTES

19. This document uses the following subscripts to clarify the handling of the numeric information maintained by mobile stations: "r" indicates a value received by a mobile station; "s" indicates a value stored in a mobile station's temporary memory; "sl" indicates stored limits on values that vary; "sv" indicates a stored value that varies as a mobile station processes various tasks; "s-p" indicates a value stored in a mobile station's semi-permanent (non-volatile) security and identification memory; and "p" indicates a value stored in a mobile station's permanent security and identification memory.

20. The term "no requirements" indicates that this section does not impose any requirements. Other sections of this standard or other standards may impose requirements. If neither this nor any other standard or specification imposes requirements, manufacturers are free to design in accordance with good and safe engineering practices.

21. The following operators define mathematical operations:

$\times$ indicates multiplication.

$\lfloor x \rfloor$ indicates the largest integer less than or equal to x: $\lfloor 1.1 \rfloor = 1, \lfloor 1.0 \rfloor = 1$.

$\lceil x \rceil$ indicates the smallest integer greater or equal to x: $\lceil 1.1 \rceil = 2, \lceil 2.0 \rceil = 2$.

$\oplus$ indicates exclusive OR.

| indicates logical OR.

& indicates logical AND.

* indicates convolution.

min (x, y) indicates the minimum of x and y.

max (x, y) indicates the maximum of x and y.

x mod y indicates the remainder when x is divided by y: $x \bmod y = x - y \lfloor x/y \rfloor$.

ε indicates "an element of."

BRIEF CONTENTS

BRIEF CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

FIGURES

FIGURES

FIGURES

FIGURES

FIGURES

TABLES

TABLES

TABLES

TABLES

No text.