TIA STANDARD

Project 25

Phase 2 Two- Slot TDMA Media Access Control Layer Description

TIA-102.BBAC December 2010

TELECOMMUNICATIONS INDUSTRY ASSOCIATION
tiaonline.org

NOTICE

TIA Engineering Standards and Publications are designed to serve the public interest through eliminating misunderstandings between manufacturers and purchasers, facilitating interchangeability and improvement of products, and assisting the purchaser in selecting and obtaining with minimum delay the proper product for their particular need. The existence of such Standards and Publications shall not in any respect preclude any member or non-member of TIA from manufacturing or selling products not conforming to such Standards and Publications. Neither shall the existence of such Standards and Publications preclude their voluntary use by Non-TIA members, either domestically or internationally.

Standards and Publications are adopted by TIA in accordance with the American National Standards Institute (ANSI) patent policy. By such action, TIA does not assume any liability to any patent owner, nor does it assume any obligation whatever to parties adopting the Standard or Publication.

This Standard does not purport to address all safety problems associated with its use or all applicable regulatory requirements. It is the responsibility of the user of this Standard to establish appropriate safety and health practices and to determine the applicability of regulatory limitations before its use.

(From Standards Proposal No. 3-0380, formulated under the cognizance of the TIA, TR-8 Mobile and Personal Private Radio Standards. TR-8.12 Subcommittee on Two-Slot TDMA).

Published by

©TELECOMMUNICATIONS INDUSTRY ASSOCIATION
Standards and Technology Department
2500 Wilson Boulevard
Arlington, VA 22201 U.S.A.

PRICE: Please refer to current Catalog of
TIA TELECOMMUNICATIONS INDUSTRY ASSOCIATION STANDARDS
AND ENGINEERING PUBLICATIONS
or call IHS USA and Canada
(1-800-525-7052) International (303-790-0600)
or search online at http://www.tiaonline.org/standards/catalog/

NOTICE OF DISCLAIMER AND LIMITATION OF LIABILITY

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Foreword

(This foreword is not part of this standard.)

This document has been published by the Telecommunications Industry Association (TIA) in accordance with the terms and conditions provided for in a Memorandum of Understanding (MoU) executed by and between the TIA, the Association of Public-Safety Communications Officials (APCO), the National Association of State Telecommunications Directors (NASTD), and various agencies of the Federal government (FED).

This TIA Standard is being promulgated and will be maintained by the TR-8.12 (Two-Slot TDMA) subcommittee and its working groups under the sponsorship of the Telecommunications Industry Association. This document has been published as a *TIA Standard* because it contains useful technical information on emerging digital techniques for Land Mobile Radio Service.

The Project 25 (P25) Phase 2 Trunked Two-Slot Time Division Multiple Access (TDMA) Voice Services Standard, which includes definition of the new P25 two-slot TDMA common air interface, is being developed by the APIC TDMA Task Group and TIA TR-8.12 to be consistent with the APCO Project 25 Statement of Requirements adopted by the Project 25 Steering Committee. This Standard uses the APCO Project 25 Statement of Requirements dated October 17, 2008 as input guidance to capture the relevant user needs requirements.

This P25 two-slot TDMA Media Access Control (MAC) layer protocol specification, which is a component of the P25 TDMA two-slot common air interface definition, establishes a TIA standard supporting the provision of P25 trunked voice services using a two-slot TDMA modulation format within a 12.5 kHz bandwidth physical radio channel.

The TIA makes no claims as to the applicability of the information contained in this document for any purpose although it is believed that the information will prove to be invaluable to implementers and operators of P25 two-slot TDMA equipment. Some aspects of the specifications contained in this document may not have been fully operationally tested; however, a great deal of time and good faith effort has been invested in the preparation of this document to ensure the accuracy of the information it contains. While all reasonable efforts have been made to ensure the accuracy of this document, it should be understood that significant work remains to fully develop the standard series and this document will be updated as necessary.

DOCUMENT REVISION HISTORY

Version	Date	Description
0.60	6/14/2010	Comment Resolution
0.61	7/2/2010	Comment Resolution
0.70	9/16/2010	Comment Resolution on letter ballot
0.71	10/5/2010	Fixes of DUID values in subclause 6.2 and typos

1 Introduction

This standard specifies the Media Access Control (MAC) layer protocol for the transmission of digital information for the trunked two-slot Time Division Multiple Access (two-slot TDMA) Voice Services air interface within a physical radio channel with a bandwidth of 12.5 kHz. This standard is included in the suite of Project 25 (P25) standards that defines the P25 Phase 2 Two-Slot Trunked TDMA Voice Services Standard (see [R6]) based on the P25 requirements specified in [R7].

1.1 Overview of the Standard

This standard defines the MAC layer protocol, including messages and procedures for voice and control functions supported by the P25 trunked two-slot TDMA common air interface (CAI). The P25 two-slot TDMA CAI MAC layer protocol provides the following main services using the P25 two-slot TDMA CAI physical layer protocol:

- Synchronization and timing;
- Management of time slots and logical channel sequencing;
- Encryption support;
- Trunking control on control channels associated with voice traffic;
- Access procedures.

1.2 Document Organization

This document is organized as follows. Clause 1 introduces the standard and includes an overview of the clauses in the standard. Clause 2 describes the scope of the standard and includes references and a glossary of terminology. Clauses 3, 4, 5, 6, 7, and 8 specify, respectively, the logical channel structure, burst description, burst field definitions, bearer service description, MAC protocol description, and the MAC Protocol Data Unit (PDU) definitions. Five informative annexes provide, respectively, information on the Galois Field for the Reed Solomon codes used in this standard, a MAC PDU opcode list, examples of Push-To-Talk (PTT) and call drop scenarios, examples of call setup scenarios, and details of the burst bit allocations.

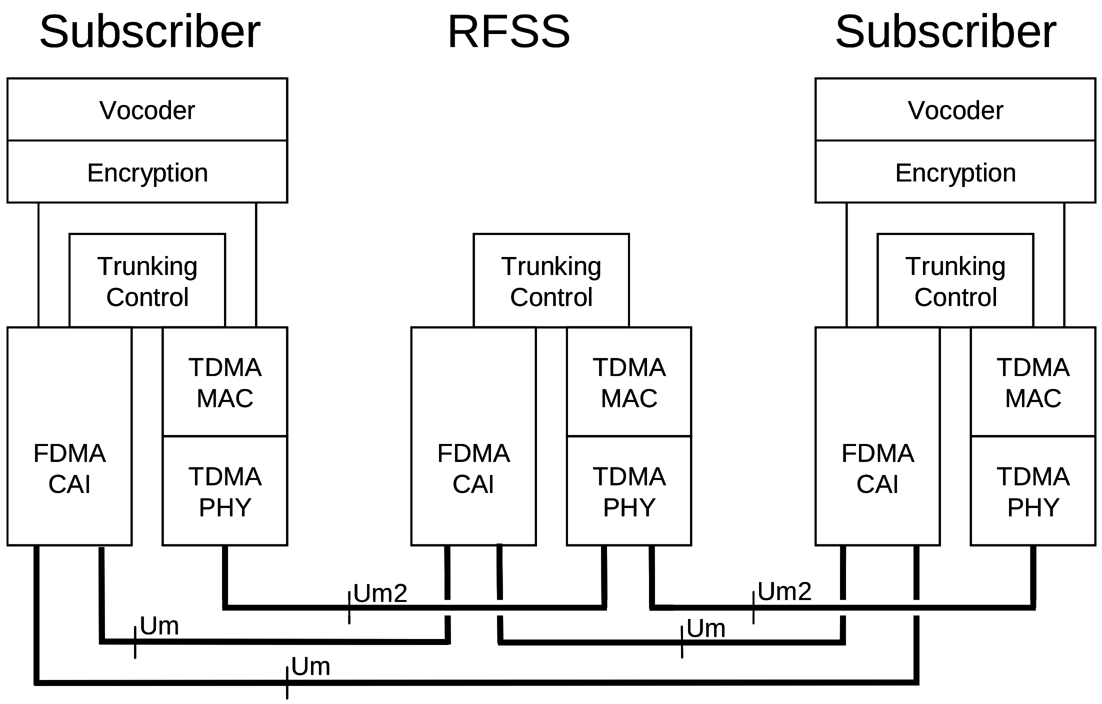


Figure 1-1 Representative Protocol Model for P25 Two-Slot TDMA Trunked Voice Service

2 Scope

This clause defines the scope of this standard and provides related information including normative and informative references and a glossary of terms.

2.1 Scope of the Standard

The reference point for the P25 two-slot TDMA CAI is U_{m2}, and this is shown in Figure 1-1 for orientation to the other parts of the air interface protocols. Document [R6] explains that the U_{m2} interface supports trunked voice and control services between the Radio Frequency Sub-System (RFSS) and the subscribers in the system.[1] In addition to the U_{m2} interface for the P25 Phase 2 two-slot TDMA CAI, a P25 Phase 2 system also supports a U_m interface for the P25 Phase 1 FDMA CAI, and this is also shown in Figure 1-1. While U_m and U_{m2} both support trunked voice and control, the U_{m2} interface has twice the spectrum efficiency of the U_m interface when used as a VCH.

The two-slot TDMA CAI is divided into a physical layer and a media access control layer, and these are abbreviated as the PHY and the MAC respectively. The PHY defines the modulation and other functions (see [R3]) used to transport information through the U_{m2} interface. The MAC has functions defined in this standard to convey trunked voice and associated control information through the PHY, and subsequently through the U_{m2} interface. The PHY and MAC are shown in the diagram in Figure 1-1. The TDMA PHY and MAC protocols are complemented by their FDMA Phase 1 equivalent protocol that is indicated in Figure 1-1 as the FDMA CAI.

Above the FDMA CAI and two-slot TDMA CAI are common functions that can operate using either air interface. The common functions shown in Figure 1-1 include P25 digital voice, encryption, and trunking control. The P25 half-rate vocoder used in TDMA is defined in [R4] and the full rate vocoder used in FDMA is defined in [R4]. The full-rate vocoder operates on the FDMA CAI through the U_m reference point. The half-rate vocoder operates on the two-slot TDMA CAI via the MAC and PHY. If the voice is encrypted, then the P25 block encryption protocol (see [R5]) is applied to the relevant voice mode to provide encrypted voice service through either the FDMA CAI or the two-slot TDMA CAI. The interconnection of the vocoder and encryption functions to both FDMA CAI and two-slot TDMA CAI indicates the interoperability of those functions with both channels. The voice information, either encrypted or unencrypted, is conveyed through the TDMA CAI on a logical channel known as the two-slot TDMA Traffic Channel (TCH). The remainder of this standard abbreviates this term to TDMA TCH. The voice and encryption functions for the TCH are typically present at the

[1] Future support by the P25 Phase 2 Two-Slot TDMA CAI for P25 packet data service is expected to involve extensions to this standard.

end points of a call, as represented by the protocol stacks in Figure 1-1 with Subscriber labels.

Another common function shown in Figure 1-1 is the trunking control. Trunking control functions in the FDMA CAI are conveyed through a Phase 1 FDMA control channel or through link control words embedded in voice messages. The FDMA control channel messages are defined in [R2] and the procedural protocol is defined in [R1]. The Phase 1 FDMA control channel is abbreviated in many instances in this standard to FDMA CCH. All of the messages in [R2] that pertain to two-slot TDMA voice services in the MAC are functionally defined in this standard as MAC Protocol Data Units (PDUs) in Clause 8. The procedural protocol for voice messages is defined in Clause 7 with supporting examples provided in Annex C and Annex D. The trunking control MAC PDUs are conveyed through the two-slot TDMA CAI in a logical channel associated with voice that is either a Slow Associated Control Channel (SACCH) or a Fast Associated Control Channel (FACCH) defined in this standard. The interconnection of the trunking control function to both the FDMA CAI and two-slot TDMA CAI indicates the interoperability of trunking control with both channels. The SACCH and FACCH permit the subscribers on a call to operate a trunking control protocol with the RFSS. This is why the subscriber stacks and the RFSS stack in Figure 1-1 contain a trunking control function block.

2.2 References

2.2.1 Normative References

The following documents contain provisions that, through reference in this text, constitute provisions of this document. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this document are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. The American National Standards Institute (ANSI), TIA, and other organizations maintain registers of currently valid standards published by them.

[R1] TIA-102.AABD (Project 25 - Trunking Procedures)

[R2] TIA-102.AABC (Project 25 - Trunking Control Channel Messages)

[R3] TIA-102.BBAB (Project 25 - Two-Slot Time Division Multiple Access Physical Layer Protocol Specification)

[R4] TIA-102.BABA (Project 25 - Vocoder Description) and TIA-102.BABA-1 (Project 25 - Half Rate Vocoder Addendum)

[R5] TIA-102.AAAD (Project 25 - Block Encryption Protocol)

2.2.2 Informative References

[R6] TSB-102.BBAA (Project 25 - Two-Slot TDMA Overview)

[R7] APCO Project 25 Statement of Requirements, October 17, 2008

2.3 Glossary

2.3.1 Acronyms

ALGID	ALGorithm IDentifier
BER	Bit Error Rate
BR	Base Radio, a reference designating a base station
CAI	Common Air Interface
CCH	Control CHannel
CQPSK	Compatible Quadrature Phase Shift Keying
CRC	Cyclic Redundancy Checksum for data error detection
C4FM	Compatible 4 level Frequency Modulation
DCH	Data CHannel
DUID	Data Unit ID
ESS	Encryption Synchronization Signaling
ETDU	Expanded Terminator Data Unit
FACCH	Fast Associated Control CHannel
FDMA	Frequency Division Multiple Access
FEC	Forward Error correcting Code
FNE	Fixed Network Equipment
GF	Galois Field to calculate parity checks for an RS code
GID	Group ID
HDU	Header Data Unit
ID	IDentifier
I-ISCH	Information ISCH
IEMI	Inbound Encoded MAC Information field
ISCH	Inter-slot Signaling CHannel
ISP	Inbound Signaling Packet, control channel message sent by SU
KID	Key IDentifier
LCH	Logical CHannel
LFSR	Linear Feedback Shift Register
LSB	Least Significant Bit
MAC	Media Access Control layer
MCO	Media access Control protocol data unit Opcode
MFID	Manufacturers ID
MI	Message Indicator
MSB	Most Significant Bit
NAC	Network Access Code
S-OEMI	Outbound Encoded MAC Information field with Sync
I-OEMI	Outbound Encoded MAC Information field with Information
OPCODE	OPerating CODE

OSP	Outbound Signaling Packet, control channel message sent to SU
P25	Project 25
PDU	Protocol Data Unit
PSTN	Public Switched Telephone Network
PTT	Push-To-Talk
RFSS	Radio Frequency Sub-System
RS	Reed Solomon
S-ISCH	Synchronization ISCH
SACCH	Slow Associated Control CHannel
SNDCP	Sub-Network Dependent Convergence Protocol
SU	Subscriber Unit
SUID	Subscriber Unit IDentifier
TCH	Traffic CHannel
TDD	Time Division Duplex
TDMA	Time Division Multiple Access
TSBK	Trunking Signaling BlocK
UID	Unit IDentity
VCH	Voice Channel
VCU	Voice Channel User
VTCH	Voice Transport CHannel
WACN	Wide Area Communications Network
WUID	Working Unit IDentifier

2.3.2 Definitions

Burst

Unit of transmission of a continuous succession of modulated bits that lasts for a timeslot. A burst corresponds to the physical contents of a timeslot.

Cell

Geographical area corresponding to the radio coverage of a site.

FACCH

Signaling channel using slots normally assigned to voice on the VCH, i.e., slots which occur outside of the two inverted slot positions in both inbound and outbound directions. The FACCH is normally used for call establishment, hang-time, and teardown signaling.

Improper PDU

A MAC PDU having been detected as erroneous by the channel decoding or having a header with contents that are inconsistent with this specification.

Inbound

Direction of the radio path, from the SU(s) to the FNE.

Inverted Signaling Slot

The two-slot TDMA implementation requires the use of two inverted signaling slots i.e., the signaling slot occurs in the opposite channel to allow an SU to switch from transmit to receive and avoid stringent switching constraints that would be required for an SU to quickly switch to an adjacent slot for outbound signaling while in transmission. The SACCH is the logical channel defined for this signaling.

Logical Channel

Predefined portions of a TDMA radio channel structure used by both FNE and SU applications to exchange digital voice and PDUs.

MAC Header

That part of a MAC PDU that encodes either a command or a response, located at the beginning of the MAC PDU. It is the first octet of every PDU.

MAC PDU

Sequence of contiguous bits, representing a MAC procedural element (signaling).

Outbound

Direction of the radio path, from the FNE to the SU(s).

PDU

Short form of MAC PDU when used in the context of this MAC document.

SACCH

Periodic signaling slot occurring once per superframe for each channel (using inverted signaling for two-slot), i.e., slots not normally assigned to voice in the VCH.

Superframe

Set of 2*6 timeslots of 30 msec each for two-slot TDMA, i.e., 360 msec. The last two timeslots are inverted signaling slots.

Talk Spurt

Interval in a two-slot TDMA voice transmission corresponding to the time between the beginning of the first MAC_PTT PDU from the transmitting SU on the VCH and the end of the last MAC_END_PTT PDU from the transmitting SU at the release of PTT.

Timeslot

Time interval of a two-slot TDMA burst corresponding to 30 msec.

Time Division Duplex

This is a method by which communication between the FNE and SU can be performed in the inbound and outbound direction simultaneously due to the fact that the outbound and inbound slots are interlaced. While similar to full duplex operation, TDD differs from full duplex in that for full duplex the SU receives and transmits RF simultaneously and in TDD it need not. For TDD the SU need only be able to switch quickly enough between transmit and receive so as to not miss data in the VCH.

Traffic Channel

A Bi-directional channel carrying information associated with a voice (VCH) or data (DCH) channel.

Ultraframe

Set of four consecutive 360 msec superframes comprising a 1.44 second time interval. Transmitting subscribers use the SACCH of the first three superframes in the ultraframe to send signaling information to the FNE and listen to information from the FNE in the outbound SACCH of the fourth superframe. The ultraframe structure is signaled in the I-ISCH field and it may optionally be determined by processing information within the SYNC_BCST message on the control channel.

Voice Channel

A set of six inbound and outbound time slots on a traffic channel that typically carries voice bursts. There are two voice channels (VCH's) on each TCH (Traffic Channel).

Voice Frame

Set of bits corresponding to 20 msec of user speech.

2.3.3 Conventions

If a number is preceded by a %, the number is to be interpreted as a binary number.

If the number is preceded by a 0x, the number is to be interpreted as a hexadecimal number.

If the number is preceded with neither a % nor a 0x, the number is to be interpreted as a decimal number, unless depicted otherwise in the text description.

In the description of the formats of the PDUs, the MSB is located on the left-hand side of the field and the LSB is located on the right-hand side of the field.

3 TDMA Trunked Voice Channel Description and Structure

3.1 Introduction

Each radio site consists of one control channel (CCH) and one or more traffic channels (TCH). The main control channel is an FDMA CCH. The configuration of the site and frequency used for control and traffic channels depends on traffic requirements, in particular the SU density under the coverage of the site and traffic patterns.

The radio physical channel for P25 two-slot TDMA consists of a 12.5 kHz frequency pair divided into 30 msec time slots (see [R3]). The physical TCH supports two logical VCHs. A P25 two-slot TDMA MAC layer ultraframe consists of 4 consecutive superframes. A P25 two-slot TDMA MAC layer superframe consists of twelve sequential 30 msec time slots on the frequency pair for the P25 two-slot TDMA CAI. The logical channel consists of one or more groups of time slots with the logical function of control or voice embedded in the physical channel structure.

3.2 MAC Layer Channel Structure

In reference to Figure 3-1, the first 10 slots in a superframe, numbered 0 to 9, can be used for voice or signaling information. If they are used for signaling they are called the Fast Associated Control Channel (FACCH). If they are used to transport voice frames, they are called the Voice Transport Channels, or VTCHs. The last 2 slots in a superframe, numbered 10 and 11, can only be used for signaling information, and they are called the Slow Associated Control Channel, or SACCH.

3.2.1 Generic Two-Slot Superframe Structure - Time Slot Numbering and TDMA Channel Numbering

A superframe contains 12 consecutive 30 msec timeslots for a total duration of 360 msec. This is the same time interval for 48 Phase 1 micro-slots. The position of a timeslot within a superframe is a number from 0 to 11. See Figure 3-1 below. Slots 10 and 11 are inverted slots for SACCH signaling.

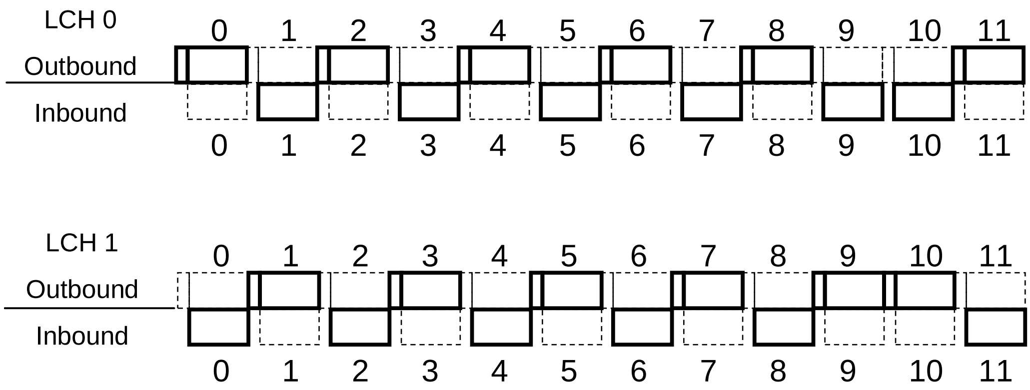


Figure 3-1 Superframe Structure for Two-Slot TDMA

Logical channel 0 (LCH 0) is a channel that consists of outbound timeslots 0, 2, 4, 6, 8, and 11 and inbound timeslots 1, 3, 5, 7, 9, and 10.

Logical channel 1 (LCH 1) is a channel that consists of outbound timeslots 1, 3, 5, 7, 9, and 10 and inbound timeslots 0, 2, 4, 6, 8, and 11.

The inverted signaling slots are slots 10 and 11. These slots are used for bidirectional signaling and are inverted (not the normal alternating slot pattern) to allow an SU to switch from transmit to receive. This avoids stringent switching constraints that would be required for an SU to quickly switch to an adjacent slot for outbound signaling while transmitting. These inverted slots are the SACCH slots.

Descriptions of the logical channels used on LCH0 and LCH1 for the TDMA voice channel are given in 3.3.

3.2.2 Ultraframe

An ultraframe is comprised of four consecutive superframes as is shown in Figure 3-2 below. The ultraframe count field is further defined in subclause 5.5.

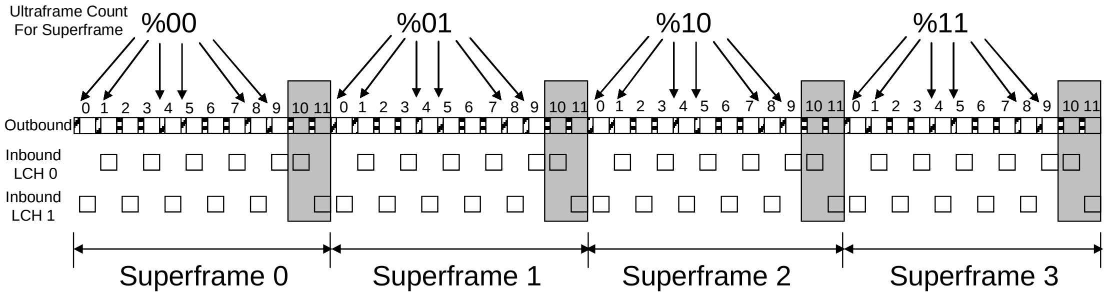


Figure 3-2 Ultraframe Structure

If an SU is transmitting inbound, the transmitting unit shall transmit in the SACCH of the first three superframes of the ultraframe, typically sending a Voice Channel User (VCU) message. A Voice Channel User message as defined in 8.3.1.2 indicates a talker and a talk group for group calls. The transmitting SU shall not transmit in the SACCH position of the fourth superframe of the ultraframe, instead, the transmitting SU shall decode the outbound SACCH during that superframe.

If a VCU message is included in the outbound SACCH of the first three superframes of the ultraframe, it shall contain the individual ID corresponding to the unit whose audio is being sent on the outbound link, which may be different than the individual ID of the talker on the inbound link. Listening SUs only display the caller ID from a VCU from one of the first three SACCHs in the ultraframe.

When an SU is transmitting on the inbound link, the VCU included in the outbound SACCH of the last superframe of the ultraframe shall contain the individual ID of the inbound talker. This individual ID may be different than the source of the outbound audio. A talker SU uses the VCU ID in the fourth SACCH as validation that it is the correct talker.

3.3 Logical Channel Descriptions on a Voice Channel

When an LCH logical channel is used to transport voice, it is known as a Voice Channel, or VCH. The VCH is a bi-directional channel used to exchange voice and signaling blocks between the FNE and one or several SUs. A VCH may be associated with a group communication, a half duplex individual call, a half duplex telephone interconnect call, or a time division duplex[2] individual call, including a telephone interconnect call. A VCH is composed of an ISCH Channel, a SACCH signaling timeslot and either Voice Transport Channel (VTCH) slots (that contain voice + encryption signaling) or FACCH timeslots, depending upon whether voice is currently present or not.

Figure 3-3 and Figure 3-4 describe the VCH 0 and VCH 1 structures for communication in VCH traffic mode (after call establishment).

---

[2] Time division duplex mode is not defined as yet and is reserved for future work

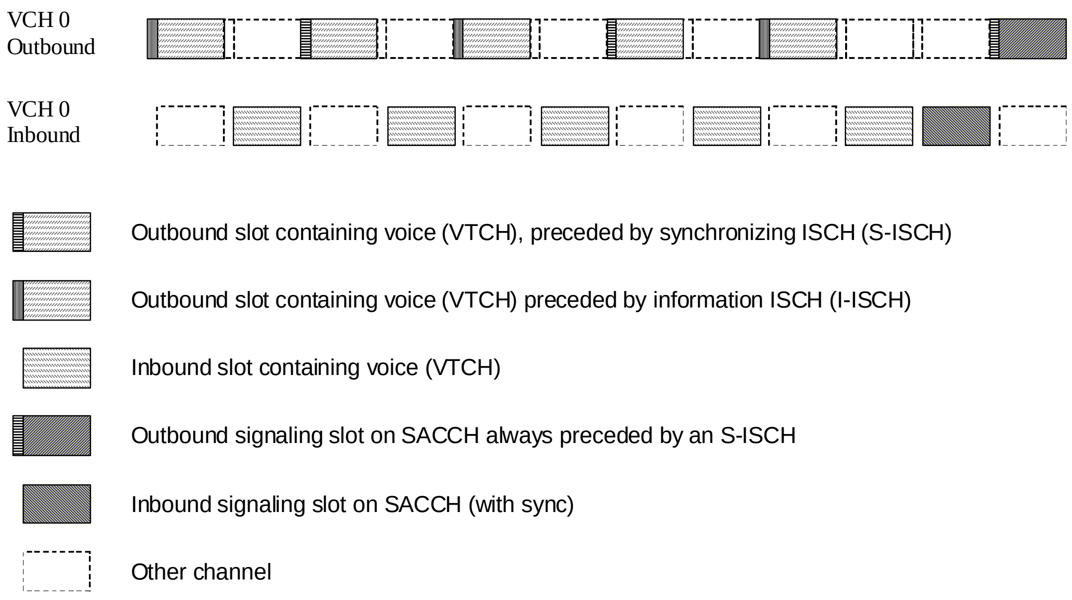


Figure 3-3 VCH 0 Structure

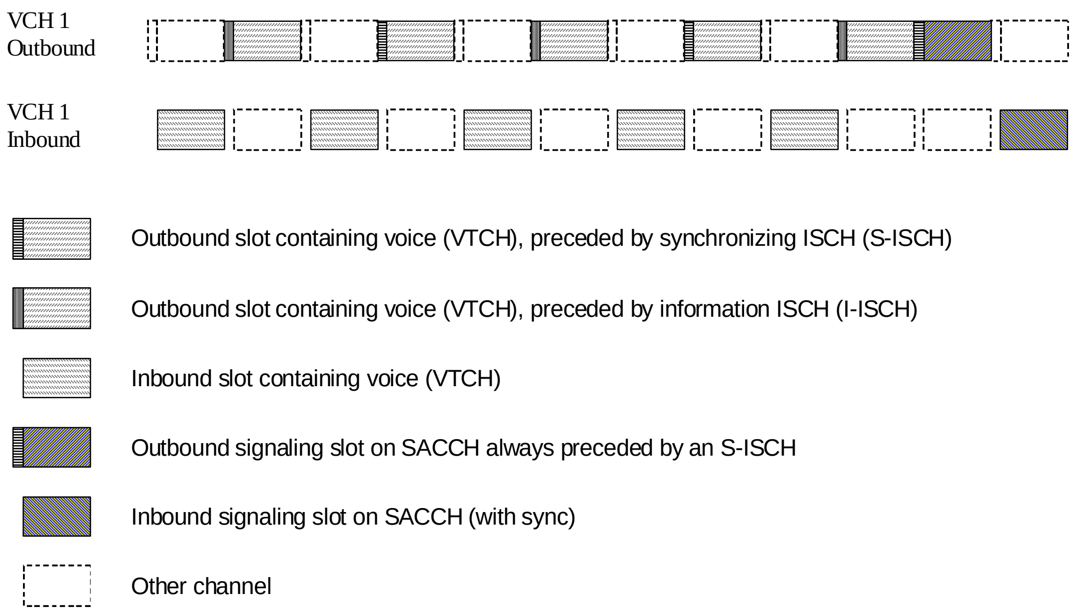


Figure 3-4 VCH 1 Structure

The remainder of this subclause describes the following logical channels that are sub-elements of the VCH:

- VTCH (Voice Transport Control CHannel)
- SACCH (Slow Associated Control CHannel)
- FACCH (Fast Associated Control CHannel)
- ISCH (Inter-slot Signaling CHannel)

3.3.1 VTCH (Voice Transport CHannel)

The VTCH is a bi-directional channel that is used to exchange voice and encryption synchronization signaling (ESS) between the FNE and one or more SUs. This logical channel takes the place of the FACCH slots when voice transport begins.

3.3.2 SACCH (Slow Associated Control CHannel)

The SACCH is a periodic bi-directional logical channel on the VCH, which is used to exchange signaling or data information between the FNE and one or several SUs assigned to the corresponding voice logical channel.

The outbound SACCH is used to convey:

- General broadcast information signaling to receiving radios such as:
    - Call specific signaling, including call grants, and information regarding current channel users and current call type
    - Information about other active calls enabling radio scanning operation
    - Paging signaling for moving individual users out of a call
- Signaling to transmitting radios such as:
    - Power control signaling
    - Transmitter shutdown signaling
    - Confirmation of right to transmit

The Inbound SACCH is used to convey:

- Call specific signaling, including information regarding current channel users and current call type
- Call interrupt requests from listening radios

One SACCH per logical voice channel occurs every superframe on the inverted timeslot.

The location of the SACCH slots is determined as follows:

- For systems that synchronize the FDMA control channel and TDMA traffic channels, the location of the SACCH shall be determined by the control channel Sync Broadcast message, and by the I-ISCH.
- For systems that do not synchronize the FDMA control channel and TDMA traffic channels, the location of the SACCH shall be determined in the I-ISCH.

The MAC layer shall manage the mechanisms of SACCH access priority for the signaling messages (see 7.2.1 and 7.2.2).

The outbound signaling burst of the SACCH shall not contain any synchronization sequence.

The inbound signaling burst of the SACCH shall always contain a synchronization sequence to facilitate late entry and synchronization of the FNE receivers.

3.3.3 FACCH (Fast Associated Control CHannel)

The FACCH is a logical channel on the VCH that occurs when voice signaling is not present.

On an unassigned VCH:
- The inbound FACCH shall not be used
- The outbound FACCH shall only contain MAC_IDLE PDUs containing the NULL information message

On an assigned VCH the FACCH is used to convey the following per the detailed Voice Channel Procedures in 7.3:
- Call setup signaling
- Call teardown signaling
- Hangtime signaling

FACCH can occur in any timeslot except where SACCH occurs.

The inbound and outbound FACCH bursts shall always contain a synchronization sequence.

3.3.4 ISCH (Inter-slot Signaling CHannel)

The ISCH is the logical channel that is located between 2 consecutive outbound slots of a physical channel [R3]. It is sized to occupy the space reserved in the inbound path for ramping up and down, pilot sequences (at the beginning and at the end of the burst) and guard time. This logical ISCH is composed of 40 consecutive bits (comprised of the 20 bits at the end of an outbound slot and the 20 bits at the beginning of the next outbound slot).

The ISCH is used to:
- Provide a symbol/timeslot synchronization mechanism for receiving SU’s
- Provide a means of identifying channel numbering
- Provide the current position within the superframe
- Provide the current position within the ultraframe
- Provide access control for usage of the inbound SACCH

Two types of ISCH are utilized on a VCH to achieve this functionality, the S-ISCH and the I-ISCH. S-ISCH and I-ISCH alternate within each VCH in a superframe as illustrated in Figure 5-3. This alternating pattern allows a reasonable balance between transmitting synchronization for late entry and the signaling information.

The first ISCH type, the S-ISCH contains a synchronization sequence that can be used to provide symbol and frame synchronization for the SU receivers. The sync pattern for the S-ISCH consists of 40 bits, or 20 dibit symbols. The specific sync pattern differs between the VCH and the TDMA CCH. The sequence is given in Table 5-1 along with the other synchronization sequences.

The second ISCH type, the I-ISCH, contains a 40 bit information sequence that provides nine information bits after decoding of the 40 bits at the MAC layer as specified in 5.5. These nine information bits contain fields that define slot and channel numbering, the current position within the superframe relative to the SACCH burst, the position of the current superframe with the ultraframe and access control information for the inbound SACCH.

The ISCH associated with inverted timeslots shall always be the S-ISCH containing a synchronization sequence.

3.4 Timing Alignment Between CCH and VCH

3.4.1 TDMA Channel Alignment

Timing synchronization between TDMA channels means that all outbound TDMA channels are aligned in time. It is mandatory to time align all outbound TDMA channels at a single site. This means that all of the superframes on all the outbound paths of TDMA channels are time aligned. In addition, there is symbol and burst alignment on all of the outbound paths of TDMA channels so that symbol sync, burst sync, ultraframe, and superframe sync on one channel gives symbol sync, burst sync, ultraframe, and superframe sync on the other TDMA channels of that RF site.

3.4.2 Synchronization Method When the CCH is a FDMA CCH

To ease migration from Phase 1 FDMA, where no synchronization is required between FDMA channels, and Phase 2 TDMA, it is not mandatory to synchronize TDMA channels with any FDMA channels.

There is, however, a benefit to synchronizing TDMA channels to an FDMA control channel. This benefit allows a SU to transmit/receive sooner upon arriving on a TDMA TCH due to prior knowledge of synchronization. Knowing where the start of the superframe and ultraframe is upon arrival on the assigned VCH allows the SU to skip the process of having to acquire this knowledge after moving to the assigned VCH thereby saving time. Without this knowledge the SU has to first receive and decode an S-ISCH and an I-ISCH so that it can determine where the start of the superframe and ultraframe is. See 3.3.4 for further information about the function of the ISCH.

The synchronization of a TDMA TCH with an FDMA CCH is ensured by the regular transmission of the SYNC_BCST message [R2]. The SYNC_BCST message, transmitted by the FNE to the SUs, gives the date (year, month, day), time (hour, minute) and the number of the micro-slot within a minute on which the SYNC_BCST outbound signaling packet begins. The micro-slot has a length of 7.5 msec, so the micro-slots are numbered from 0 to 7999 in ascending consecutive order in a minute. Superframes occur every 360 ms, or every 48 microslots on the FDMA CCH while ultraframes occur every four superframes, which corresponds to 1.44 seconds or every 192 microslots. However, the microslot count rolls over at each minute boundary, every 8000 microslots. Since a minute does not include a whole number of superframe or ultraframe intervals, but every 3 minutes does have a whole number of each type of interval, the time mark for a superframe boundary and ultraframe boundary can be computed by including the minute count and the microslot count, as follows:

Superframe_mark = (minute_count * 8000 + uslot_count) MOD 48 (1)

Ultraframe_mark = (minute_count * 8000 + uslot_count) MOD 192 (2)

Note that the beginning of every 3rd minute is coincident with the start of both a superframe and ultraframe.

Figure 3-5 shows how the SYNC_BCST message on the FDMA control channel references the micro-slot number which in turn is used to synchronize the SU to the VCH.

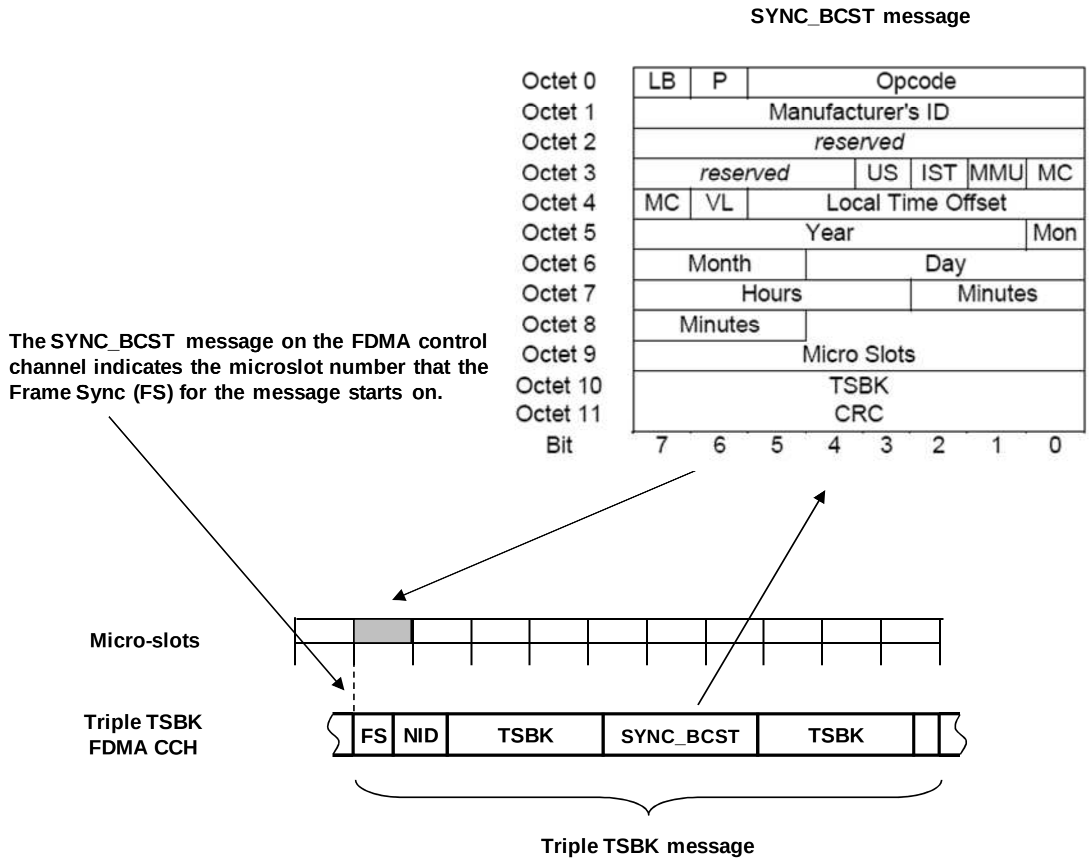


Figure 3-5 SYNC_BCST Message relationship to FDMA CCH

Once the SU knows the micro-slot number it is able to synchronize to the TDMA VCH since all of the TDMA VCH's are synchronized to each other and the FDMA control channel. Figure 3-6 illustrates this relationship by showing that at the sync'd minute boundary the micro-slot number transitions from 7999 to 0 and that that is precisely where the TDMA superframe starts.

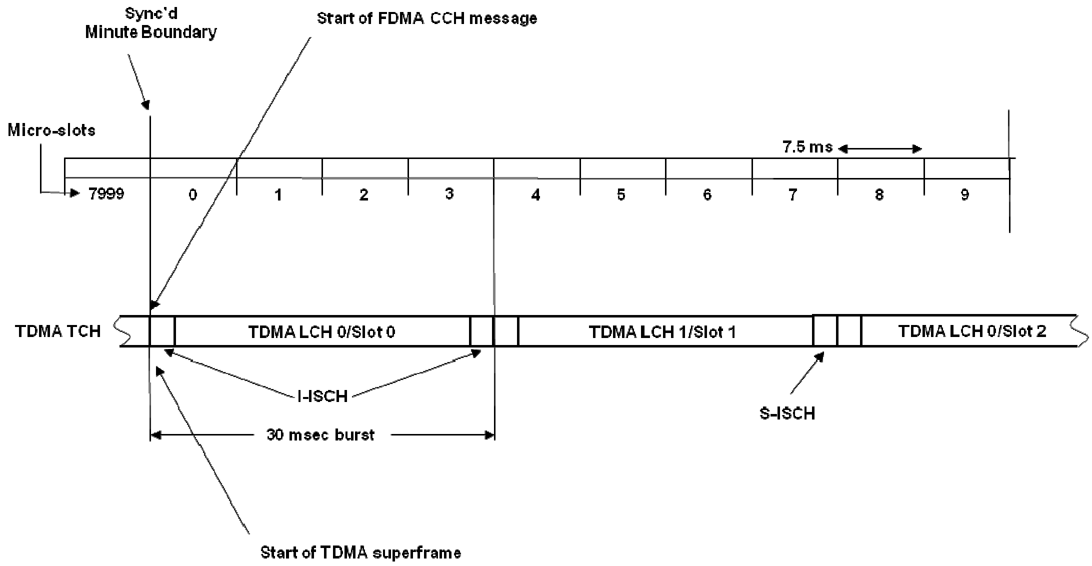


Figure 3-6 TDMA Superframe relationship to FDMA CCH Micro-slot

Figure 3-6 shows the precise location of the start of a TDMA superframe and the point of synchronization on the FDMA control channel. Referring to Figure 3-6, the start of the TDMA superframe is the center of the first I-ISCH symbol of the outbound burst. Note that this first symbol corresponds to the 11th symbol of that particular ISCH sequence as illustrated in Figure 4-1 since any particular ISCH is split between the end of one burst and the beginning of the next burst.

The precise reference point of the sync'd minute boundary with respect to the symbols are diagrammed in Figure 3-7.

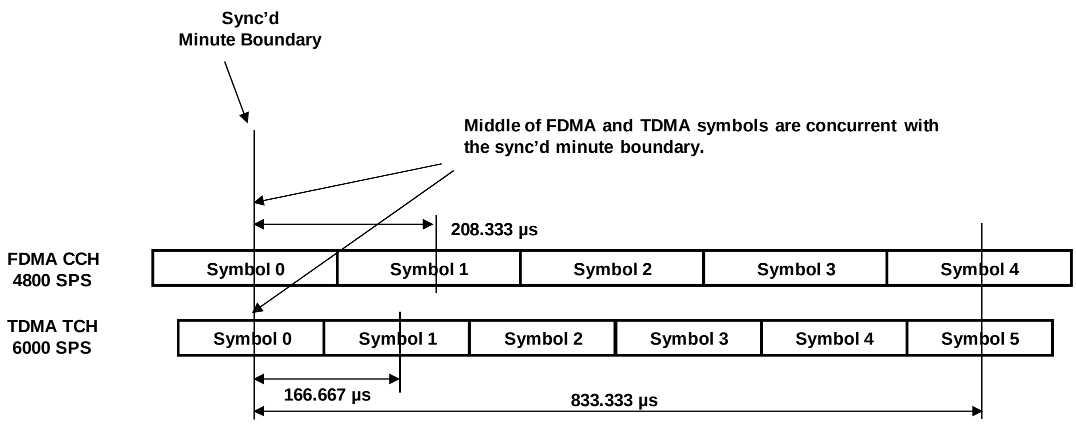


Figure 3-7 Alignment of FDMA and TDMA symbols at Sync'd Minute boundary

4 Burst Description

4.1 General Description

There are two types of inbound bursts, one with synchronization and one without. An inbound burst with synchronization is composed of a ramp up sequence, a synchronization sequence, a sequence of modulated information bits, a pilot sequence and a ramp down. An inbound burst without synchronization has a ramping up sequence, a pilot sequence, a sequence of modulated information bits, a pilot sequence, and a ramping down sequence as illustrated in Figure 4-1.

An outbound burst is only composed of modulated information bits (with or without synchronization).

A summary of burst type and synchronization is shown below

Table 4-1 Burst Type summary

Burst Type	Burst Description	Synchronization	Signaling Channel	Figure Reference
Inbound 4V	Inbound 4 Voice with ESS	None	VCH	Figure 4-2
Inbound 2V	Inbound 2 Voice with ESS	None	VCH	Figure 4-3
Outbound 4V	Outbound 4 Voice with ESS	None	VCH	Figure 4-4
Outbound 2V	Outbound 2 Voice with ESS	None	VCH	Figure 4-5
IEMI	Inbound Signaling with sync	Yes – 44 bits	FACCH and SACCH	Figure 4-6
S-OEMI	Outbound Signaling with sync	Yes – 42 bits	FACCH	Figure 4-7
I-OEMI	Outbound Signaling w/o sync	None	SACCH	Figure 4-8

All the bursts contain a Data Unit ID (DUID) as part of the modulated information bits.

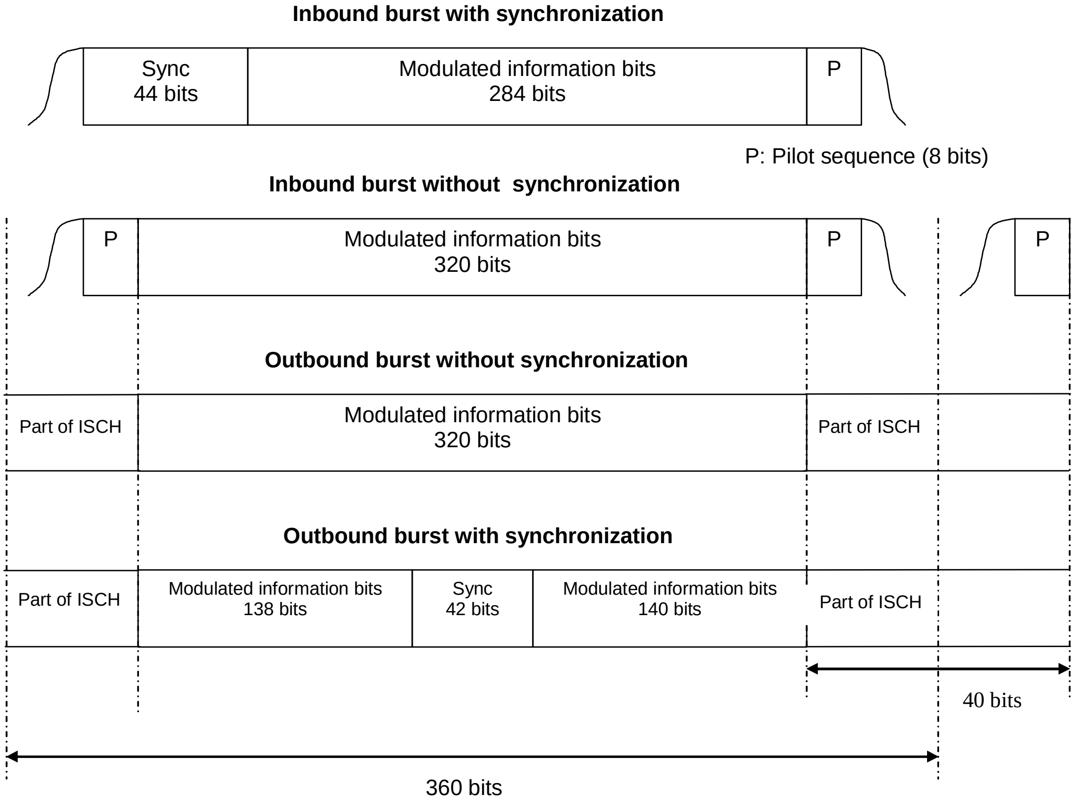


Figure 4-1 Inbound and Outbound Burst Structure

4.2 Bursts Containing Voice Frames

Bursts on the VCH are defined for inbound and outbound bursts, with 4 voice frames and with 2 voice frames. The Encryption Synchronization Signaling (ESS) is distributed through the voice bursts.

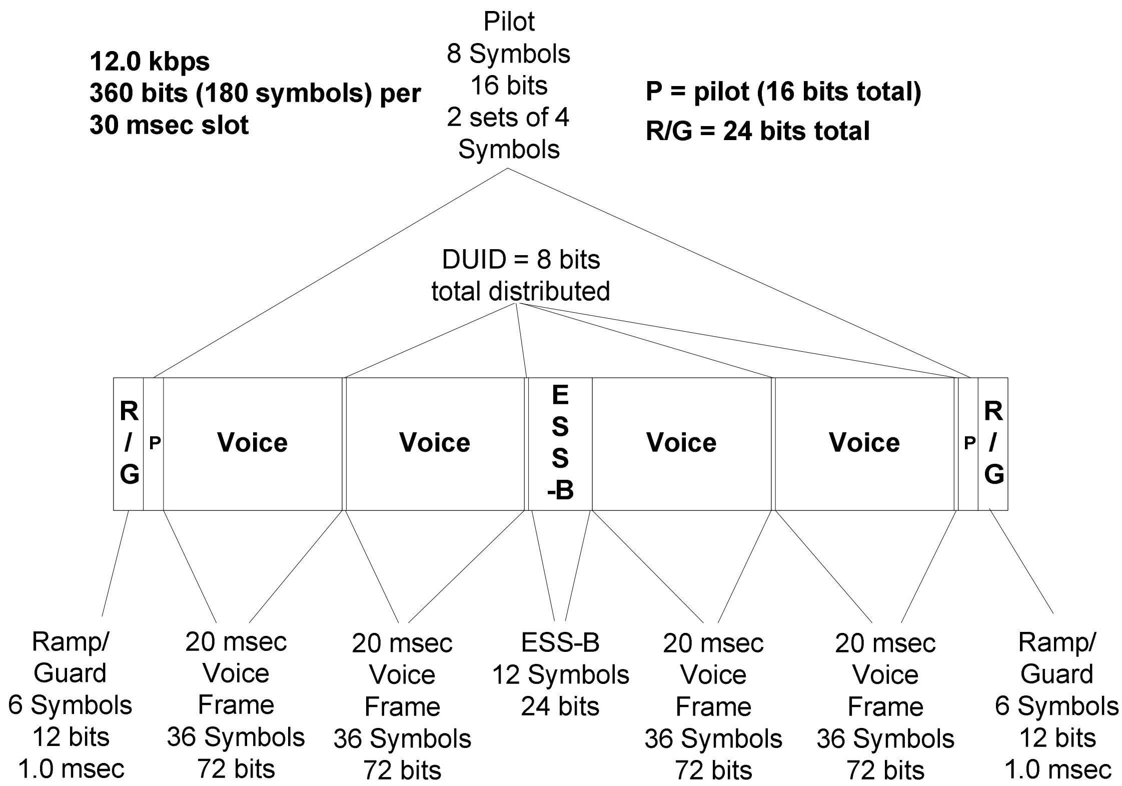


Figure 4-2 Inbound 4 Voice Burst Structure with ESS

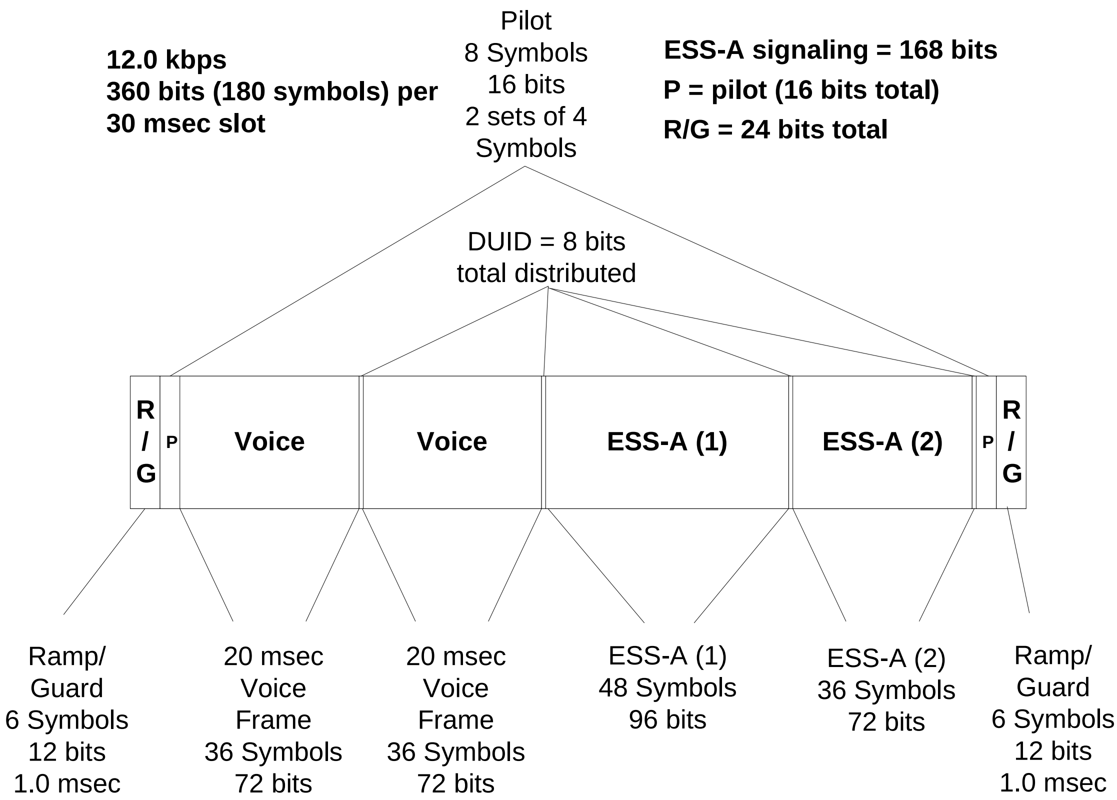


Figure 4-3 Inbound 2 Voice/Short Signaling Burst Structure with ESS

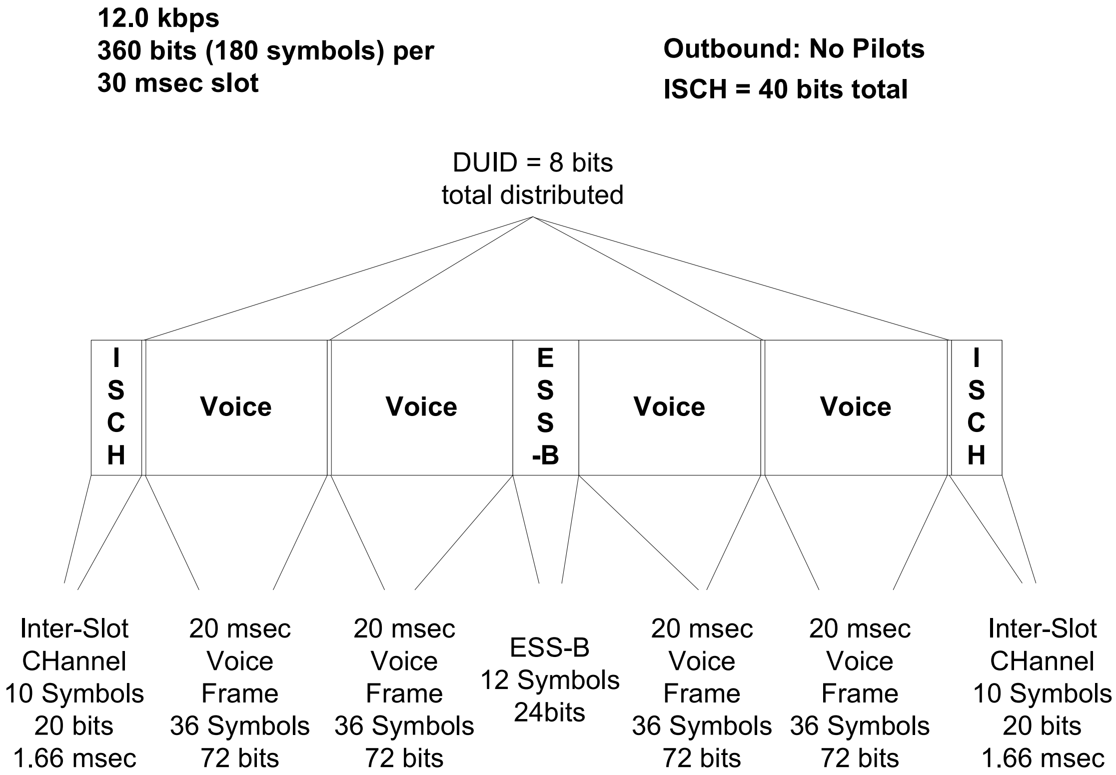


Figure 4-4 Outbound 4 Voice Burst Structure with ESS

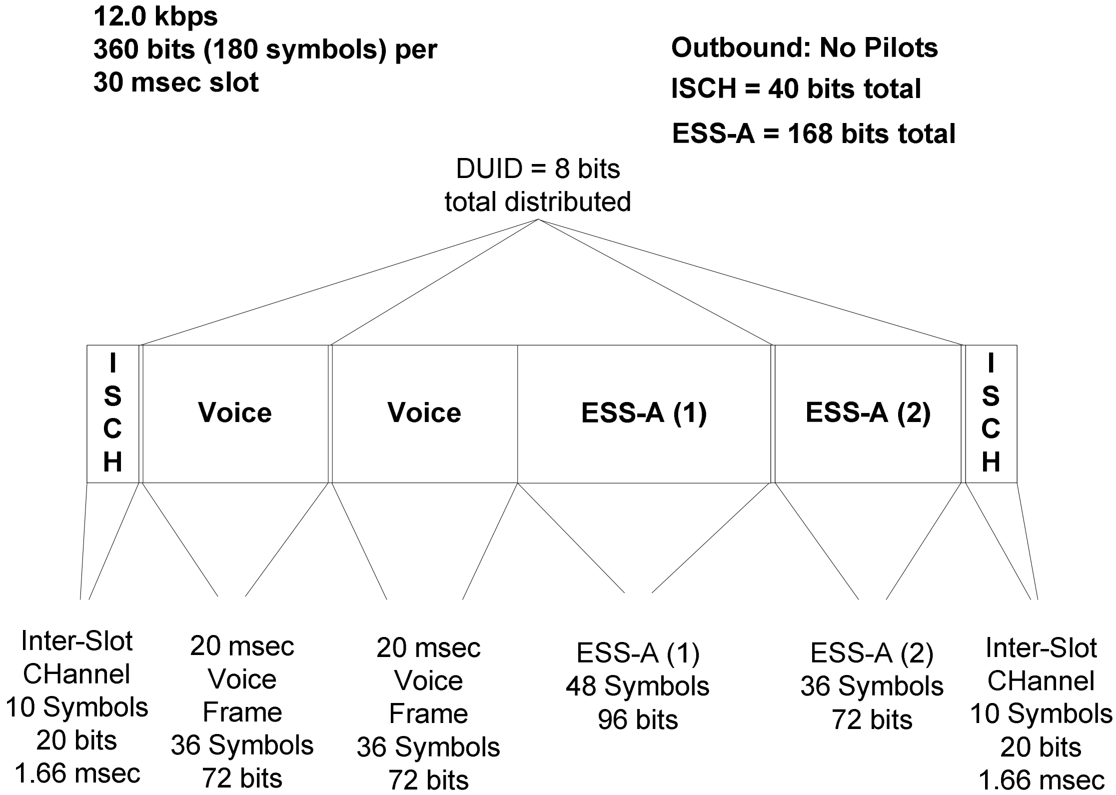


Figure 4-5 Outbound 2 Voice Burst Structure with ESS

4.3 Bursts Containing Signaling (Data, Control)

The inbound bursts with signaling contain a synchronization sequence. There are two types of outbound signaling bursts, one with sync, and one without. The outbound signaling burst with synchronization is a burst that contains signaling information and a 42 bit synchronization sequence.

The inbound signaling burst with synchronization is a burst that contains signaling information and a 44 bit synchronization sequence that includes a pilot sequence located at the beginning of the burst.

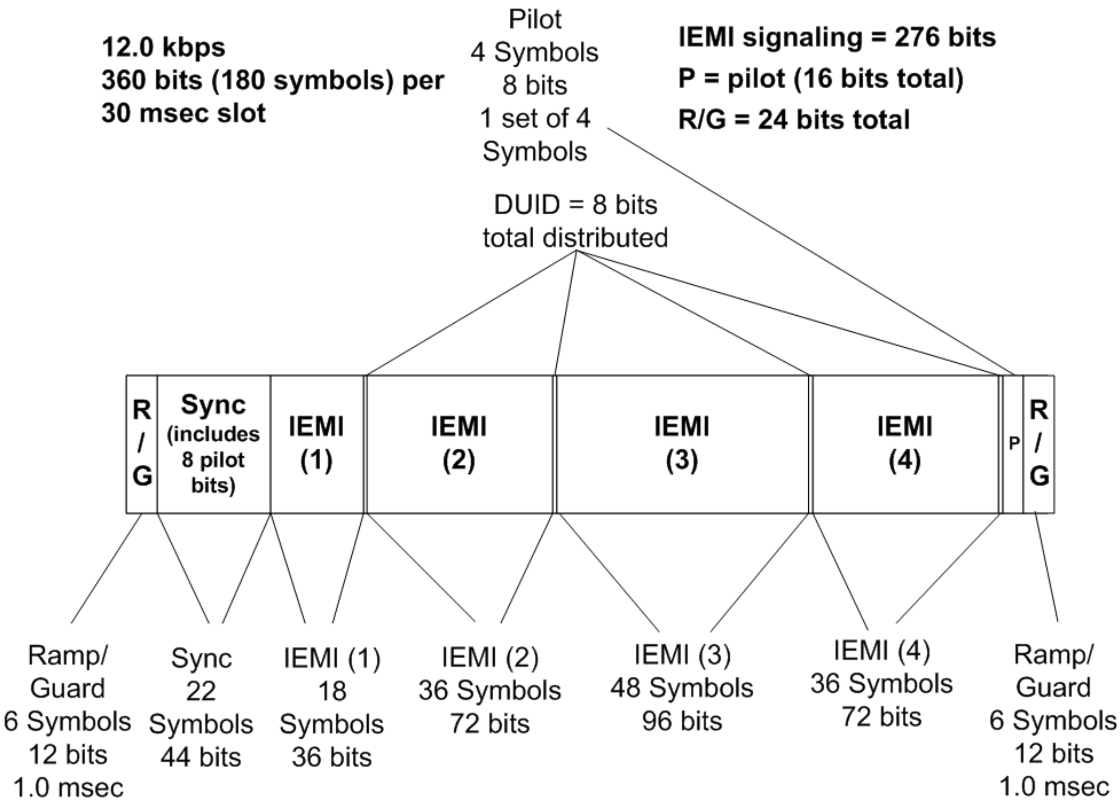


Figure 4-6 Inbound Signaling Burst Structure with Synchronization

The structure of the outbound signaling burst with synchronization is shown in Figure 4-7.

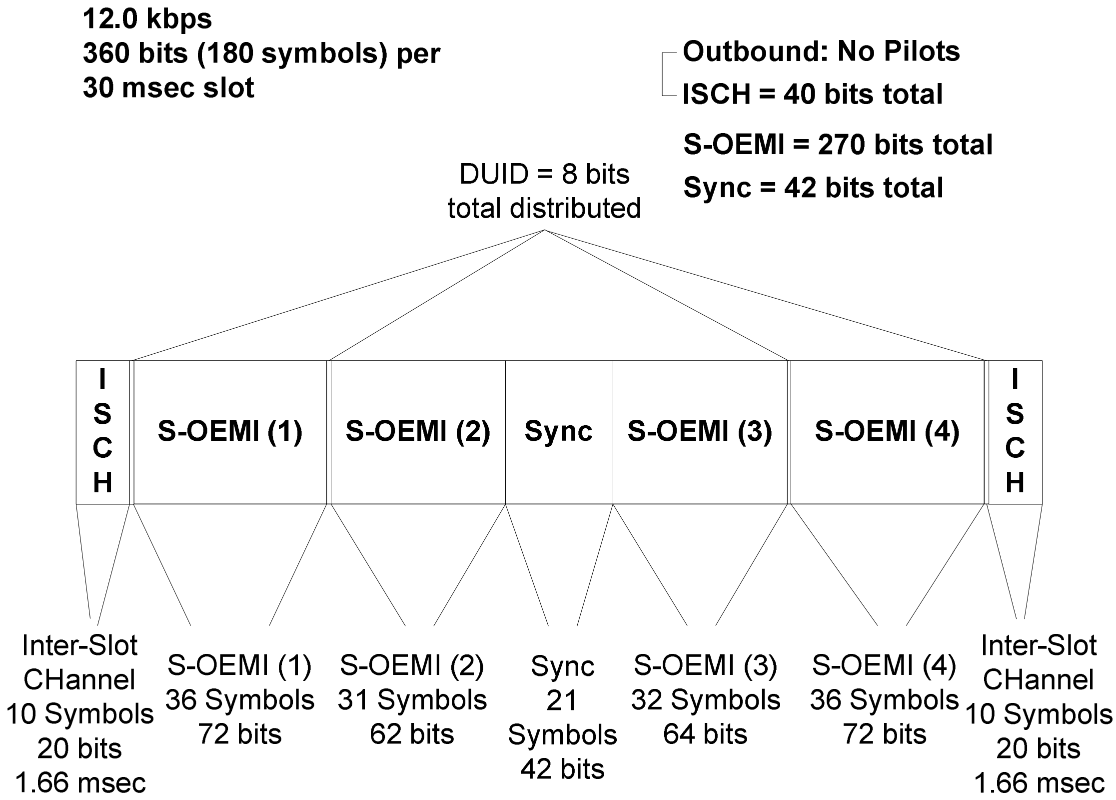


Figure 4-7 Outbound Signaling Burst Structure with Synchronization

The outbound signaling burst without synchronization is a burst that only contains signaling information.

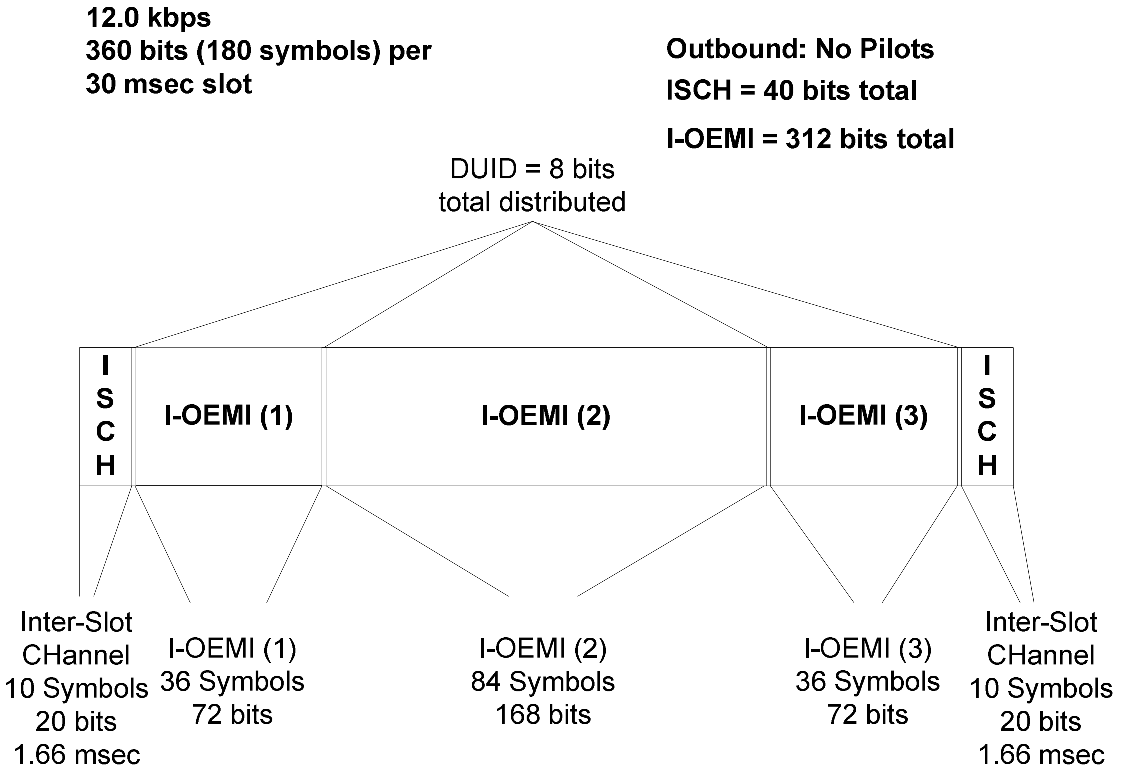


Figure 4-8 Outbound Signaling Burst Structure without Synchronization

5 Burst Field Definitions

The bursts contain several fields of modulation information that are defined in the following subclauses. This document uses various codes for forward error correction (FEC), and these codes are defined in terms of a number triplet that is customarily represented as (n,k,d). In this triplet, n represents the number of symbols in the code word, k represents the number of information symbols, and d is the minimum distance between code words. In most cases, the symbols are binary bits, but this document also uses Reed-Solomon (RS) codes over Galois Field GF(64). In the case of RS codes, the triplet is represented as (N,K,D) and the symbols are each 6 bits. The redundancy, R, is also defined for codes as R = N - K.

5.1 Synchronization Sequences

There are four different synchronization sequences in the traffic channel signaling. The first is an inbound synchronization sequence that occurs in a MAC information signaling slot (clause 4) that has 22 symbols. The second occurs in an outbound signaling slot and has 21 symbols. The third and fourth kinds of synchronization sequences are in the outbound ISCH and contains 20 symbols. The sync pattern for the outbound ISCH is also mentioned in 3.3.4. The synchronization sequences are given in this subclause. The synchronization sequences are transmitted in the order from top to bottom; the top symbol is transmitted first and the bottom symbol is transmitted last.

The signed dibit symbols, in order of transmission, for the various synchronization sequences that occur in MAC signaling are shown in Table 5-1.

Table 5-1 Synchronization Sequences

Symbol/Dibit Name	IEMI Sync	S-OEMI Sync	VCH S-ISCH Sync	CCH S-ISCH Sync (Informative)
S0	+3	-3	+3	-3
S1	+3	-3	+3	-3
S2	-3	-3	+3	-3
S3	-3	-3	-3	-3
S4	+3	+3	+3	-3
S5	+3	+3	+3	+3
S6	+3	+3	-3	-3
S7	-3	+3	+3	-3
S8	+3	+3	+3	-3
S9	-3	-3	+3	+3
S10	-3	+3	+3	+3
S11	+3	-3	-3	+3
S12	+3	+3	-3	+3
S13	+3	-3	-3	-3
S14	+3	-3	+3	+3
S15	-3	+3	-3	+3
S16	+3	+3	-3	-3
S17	-3	-3	-3	+3
S18	-3	-3	-3	+3
S19	-3	+3	-3	+3
S20	-3	+3		
S21	-3			

5.2 Pilot Sequence

The pilot sequences are 8 bit fields found in inbound bursts and are composed of two sets of four symbols defined in this document and referenced in [R3]. The signed dibit symbols for the pilot sequences are defined as follows.

P1 = [+1, –1, +1, –1]
P2 = [–1, +1, –1, +1]

The pilot sequence P1 is sent at the beginning of the inbound bursts without sync, which is shown as the left most P in Figure 4-1, Figure 4-2, and Figure 4-3. The pilot sequence P2 is sent at the end of the inbound burst, including bursts with or without sync, which is shown as the right most P in Figure 4-1, Figure 4-2, Figure 4-3, and Figure 4-6. The first four symbols of the inbound signaling burst with sync shown in Figure 4-6 are characterized as pilot symbols, and in that specific instance the pilot symbols would correspond to the first four symbols of the inbound synchronization sequence given in Table 5-1.

5.3 Voice Fields

The voice information is defined in reference [R4]. Reference [R4] also includes a bit interleaving schedule for the bits in a voice frame. The individual frames are then inserted into voice bursts as explained in 4.2.

5.4 Data Unit ID (DUID)

The Data Unit ID, DUID, is a field that exists in every burst type, both inbound and outbound. The DUID is used for identification of the burst type (e.g., FACCH/SACCH, voice, and DCH), which allows the receiver to know how to decode the content and to know where in a transmission sequence it may be entering. Bursts that have not yet been defined, for example, the ones to be used with the TDMA CCH and TDMA DCH, may have new names and may or may not have sync, but in any case they need a unique DUID.

The DUID code is an (8,4,4) binary code. The DUID is an 8-bit field that conveys 4 bits of information. The field is defined as follows:

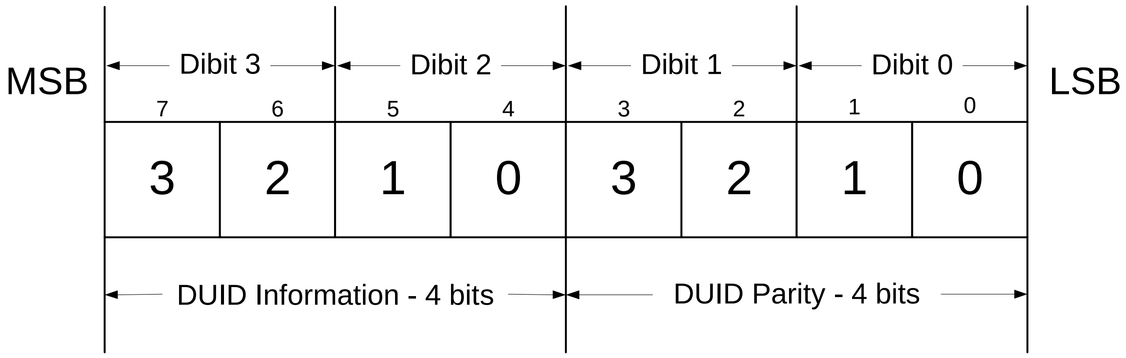


Figure 5-1 DUID Codeword Construction for (8,4,4) Binary Code

The 8-bit DUID codeword is distributed within the inbound and outbound bursts in 4 separated dibits (see clause 4) with the most significant dibit transmitted first.

5.4.1 DUID Encoding

The generator matrix for the (8,4,4) binary code is shown in Table 5-2 below:

Table 5-2 DUID Generator Matrix

1	0	0	0	1	1	0	1
0	1	0	0	1	0	1	1
0	0	1	0	1	1	1	0
0	0	0	1	0	1	1	1

The four information bits are defined for a voice channel in Table 5-3. Definitions for the control and data channels are reserved at this time.

Table 5-3 DUID Information Bits

DUID Information bits				Burst
3	2	1	0	
0	0	0	0	4V Burst
0	0	0	1	Reserved
0	0	1	0	Reserved
0	0	1	1	SACCH Burst with scrambling
0	1	0	0	Reserved
0	1	0	1	Reserved
0	1	1	0	2V Burst
0	1	1	1	Reserved
1	0	0	0	Reserved
1	0	0	1	FACCH Burst with scrambling
1	0	1	0	Reserved
1	0	1	1	Reserved
1	1	0	0	SACCH Burst w/o scrambling
1	1	0	1	Reserved
1	1	1	0	Reserved
1	1	1	1	FACCH Burst w/o scrambling

5.4.2 Decoding Schemes

The DUID can be decoded through a number of methods. A specific implementation can use any of a variety of these schemes. Presented here are two schemes for illustrative use.

Hard Decode/Inclusive Search: This decoder would take the incoming data and hard limit the results to +/- 1. It would then compare the distance from this 8 bit point to all 8 possible valid codewords and pick the closest one.

Soft Decode/Inclusive Search: This decoder would take the incoming data and consider it a point in 8 bit space. It would then compare the distance from this 8 bit point to all possible valid codewords and pick the closest one.

5.5 Information in ISCH

The 9 I-ISCH bits are encoded into 40 bits and decoded from 40 bits (see Figure 5-2).

8 7	6 5	4 3	2	1 0
Reserved	Channel No	ISCH Loc	FR	Ultraframe_Count

Figure 5-2 ISCH Containing Information

The channel number (Channel No) sub-field gives the parity of the VCH channel on the physical channel:

- %00: VCH Channel 0
- %01: VCH Channel 1
- %10: Reserved
- %11: Reserved

The ISCH sequence location (ISCH Loc) sub-field gives the location of the ISCH sequence on the superframe:

- %00: First I-ISCH sequence of the superframe
- %01: Second I-ISCH sequence of the superframe
- %10: Third I-ISCH sequence of the superframe
- %11: Reserved

Details of how the ISCH information is coded is found in 5.5.

The ultraframe count (Ultraframe_Count) sub-field is a counter that gives the location of the current superframe within the ultraframe:

- %00: the current superframe is the 1^{st} superframe in the ultraframe
- %01: the current superframe is the 2^{nd} superframe in the ultraframe
- %10: the current superframe is the 3^{rd} superframe in the ultraframe
- %11: the current superframe is the last superframe in the ultraframe

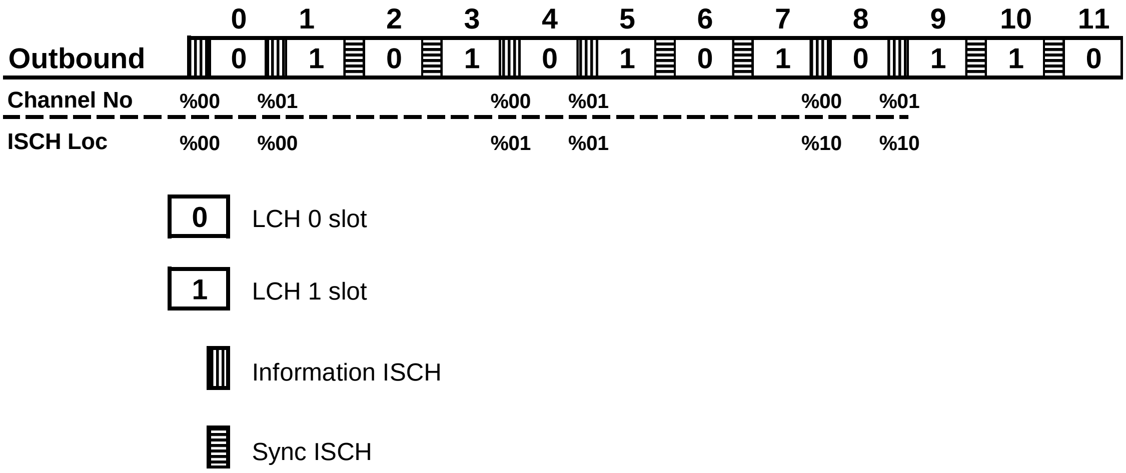


Figure 5-3 ISCH of Payload VCH Timeslot

For the VCH, the FR sub-field gives an indication to the SU(s) who the next inbound SACCH timeslot is free for access for:

- 0: The next inbound SACCH timeslot is not FRee for listener access
- 1: The next inbound SACCH timeslot is FRee for listener access

The FNE determines whether listening radios are allowed to use the inbound SACCH by the appropriate setting of the FR sub-field.

The Information field in the ISCH is 40 bits encoded with a (40, 9,16) binary code. The nine bits of information are defined in 3.3.4. The (40, 9,16) code derived from a (40,10,16) binary code with a generator matrix, g, given in Table 5-4.

Table 5-4 Generator Matrix, g, for I-ISCH

1	0	0	0	1	0	0	0	0	0	0	1	0	1	1	0	1	1	0	0	1	1	1	0	0	0	1	1	0	1	1	0	1	1	0	1	0	1	1	1
0	0	1	0	0	0	0	0	0	0	0	1	1	1	0	1	1	1	1	1	1	1	0	1	0	1	0	0	1	1	1	1	0	1	1	0	0	1	0	0
0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	1	0	1	0	0	1	0	1	1	0	0	0	1	0	1	1	1	0	1	0	1	1	0	0	0
0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	0	1	1	0	1	0	0	0	1	1	0	0	0	1	1	1	0
0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1
0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	1	1	0	1	1	0	0	1	1	0	1	1	0	1	1	1	0	0	1	0
0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	1	1	0	1	0	0	0	1	1	1	0	1	0	0	0	0	1	0	1	1	1	0	0	0	1
0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	1	1	0	0	1	0	1	1	1	0	1	0	1	0	1	0	0	1	0	0	1	1	1	0
0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	1	1	1	1	0	1	1	0	0	0	0	1	0	1	1	0	0	1	0	1	1	1

This results in a 40-bit code word which is then added to a code word offset vector, c_0, given as follows.

$$C_0 = \%0001\ 1000\ 0100\ 0010\ 0010\ 1001\ 1101\ 0100\ 0110\ 0001 \quad (3)$$

The final result is a 40-bit coset code word to transmit in the I-ISCH field. This encoding process is shown in Figure 5-4. The use of the U/F count (UltraFrame count) is diagrammed in Figure 3-2. The two reserved information bits are set to zero.

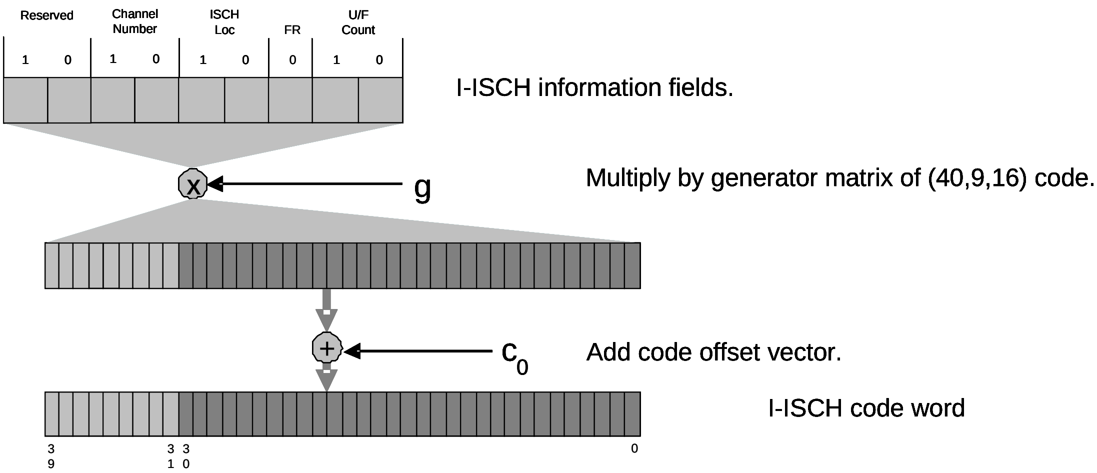


Figure 5-4 ISCH Coset Code Word Construction

5.6 Encoded MAC Information and Encryption Synchronization Signal

Both the Encoded MAC Information and Encryption Synchronization Signal (ESS) are FEC encoded with a Reed Solomon code. As is detailed in the following subclauses, the Encoded MAC Information has three applications of FEC coding while the ESS comprises a single application of the FEC coding.

A common mother FEC code is used to create commonality in the implementation of the encoder and decoder while allowing for flexibility of the coding to accommodate multiple system applications. These separate applications are summarized below:

1. Inbound IEMI (with sync)
2. Outbound S-OEMI (with sync)
3. Outbound I-OEMI (without sync)
4. ESS

The mother code is a (63,35,29) Reed Solomon code over GF(64) for all the cases. The symbols of the RS code are 6 bits each, and they are called hexbits.

Table 5-5 defines the code parameters for all the cases presented above. Refer to Annex A (informative) for further details.

Table 5-5 Mother Code Applications and Definitions

Case #	Description	Code	N	K	R	U	S	N'	K'	R'
1	IEMI	(46,26,21)	63	35	28	8	9	46	26	20
2	S-OEMI	(45,26,20)	63	35	28	9	9	45	26	19
3	I-OEMI	(52,30,23)	63	35	28	6	5	52	30	22
4	ESS	(44,16,29)	63	35	28	0	19	44	16	28

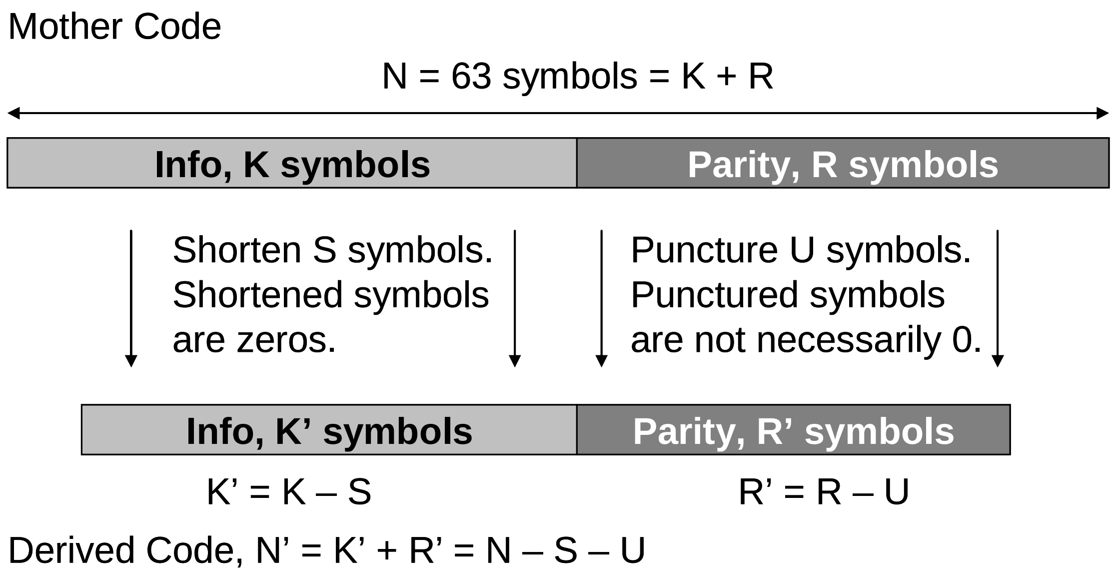


Figure 5-5 Derived Codes from Mother Code

In Table 5-5, the N parameter is the number of hexbits in the codeword for the mother code, K is the number of hexbits in the information word for the mother code, and R is the redundancy factor for the mother code. From that mother code, U hexbits are removed from the LSB’s of the parity (punctured) and the Information portion is shortened by S hexbits by assuming the S most significant hexbits are zero. In doing this, the derived codes are designated by the N’, K’, and R’ parameters listed in Table 5-5, K’=K–S and R’=R–U. Figure 5-5 illustrates how the derived codes descend from the mother code.

This document recommends that implementations use a soft errors and erasures RS decoder. An RS decoder that utilizes erasures is appropriate for decoding the signaling bursts defined here, where punctured symbols are treated as erasures by the receiver and shortened symbols are zero. The shortening and puncturing is defined in Table 5-5 above. The generator polynomial and the generator matrix of the mother code are given in Annex A.

5.6.1 Encoded MAC Information (EMI)

The Encoded MAC Information slots can have multiple functions depending on the system application. These specific applications are described in detail in the following subclauses.

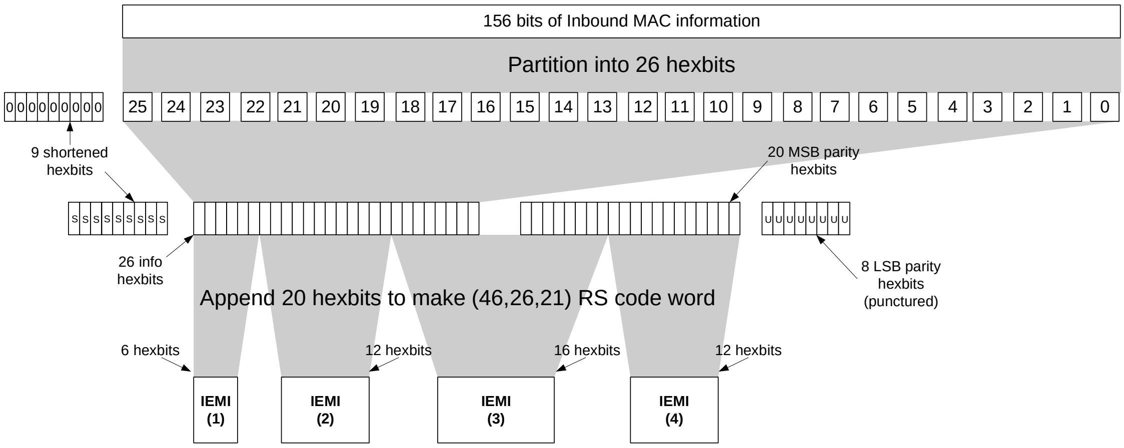


Figure 5-6 IEMI Distribution

5.6.1.1 Inbound Encoded MAC Information (IEMI)

The IEMI conveys 156 bits of information – or 26 hexbits. This information content is described in Clause 8. The information is in turn encoded into 276 bits (46 hexbits). The IEMI is always sent with sync. The information and parity allocation within the IEMI slot is diagrammed in Figure 5-6. The IEMI code is a (46,26,21) Reed Solomon code over GF(64).

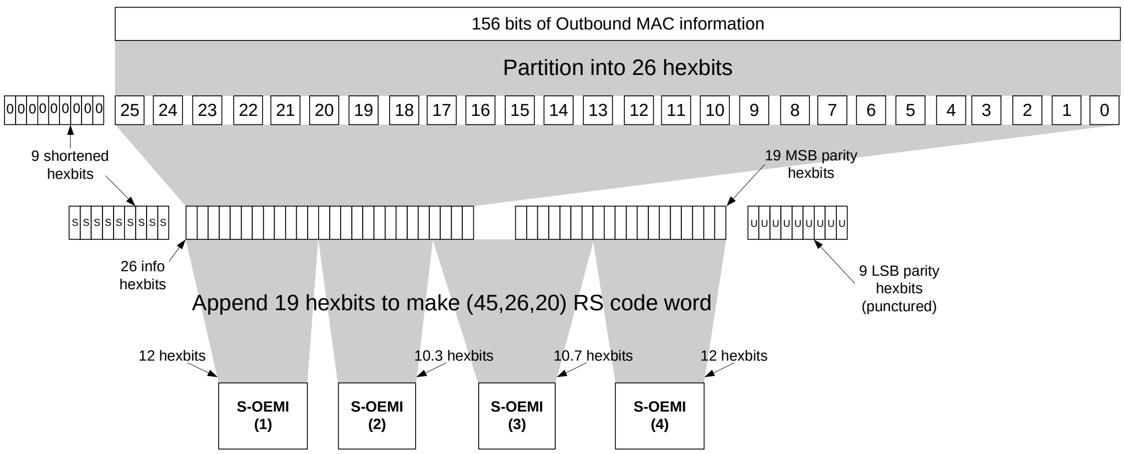


Figure 5-7 S-OEMI Distribution

5.6.1.2 Outbound Encoded MAC Information with Sync (S-OEMI)

The S-OEMI conveys 156 bits of information – or 26 hexbits. This information content is described in Clause 8. The information is in turn encoded into 270 bits (45 hexbits). The S-OEMI is sent with sync. The information and parity allocation within the S-OEMI slot is diagrammed in Figure 5-7. The S-OEMI code is a (45,26,20) Reed Solomon code over GF(64).

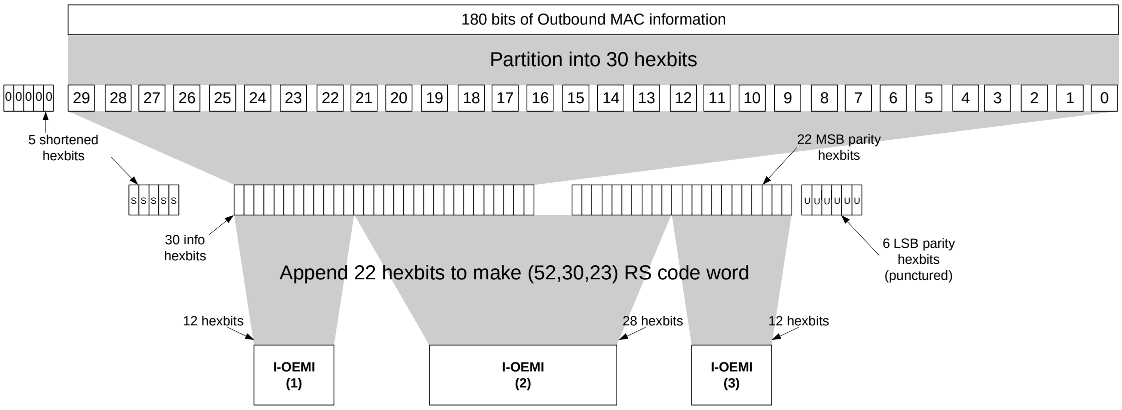


Figure 5-8 I-OEMI Distribution

5.6.1.3 Outbound Encoded MAC Information (I-OEMI)

The I-OEMI conveys 180 bits of information – or 30 hexbits. This information content is described in Clause 8. The information is in turn encoded into 312 bits (52 hexbits). The I-OEMI is sent without sync. The information and parity allocation within the I-OEMI slot is diagrammed in Figure 5-8. The I-OEMI code is a (52,30,23) Reed Solomon code over GF(64).

5.6.2 Encryption Synchronization Signal (ESS)

The ESS conveys 96 bits of information, divided into an 8-bit ALGID, 16-bit KID, and 72-bit MI. The operation of the MI, ALGID, and KID is defined in [R5]. This is encoded in the embedded ESS to 264 bits. These 264 bits are divided into 168 bits in the 2-voice frame burst (ESS-A), and 24 bits in each of 4 bursts with 4-voice frames (ESS-B). This is diagrammed in Figure 5-9.

The Encryption Sync Signal is a (44,16,29) Reed Solomon code over GF(64). The definition of the GF(64) field is given in Annex A.

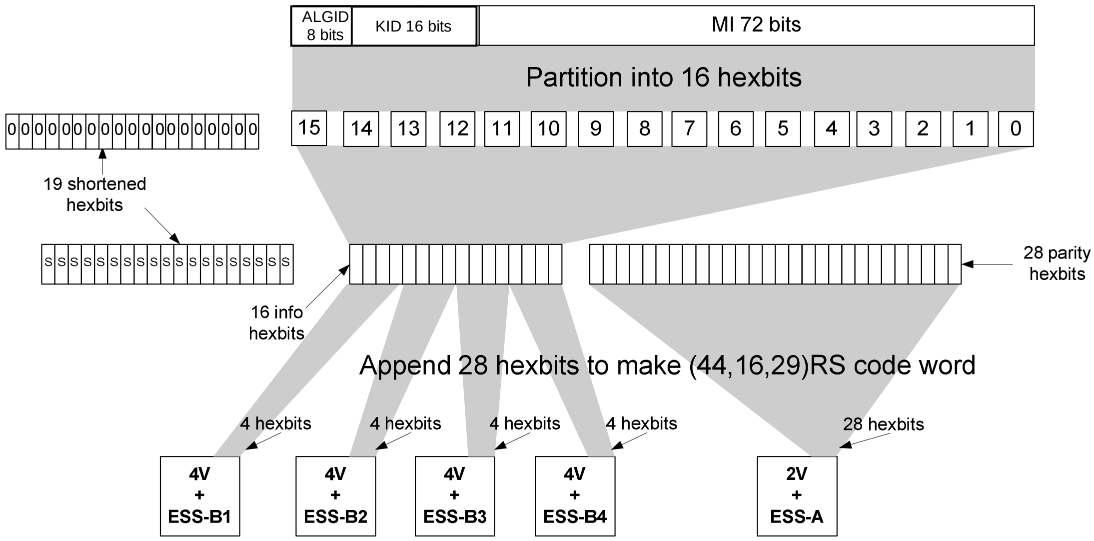


Figure 5-9 ESS Distribution

5.6.2.1 ESS Decoding

The decode process for the ESS is done in a progressive fashion. A soft erasure decoder is recommended for this codeword. The ESS information is collected as the bursts arrive, starting with the four different 4V bursts with the ESS-B segments and then lastly with the 2V burst with the ESS-A segment. The decode process for this would be as follows:

1. With the ESS segments received obtain the corrected output of the RS decoder with erasures for any of the ESS information not obtained.
   a. If only the ESS-A segment is received, then obtain the (44,16,29) RS decoder output with 16 erasures for the four ESS-B segments not received.
   b. If the ESS-A and one ESS-B segments are received, then obtain the (44,16,29) RS decoder output with 12 erasures for the three ESS-B segments not received.
   c. Other scenarios extended as required.

2. Re-compute the syndrome based on the output of the RS decoder. If it is zero, then the answer is presumed to be correct, otherwise an uncorrectable error combination has been found.
3. Check the ALGID and KID to give more assurance that the answer is valid. The ALGID may be checked against valid P25 values or values present in the radio while KID may be checked against values present in the radio to provide more assurance that the answer is valid.
4. If the decode output has a non-zero syndrome, then start the process again for the next superframe.

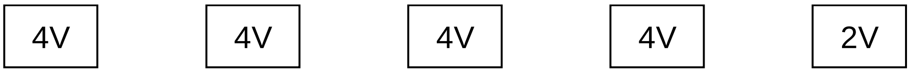
5.7 Ramp

For inbound bursts, a total of 2 msec of time is reserved as “Guard” time to allow for power ramping and propagation delay protection. The modulation burst is centered in the 30 msec time slot, with 1 msec of the “Guard” time at the beginning of the burst and 1 msec at the end of the burst. See reference [R3] for details regarding the ramp sequence.

6 Bearer Service Description

6.1 Voice Burst Sequencing (Basic Voice Service)

Voice timeslots are transmitted in a repetitive pattern of five bursts as shown in Figure 6-1. The five bursts convey 18 voice frames, arranged such that the first four bursts have four voice frames and the fifth burst has the two remaining voice frames and additional signal bits (not shown in the Figure 6-1).



Five voice bursts convey 360 ms of voice in 18 voice frames, arranged into 5 TDMA bursts.

Figure 6-1 Voice Bursts Repetitive Pattern

The sequencing of the voice bursts within the superframe structure as described in 3.2.1 depends on the beginning of the talk spurt setup (PTT) at the site of the talker. The starting point of the voice bursts does not depend on the position of the SACCH timeslots. The sequence of five voice bursts illustrated in Figure 6-2 below is repeated until the end of the talk spurt.

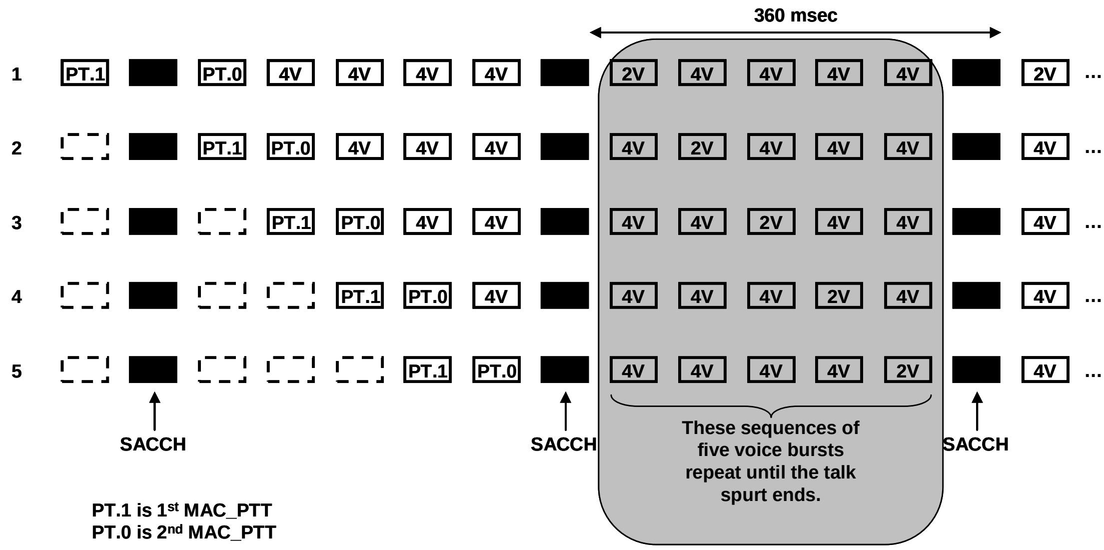


Figure 6-2 Example Voice Burst Sequencing

Figure 6-2 describes the 5 different cases for the way the sequence of five voice bursts are interleaved between two consecutive SACCH timeslots. This sequence depends on the start of the voice transmission in relation to the fixed outbound SACCH schedule.

6.2 DUID Management

The DUID code word is described in 5.4. The DUID is interleaved into each TDMA burst according to the burst structures presented in clause 4. Bursts on a VCH that contain voice are marked with DUID information values of %0000 or %0110 as shown in Table 5-3.

The group of five voice bursts depicted in Figure 6-1 would be transmitted consecutively from left to right. The DUID information values for the bursts would be %0000, %0000, %0000, %0000, and %0110, from first to last in the order given.

This standard order of DUID information values would translate to the five examples in Figure 6-2 in the following way. The first 4V burst following the PTT would have a DUID information value of %0000. In example 1 in Figure 6-2 this would mean that the 2V burst following the SACCH would have a DUID value of %0110, and the following four bursts would take DUID information values of %0000, %0000, %0000, and %0000 in the order from left to right.

In example 2 of Figure 6-2, the 4V burst following the SACCH would take a DUID information value of %0000, and the following four bursts would have values of %0110, %0000, %0000 and %0000 in the order from left to right.

Similarly, for example 3, the order of the DUID values between the SACCH bursts would be %0000, %0000, %0110, %0000, and %0000.

Similarly, for example 4, the order of the DUID values between the SACCH bursts would be %0000, %0000, %0000, %0110, and %0000.

Similarly, for example 5, the order of the DUID values between the SACCH bursts would be %0000, %0000, %0000, %0000, and %0110.

7 MAC Protocol Description

This clause explains the procedures to use the MAC PDUs that are defined in clause 8. The MAC PDUs convey the signal information used to control the traffic that is on the logical channels of a TDMA system. The MAC PDUs are transmitted in the FACCH and SACCH defined in earlier clauses of this document.

7.1 Overview of Protocol

A logical channel can be either a traffic channel (TCH) or a control channel (CCH). The definitions of the FDMA CCH are given in [R2].

The TCH can be either a voice channel (VCH) or a data channel (DCH). The TCH has a variety of generic procedures that are defined in 7.2. For example, if the TCH is not assigned for any traffic, then a generic procedure defines signaling to convey on the unassigned TCH. If the TCH is assigned for voice traffic, then it becomes a VCH. Procedures for the VCH are given in 7.3. Diagrams to illustrate call setup on a VCH are given in Annex D.

7.2 Generic MAC Procedures

The following subclauses describe general procedures for signals on unassigned channels, signals on assigned voice channels, synchronization signal procedures, scrambling procedures, radio link failure detection, and power control.

7.2.1 Signaling on Unassigned Channel

When neither of the VCHs has been assigned on a frequency, the FNE may shut down the transmitter. If the transmitter stays keyed, both VCHs are considered unassigned.

For any unassigned VCH, the FNE shall broadcast MAC_IDLE PDUs on the outbound FACCH. These PDUs shall contain the Null Information message. The inbound FACCH shall not be used on an unassigned VCH. SU receivers do not have to listen to unassigned FACCH time slots that contain MAC_IDLE PDUs on a channel.

For any unassigned VCH, the FNE shall broadcast MAC_IDLE PDUs on the outbound SACCH. These PDUs may be used to broadcast MAC messages containing general information to the SUs assigned to the adjacent slot, but these MAC_IDLE PDUs shall not be used to send messages that would cause a listening radio to attempt a reply on a VCH. The inbound SACCH shall not be used on an unassigned VCH.

7.2.2 Signaling on an Assigned VCH

For an assigned VCH, the inbound and outbound FACCH are used for call control when no voice signaling is present. This includes the following phases of a call as detailed in 7.3:

- Call Setup
- Call Hangtime
- Call Termination

For an assigned VCH, the inbound and outbound SACCH are used for signaling between the FNE and both talker and listener SUs participating in the assigned call as detailed in 7.3. The SACCH signaling provides for the following services:

- Voice channel user information for both group and individual calls
- Assigned outbound audio source ID
- Assigned inbound audio source ID
- Audio preemption signaling
- Call setup information (optional)
- Call termination information (optional)

The outbound SACCH may also be used to provide general information messages to the SUs participating in the assigned call as detailed in 7.2.3.

The outbound SACCH may also be used to provide general information to the SUs assigned to the adjacent slot. SUs monitoring the outbound SACCH on the adjacent slot should ignore call specific information decoded as it is not applicable to the slot the SU is assigned to.

If a receiving SU decodes a message from a PDU sent on either the FACCH or SACCH containing information relevant to the assigned call indicating that the call is not intended for it (e.g. wrong GID, UID, etc.), then the receiving SU should return to the control channel.

The MAC PDUs used on either the FACCH or SACCH of an assigned VCH are:

- MAC_PTT PDU which contains the group and source IDs plus information necessary for encrypted calls; Message Indicator, Algorithm ID and Key ID.
- MAC_ACTIVE PDU which may contain one or more messages, as determined appropriate by the FNE.
- MAC_HANGTIME PDU which may contain one or more messages, as determined appropriate by the FNE.
- MAC_END_PTT PDU which contains the group and source IDs.

The MAC_HANGTIME and MAC_ACTIVE PDUs may be used to broadcast MAC messages containing general information not related to the assigned VCH traffic to the SUs assigned to the slot. Listening radios shall not attempt a reply on the

VCH to a message received that is not related to the assigned VCH traffic if a dedicated control channel is available.

7.2.2.1 Use of the Inbound SACCH on an Assigned Channel

The inbound SACCH is a logical channel used by SUs present on the VCH to send information to the FNE.

Use of the inbound SACCH for receiving radios is controlled by the FNE with the FR bit in the I-ISCH. When an inbound SACCH timeslot is not being used by a transmitting SU, either at the talker site or at non-talker sites, the FNE may allow listening SU units to use the SACCH by indicating it is free with the FR bit.

Transmitting SUs may not be able to receive the I-ISCH and are not expected to use the FR bit for inbound SACCH access control. Instead, transmitting SUs shall use a fixed set of rules based on the ultraframe structure to determine which inbound SACCH burst(s) to use as described in 3.2.2 and 7.3.2. SACCH bursts used by inbound talkers are known as the inbound talker SACCH. The transmitting radio uses the inbound talker SACCH to provide the FNE with information related to the call itself or information related to the transmitting radio itself such as Talker ID.

7.2.2.2 Use of the Outbound SACCH on an Assigned Channel

The outbound SACCH is a logical channel used by the FNE to send information to the SUs present on the VCH. Information may include broadcast messages to all SUs or messages targeted at specific individual SUs, including the current talker. All listening SUs should monitor the outbound SACCH of both timeslots.

A transmitting radio may not be able to receive the outbound SACCH immediately following an inbound SACCH used by the transmitting radio. For this reason, the FNE should schedule the transmission of any outbound SACCH directed to the transmitting radio so that the radio can detect it, by assuming that the adjacent inbound SACCH is not scheduled for the use of the transmitting radio or by repeating any outbound SACCH directed to the transmitting radio.

In general, the FNE is free to transmit whatever outbound SACCH information the FNE determines is appropriate, however, the FNE should prioritize use of the outbound SACCH as follows.

- Messages containing the ID of the talker, if available.
- Messages intended for the transmitting radio, if any.
- Messages intended for control of the assigned call.
- Messages to respond to signaling in the inbound SACCH, if applicable.

- Messages containing information associated with scan operation. The next priority should be those containing information for de-scrambling (such as Net Sts Bcast if required on the VCH)
- Messages of general interest as determined by the FNE.

7.2.3 Alternate Activity Signaling

Multiple methods for notifying VCH users of other activity are possible with the MAC protocol. These methods may be used to convey information about other active calls (at the site) to VCH users for scanning purposes, or to request that a VCH user move to another channel for a specific purpose such as re-keying.

Alternate Activity Signaling may be done on either assigned or unassigned VCHs per the guidelines established in 7.2.1 and 7.2.2. Alternate Activity Signaling may be either direct or indirect and may be sent to either talker or listener radios. In the direct signaling mode, sufficient information is present in the MAC PDU for interested VCH users to move directly to a channel of interest. In indirect signaling, only a minimum amount of information is present in the MAC PDU, requiring the VCH user to go to the CCH to acquire the additional information required to proceed to the desired channel. This latter mode is often referred to as paging. The details of the MAC messages that can be used for Alternate Activity Signaling, either direct or indirect, can be found in clause 8.
The indirect individual paging message specified in 8.3.1.38 contains a bit that specifies the priority level of the page. If an SU receives a low priority page with its individual ID, then the SU is free to decide whether to act on the paging message or to remain in the call it is currently in. If an SU receives a high priority page with its individual ID, the SU should go back to the control channel and look for individual messaging targeted for it.

The primary tradeoff between direct mode and indirect mode is between the update rate and response time. The update rate for indirect mode is higher than direct mode as shorter messages are possible, allowing multiple IDs to be transmitted within a given FACCH or SACCH. However, VCH users that receive an indirect Alternate Activity Signaling message have to move to the CCH to get the rest of the information required to move to the desired channel, and this may take longer in some scenarios. The FNE decides which method is most appropriate for any given scenario.

Note that multiple MAC messages may be included in a single SACCH or FACCH depending upon message length, so for example, two separate Group Paging Messages containing 4 group IDs each (length 10) fit in an outbound SACCH. The described configuration is only an example, other combinations of messages are also possible.

7.2.4 Synchronization Procedures

Three different types of synchronization are supported by this protocol, symbol synchronization, synchronization to the VCH and FDMA control channel to TDMA voice channel synchronization. These synchronizations are related, but each serves a slightly different purpose. The following subclauses describe each of these types of synchronization in more detail.

7.2.4.1 Symbol Synchronization

Receivers need to synchronize themselves to demodulate symbols in order to obtain the bits of information transmitted. Typically this is accomplished by searching the received signal for synchronization patterns such as the ones described in 5.1.

For the outbound link, the subscriber receiver may use either the synchronization symbols located within the S-ISCH or within the FACCH to gain initial symbol synchronization.

For the inbound link there is no ISCH, instead, the FNE relies either on the synchronization symbols within the FACCH or the SACCH to gain initial symbol synchronization. Normal entry occurs with the detection of the sync in the FACCH, while the late entry occurs with the detection of the sync within the SACCH. The SACCH is allocated once every superframe, that is, once every 360 msec. However, it should be noted that not all inbound SACCH bursts are associated with the talker SU, instead, some inbound SACCH are dedicated for listeners. The FNE needs to accommodate sync detection in the SACCH regardless of the unit transmitting the burst.

7.2.4.2 Synchronization to the VCH

In addition to using the synchronization word to identify the location of the symbols in the received stream, it can also be used to assist in determining the framing of the received data. On the VCH, the elements of framing that need to be determined are the channel numbering, superframe structure, ultraframe structure, and the voice framing structure. The channel numbering identifies the position of the two TDMA logical channels, the superframe structure identifies the location of the SACCH burst, the ultraframe structure identifies the location of the talker SACCH, and the voice framing structure identifies the position within the voice burst sequence of 4V, 4V, 4V, 4V, 2V. Identification of all three of these elements is required to receive a voice transmission. An SU monitoring the outbound link additionally has to determine the ISCH framing. The ISCH framing identifies which ISCH fields are used for synchronization and which are used for information.

7.2.4.2.1 Inbound Initial Synchronization to the VCH

For the inbound link, the FNE uses a combination of the synchronization word, signaling within the FACCH burst and the DUID value to determine the current framing of the data.

Superframe structure and slot numbering are known a priori in the FNE as the inbound superframe structure used by the transmitting subscribers conforms to the outbound superframe structure per this specification. Therefore, the FNE only needs to determine the voice framing structure. The voice framing can be determined either by decoding the offset field in the MAC_PTT messages sent on the FACCH, through the offset field in a SACCH, or by monitoring DUIDs for the 2V burst, whichever is found first.

7.2.4.2.2 Outbound Initial Synchronization to the VCH without FDMA CCH and TDMA VCH synchronization

For the outbound link when the FDMA CCH and the TDMA VCH are not synchronized, the SU receiver uses a combination of the synchronization word in either the S-ISCH or the FACCH, signaling within the FACCH or SACCH burst, the information field within the I-ISCH, and the DUID to determine framing.

ISCH framing is determined by searching for the sync pattern within the S-ISCH field. Once an I-ISCH has been found, it can be used to determine the channel numbering and superframe structure. This is accomplished by examining the Channel No and ISCH Loc fields of the I-ISCH.

Voice framing structure can be determined either by decoding the offset field in a FACCH or SACCH message, or by monitoring DUIDs for the 2V burst, whichever is found first.

7.2.4.2.3 Outbound Initial Synchronization to the VCH with FDMA CCH and TDMA VCH synchronization

This procedure applies to SUs in systems where the FDMA CCH and TDMA VCH are synchronized and the SU has received a SYNC_BCST message that tells it the synchronization between the two channels. An SU in this type of system that receives a channel assignment before seeing the SYNC_BCST should follow the procedure outlined in 7.2.4.2.2 instead of the one described here. Once an SU has successfully received a SYNC_BCST message on the FDMA CCH, it then knows the symbol synchronization, the superframe structure, the ultraframe structure, the ISCH structure and Channel Number on the VCH and therefore does not have to determine that information when it arrives on the VCH.

Therefore in this scenario, the SU only needs to determine the voice framing structure. Voice framing structure can be determined either by decoding the offset field in a FACCH or SACCH message, or by monitoring DUIDs for the 2V burst, whichever is found first.

7.2.4.2.4 Inbound Maintenance of Synchronization to the VCH

Synchronization is maintained by continuously monitoring the SACCH burst. The SACCH burst contains two elements that may be used to assist with synchronization maintenance, the sync word and MAC PDU contained within the burst. An FNE can use either the detection of sync or the successful decoding of the 12 bit Cyclic Redundancy Checksum (CRC) in the MAC PDU to indicate it is still in synchronization with the subscriber unit.

7.2.4.2.5 Outbound Maintenance of Synchronization to the VCH

Synchronization is maintained by continuously decoding the S-ISCH, the I-ISCH and the SACCH burst. An SU should move back to the control channel and look for further call updates if it determines it can no longer reliably decode the ISCH or SACCH burst.

An SU may also use muting information provided by the vocoder and SACCH decoding to aid in detection of the reception of an incorrect system. Since the ISCH and sync fields are not scrambled, an SU listening to a co-channel system may still be able to detect sync and framing of the ISCH. Therefore, additional processing can be attempted to determine if the channel being monitored is not its desired system. An SU may use the knowledge that the voice frames and SACCH are scrambled to assist in this determination. Here, the presence of consistent failures of MAC PDUs or channel mutes, even with valid sync and ISCH decoding, may indicate this condition. If an SU believes it is receiving an incorrect system, it should return to the control channel to verify the WACN ID, System ID, and Color Code.

If the SU leaves the channel, such as might occur to execute a transaction on the CCH, it can maintain a time counter to resume operation on the channel in sync with previous operation on the channel.

7.2.4.2.6 Transmitting Radio Synchronization Maintenance

Real world impairments such as oscillator offsets, oscillator drift due to PA power dissipation, etc., during a transmission may cause an SU’s transmit clock to drift. Therefore, there exists a need for a transmitting SU to maintain sync to the outbound stream in order to compensate for this drift. Synchronization maintenance for an SU transmitter is made possible by monitoring the S-ISCH in slots 10 and 11 as part of the process to receive outbound MAC PDUs in the SACCH. SU transmitters on LCH 0 can receive signals in SACCH slot 11 by decoding the S-ISCH immediately prior to the MAC PDU. SU transmitters on LCH 1 can receive signals in SACCH slot 10 by decoding the S-ISCH immediately prior to the MAC PDU. The slot arrangement in time is illustrated in Figure 3-1.

7.2.4.3 FDMA CCH and TDMA VCH Synchronization Procedures

A provision is made within this standard to optionally synchronize the 30 msec slots on the working channel to an FDMA control channel such that the subscriber radios can anticipate the slot time boundaries and the burst schedule directly from monitoring the control channel messages. Subscribers that can maintain this synchronization when they switch from the control channel to the working channel can immediately transmit or receive on the first slot they encounter after the switch. Unsynchronized subscribers have to first decode the synchronization on the working channel before they can operate on the desired TDMA sub-channel as described in 7.2.4.2.2.

In order to accomplish the FDMA CCH to TDMA VCH synchronization, the Phase 1 FDMA CCH defines a SYNC_BCST message that can be used in this process as explained in 3.4.2. All of the TDMA channels at a site shall be time aligned so that the slot boundaries, ultraframe boundaries, and superframe boundaries coincide, as explained in 3.4.1. The SYNC_BCST message shall indicate the location of the center of the first symbol in the superframe, referring to Figure 3-1, this corresponds to the center of the first symbol in timeslot 0.

For an SU on a system, there are two major choices for synchronization. The first choice derives from the presence of the SYNC_BCST message on the FDMA CCH. The presence of this message necessarily requires that the TDMA TCH and the FDMA CCH are synchronized with slot, ultraframe, and superframe boundaries aligning to specific microslot boundaries. The second choice derives from the absence of the SYNC_BCST. The absence of the SYNC_BCST requires the SU to obtain sync directly on a TDMA channel. The procedures for each choice are explained.

Choice 1. FDMA CCH transmits SYNC_BCST at least once every T_{SYNC_BCST} seconds with the UnSync'd (US) field clear (0) indicating the system is synchronized. If the FDMA CCH transmits such a SYNC_BCST message, then the SU can synchronize from the SYNC_BCST time mark as explained in 3.4.2. The SU can compute the boundaries for TDMA slots, TDMA ultraframe, and the TDMA superframe.

Choice 2. SYNC_BCST is not available or the SYNC_BCST message is sent with the UnSync'd (US) bit set (1) indicating the system is unsync'd. The absence of SYNC_BCST might be due to a system that does not synchronize the CCH and the TCH, or it could also happen that the SU has not waited long enough on the CCH to decode a SYNC_BCST. If the SU has determined the system is unsync'd, then on the TDMA channel it follows the procedure in

7.2.4.2.2 to obtain the outbound framing. An SU uses this information to transmit on the inbound channel.

7.2.5 Scrambling

Scrambling of specific PDUs on a TDMA channel is used to help reject messages from an interfering P25 TDMA system from being interpreted as a valid message to/from the primary system.

The inbound and outbound voice bursts (2V and 4V) are always scrambled. The signaling bursts are optionally scrambled. A description of the bits that are scrambled are provided later in this subclause.

The information used for the scrambling seed is obtained from the Network Status Broadcast message on the FDMA control channel or the Network Status Broadcast MAC message on the TDMA channel. This scrambling is only performed on the TDMA channel. The specific information and how it is used as the seed is described later in this subclause.

A scrambling sequence is generated with a 44-bit LFSR. The generator polynomial for the LFSR is:

$$G(x) = x^{44} + x^{40} + x^{35} + x^{29} + x^{24} + x^{10} + 1 \qquad (4)$$

An LFSR with internal feedback points is shown in Figure 7-1. An equivalent LFSR with external feedback is shown in Figure 7-2. Both LFSR's generate the same scramble sequence out of bit 43 if they are properly initialized.

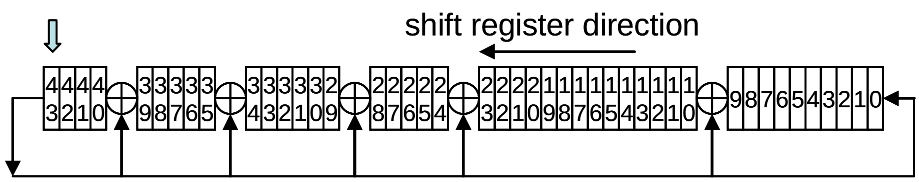


Figure 7-1 Internal LFSR Generator of Scramble Sequence

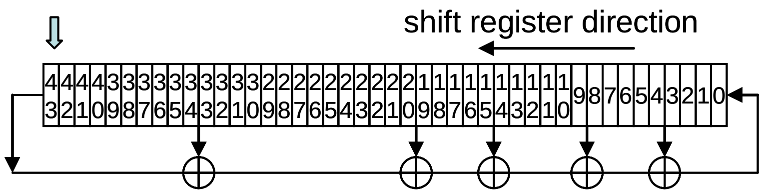


Figure 7-2 External LFSR Generator of Scramble Sequence

The seed for the external LFSR is computed from the WACN ID (20 bits), the System ID (12 bits), and a Color Code (CC, 12 bits). The Color Code is the same value as the NAC for Phase 1 FDMA channels, specifically the Phase 1 FDMA Control Channel if this is used. All three values are also transmitted in the Network Status Broadcast MAC message as seen in 8.3.1.25. The calculation of the seed is given by this equation.

$$\text{seed\_external} = (a \bullet \text{WACN\_ID} + b \bullet \text{System\_ID} + c \bullet \text{CC}) \qquad (5)$$

where

$a = 2^{24} = 16777216$
$b = 2^{12} = 4096$
$c = 1$

The dot (•) represents ordinary unsigned integer multiplication.
If seed_external = 0, then set seed_external = 2^{44} - 1.

The resulting seed calculation always obtains a result in the range of 1 to 2^{44} - 1, inclusive. The zero value is excluded. The states of the internal and external LFSR's are related by a simple matrix multiplication.

$$\text{State\_internal} = \text{state\_external} \ast M \qquad (6)$$

The asterisk (∗) denotes matrix multiplication in GF(2).
The state vectors are 44-bit row vectors.
M is a 44x44 matrix given in Figure 7-3.

```
1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0
0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0
0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0
0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0
0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0
0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0
0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0
0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0
0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0
0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 1
0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 1 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 1 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 1 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 1 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 1 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 1 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 1 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 1 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 1
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 1
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1
```

Figure 7-3 Matrix to Convert to Internal LFSR

The seed value to generate the scramble sequence for the outbound signals is as previously described. The scramble sequence for the inbound signals is computed by advancing the LFSR by 2^{43} shift cycles. This is conveniently computed by a matrix multiplication by $SH(2^{43})$ given in Figure 7-4.

$$\text{Seed\_external\_outbound} = \text{seed\_external} \tag{7}$$

$$\text{Seed\_external\_inbound} = \text{seed\_external} * SH(2^{43}) \tag{8}$$

0 1 0 0 1 1 0 0 1 0 0 1 1 0 1 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 0 0 1 0 1
1 0 1 0 0 1 1 0 0 1 0 0 1 1 0 1 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 0 0 1 0
1 1 0 1 0 0 1 1 0 0 1 0 0 1 1 0 1 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 0 0 1
0 1 1 0 1 0 0 1 1 0 0 1 0 0 1 1 0 1 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 0 0
1 0 1 1 0 1 0 0 1 1 0 0 1 0 0 1 1 0 1 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 0
1 1 0 1 1 0 1 0 0 1 1 0 0 1 0 0 1 1 0 1 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0
0 1 1 0 1 1 0 1 0 0 1 1 0 0 1 0 0 1 1 0 1 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0
1 0 1 1 0 1 1 0 1 0 0 1 1 0 0 1 0 0 1 1 0 1 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1
1 1 0 1 1 0 1 1 0 1 0 0 1 1 0 0 1 0 0 1 1 0 1 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0
0 1 1 0 1 1 0 1 1 0 1 0 0 1 1 0 0 1 0 0 1 1 0 1 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0
0 1 1 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 1 0 1 1 0 1 1 0 1 1 0 1 1 0 0 1 1 0 0
1 0 1 1 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 1 0 1 1 0 1 1 0 1 1 0 1 1 0 0 1 1 0
1 1 0 1 1 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 1 0 1 1 0 1 1 0 1 1 0 1 1 0 0 1 1
0 1 1 0 1 1 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 1 0 1 1 0 1 1 0 1 1 0 1 1 0 0 1
1 0 1 1 0 1 1 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 1 0 1 1 0 1 1 0 1 1 0 1 1 0 0
1 1 0 1 1 0 1 1 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 1 0 1 1 0 1 1 0 1 1 0 1 1 0
0 1 1 0 1 1 0 1 1 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 1 0 1 1 0 1 1 0 1 1 0 1 1
1 0 1 1 0 1 1 0 1 1 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 1 0 1 1 0 1 1 0 1 1 0 1
1 1 0 1 1 0 1 1 0 1 1 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 1 0 1 1 0 1 1 0 1 1 0
0 1 1 0 1 1 0 1 1 0 1 1 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 1 0 1 1 0 1 1 0 1 1
1 0 1 1 0 1 1 0 1 1 0 1 1 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 1 0 1 1 0 1 1 0 1
0 1 0 1 1 0 1 1 0 1 1 0 1 1 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 1 0 1 1 0 1 1 0
1 0 1 0 1 1 0 1 1 0 1 1 0 1 1 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 1 0 1 1 0 1 1
1 1 0 1 0 1 1 0 1 1 0 1 1 0 1 1 1 1 0 1 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 1 0 0 1 0 1 1 0 1
0 0 1 0 0 1 1 1 1 1 1 1 0 1 1 0 1 1 0 0 1 1 0 1 1 0 1 1 0 0 1 0 0 1 0 0 0 0 0 1 0 0 1 1
0 0 0 1 0 0 1 1 1 1 1 1 1 0 1 1 0 1 1 0 0 1 1 0 1 1 0 1 1 0 0 1 0 0 1 0 0 0 0 0 1 0 0 1
0 0 0 0 1 0 0 1 1 1 1 1 1 1 0 1 1 0 1 1 0 0 1 1 0 1 1 0 1 1 0 0 1 0 0 1 0 0 0 0 0 1 0 0
1 0 0 0 0 1 0 0 1 1 1 1 1 1 1 0 1 1 0 1 1 0 0 1 1 0 1 1 0 1 1 0 0 1 0 0 1 0 0 0 0 0 1 0
0 1 0 0 0 0 1 0 0 1 1 1 1 1 1 1 0 1 1 0 1 1 0 0 1 1 0 1 1 0 1 1 0 0 1 0 0 1 0 0 0 0 0 1
0 1 1 0 1 1 0 1 1 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 1 1 1 1 1 1 1 1 1 1 0 1 1 0 1 0 0 1 0 1
0 0 1 1 0 1 1 0 1 1 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 1 1 1 1 1 1 1 1 1 1 0 1 1 0 1 0 0 1 0
1 0 0 1 1 0 1 1 0 1 1 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 1 1 1 1 1 1 1 1 1 1 0 1 1 0 1 0 0 1
0 1 0 0 1 1 0 1 1 0 1 1 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 1 1 1 1 1 1 1 1 1 1 0 1 1 0 1 0 0
1 0 1 0 0 1 1 0 1 1 0 1 1 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 1 1 1 1 1 1 1 1 1 1 0 1 1 0 1 0
1 1 0 1 0 0 1 1 0 1 1 0 1 1 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 1 1 1 1 1 1 1 1 1 1 0 1 1 0 1
1 0 1 0 0 1 0 1 0 0 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 0 1 1 0 1 1 0 1 1 1 0 0 1 1
0 1 0 1 0 0 1 0 1 0 0 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 0 1 1 0 1 1 0 1 1 1 0 0 1
0 0 1 0 1 0 0 1 0 1 0 0 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 0 1 1 0 1 1 0 1 1 1 0 0
0 0 0 1 0 1 0 0 1 0 1 0 0 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 0 1 1 0 1 1 0 1 1 1 0
0 0 0 0 1 0 1 0 0 1 0 1 0 0 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 0 1 1 0 1 1 0 1 1 1
1 1 0 0 1 0 0 1 1 0 1 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 0 0 1 0 1 1 1 1 0
0 1 1 0 0 1 0 0 1 1 0 1 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 0 0 1 0 1 1 1 1
0 0 1 1 0 0 1 0 0 1 1 0 1 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 0 0 1 0 1 1 1
1 0 0 1 1 0 0 1 0 0 1 1 0 1 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 0 0 1 0 1 1

Figure 7-4 Matrix to Advance External LFSR 2^{43} Shift Cycles

The scramble sequence is long enough to scramble a superframe lasting 360 ms, or 4320 bits for two-slot TDMA. The scramble sequence consists of shifting the LFSR register with the seed value to obtain 4320 bits. The signal bits corresponding to bits to be scrambled are then exclusive-or'ed with the corresponding bits in the scramble sequence. The bits of the scramble sequence corresponding to signal bits that are not scrambled or not used are discarded.

The inbound and outbound signal bits that shall be scrambled are the bits corresponding to the voice frames and the ESS signals in the Inbound 4 Voice

Burst shown in Figure 4-2, the Inbound 2 Voice /Short Signaling Burst shown in Figure 4-3, the Outbound 4 Voice Burst shown in Figure 4-4, and the Outbound 2 Voice Burst shown in Figure 4-5. All signaling bursts sent on the FACCH and SACCH shall also be scrambled except those that contain either a Network Status Broadcast MAC message or a MAC_END_PDU. Bursts that contain a MAC_END_PDU are sent unscrambled to allow identification of the color code of potential interfering systems. Signaling bursts containing the Network Status Broadcast MAC message are never scrambled as this message provides the information required for descrambling. Since there is no mechanism provided to scramble only a subset of the messages in a signaling burst, the entire signaling burst will not be scrambled in this case. The scrambled signal bits include both the information and the parity checks for any forward error correction.

The bits for Ramp and Guard times, Pilots, and DUID given in Figure 4-2 and Figure 4-3 are not scrambled. The bits for ISCH and DUID given in Figure 4-4, Figure 4-5, and Figure 4-8 are not scrambled. The bits for ISCH, DUID, and sync in Figure 4-6 and Figure 4-7 are not scrambled. There is no scrambling of information on any FDMA control channel, or any FDMA traffic channel.

The DUID information bits given in Table 5-3 indicate whether or not the SACCH or FACCH bursts (IEMI, S-OEMI, and I-OEMI) are scrambled (Figure 4-6, Figure 4-7, and Figure 4-8).

The scramble sequence restarts with the seed value at the beginning of each superframe. Figure 7-5 provides the locations for the start and end of the scrambling sequence for outbound as well as the start and end location for each of the inbound bursts for both VCH0 and VCH1. Each slot corresponds to a 30 msec duration and contains one of the bursts described in Clause 4. Note that the start of the outbound superframe begins half-way through the ISCH that began in the previous slot. Offsets for the inbound bursts are given at the slot boundaries.

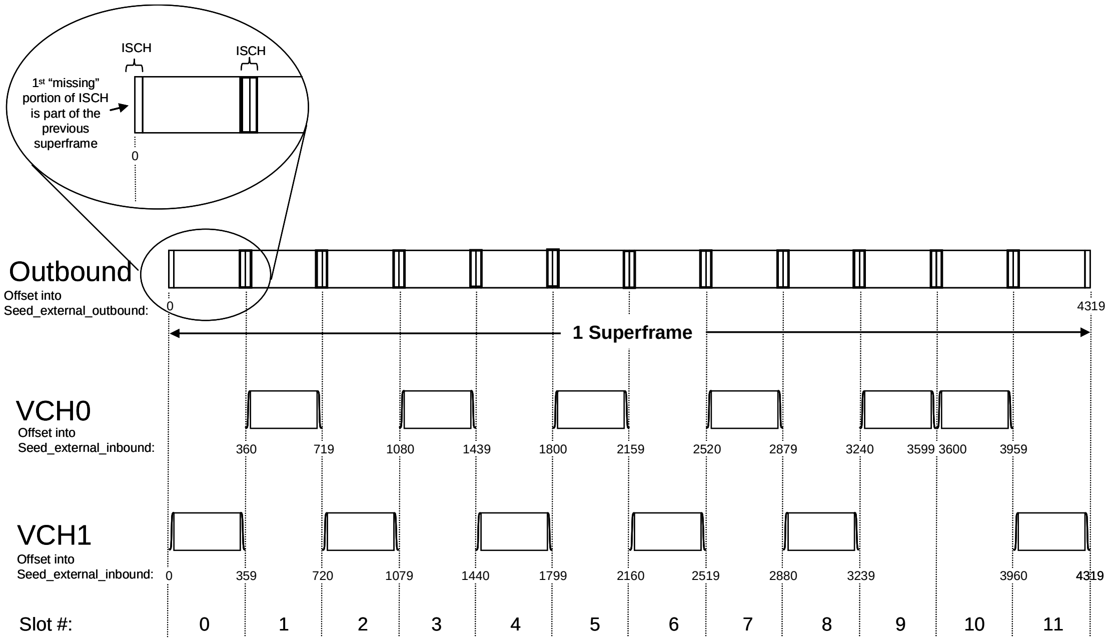


Figure 7-5 Scrambling Sequence Offsets

The receiver unscrambles the signal after demodulation but prior to any forward error correction or any other decoding functions. The purpose of scrambling is that interfering signals using a different scramble sequence can not decode any usable voice information.

7.2.6 Power Control

7.2.6.1 Introduction

Adaptive radio frequency power control may be used by the SU on the traffic channel. It allows the system to minimize the transmitted power from the SU while maintaining the quality of the inbound radio path of the TCH. The system can often reduce interference from common sources such as co-channel or adjacent channel subscribers by minimizing the transmitted radio power levels. Reduced power levels might also reduce SU power consumption. Two methods of adaptive radio frequency power control may be used, one is open loop, and the other is closed loop.

No dynamic power control is provided on the outbound path to control the transmit power of the FNE.

7.2.6.2 Open Loop Power Control on Inbound VCH

The first power control method presented is referred to as an open loop power control and implementation impacts the SU only. The SU may adapt its transmitted power to the power level of the signal received from the FNE, or it may use a default power setting.

7.2.6.3 Closed Loop Power Control on Inbound VCH

The second power control method presented is a closed loop power control and implementation impacts both the FNE and SU. In this second method, the SU may adapt its transmitted power level based on the information provided in the Power Control Signal Quality message transmitted by the FNE. The FNE may calculate the power level of the signal being received by the FNE coming from the SU and optionally calculate an estimate of the received BER coming from the SU. The FNE may provide this information to the SU in the Power Control Signal Quality message. The SU then makes a decision to reduce or increase its transmitted power level.

The Power Control Signal Quality message may be included in some MAC PDUs directed to a transmitting SU.

When the transmitting SU receives a Power Control Signal Quality message with its ID, it should reduce or increase it's transmit power as appropriate in response to the signal quality reported by the FNE (See 8.4.3).

The algorithm that manages the decision making for the closed loop power control command at the SU MAC side is outside of the scope of this document.

The form of the Power Control Signal Quality message RF level is described in subclause 8.4.3, and the BER is described in subclause 8.4.4.

7.3 Voice Channel Procedures

In a typical call, a requestor initiates a voice call request to the FNE which provides a VCH grant message indicating the channel resource to use for the requested call. If the requesting resource is a non-RF device (e.g., a console, remote site, etc.) then the voice frames are commonly collected at the FNE, encoded and formatted per this document, and output on the appropriate channel to the destination SU's.

If the requesting resource is an SU, then other processing has to be performed as well as repeating the inbound VCH information on the outbound path. The inbound bursts have to be demodulated, identified as to the type, and decoded with appropriate error correction. If the call is to be repeated, the decoded bursts have to be re-encoded and transmitted through the downlink channel. As part of the repeat process, inbound and outbound voice bursts are staggered in time (if inbound bursts occur on the even slots, the outbound bursts are on the odd slots and vice versa.)

When using an FDMA CCH, the procedures for service requests and grants on the FDMA CCH are the same as Phase 1 [R1]. Once a grant is received on the FDMA CCH, SUs move to the TDMA VCH. Unlike an FDMA VCH, TDMA VCH operation requires some amount of initial and ongoing SU/FNE synchronization for both talker and listening radios. This synchronization is described in 7.2.4. This subclause describes the procedures for operating on a TDMA VCH beyond synchronization procedures.

The procedures in [R1], originally written for an FDMA VCH, apply when using a TDMA VCH unless superseded by this document.

7.3.1 Assigned VCH Initial Access Procedures (Call Setup)

Once a TDMA VCH has been assigned, the assigned BR shall begin sending MAC_ACTIVE PDUs in the FACCH and SACCH on the assigned RF channel and slot. The MAC_ACTIVE PDUs sent in the FACCH shall contain a voice channel user message but may contain other messages as well. These MAC_ACTIVE PDUs are sent until the BR either determines the call failed or has inbound audio or signaling from the talker radio to send. The voice channel user message shall contain the source and destination ID of the voice call, if known, and may indicate the emergency state of the call from the trunking assignment if the FNE is capable of maintaining the emergency state during emergency calls. See [R1], clause 11 for detailed procedures on group and emergency call procedures. During this phase of call setup, the MAC_ACTIVE PDUs being sent on the FACCH and SACCH of the assigned slot may contain other messages not associated with the voice channel user in addition to a voice channel user message. See 7.2.2.2 for priorities associated with the use of the outbound SACCH in this phase of the assigned call.

If the alternate slot is unassigned, the BR sends MAC_IDLE PDUs on both the FACCH and SACCH on the unassigned slot. The MAC_IDLE PDUs sent on the unassigned slot may provide general information. See 7.2.1 for priorities associated with the use of the outbound SACCH on an unassigned slot.

After the FNE transmits a VCH grant message for a call request on the CCH, a unique radio SU has received the right to talk. After receiving an FDMA CCH grant for a requested voice service as described in [R1] the talker radio synchronizes to the assigned TDMA VCH in one of two ways as described in 7.2.4. After having acquired symbol synchronization and knowledge of the slot numbering and location within the superframe and location within the ultraframe, the talker radio is ready to send the first inbound burst. The talker radio's readiness to send the first burst may fall in any timeslot within a superframe and any superframe within an ultraframe.

The talker radio shall begin the TDMA VCH transmissions by sending two MAC_PTTs on the FACCH, and may send a MAC_PTT on the SACCH if the SACCH is adjacent to a FACCH that a MAC_PTT was transmitted on. When the talker radio is initiating an individual call (unit to unit or telephone interconnect), the reserved group ID of zero is used in the group address portion of the MAC_PTT PDU and the source ID is that of the talker radio.

The FNE synchronizes to the inbound transmissions of the talker radio as described in 7.2.4. Having received one or more MAC_PTT PDUs from the talker radio, the FNE shall generate one outbound MAC_PTT PDU on the outbound FACCH for each MAC_PTT PDU received on the inbound FACCH. The FNE may send an additional MAC_PTT PDU on the outbound SACCH if the SACCH is adjacent to an outbound FACCH that a MAC_PTT PDU was transmitted on. If only one MAC_PTT PDU is received by the FNE and it was received on the SACCH, the FNE shall generate the corresponding outbound MAC_PTT PDU on the outbound FACCH. Should the FNE only successfully decode one inbound MAC_PTT PDUs from the talker radio, the FNE may generate a second MAC_PTT PDU on the outbound FACCH.

At this point, the call setup mode for both the BR and talker radio is completed. Further voice procedures describing operation during the call are detailed in 7.3.2.

After receiving an FDMA CCH grant for a voice service as described in [R1] the listening radio synchronizes to the assigned TDMA VCH in one of two ways as described in 7.2.4. Having the slot and channel numbering and knowing the location within the superframe and the location within the ultraframe, the listening radio monitors the outbound FACCH and SACCH. For group calls, radios shall check the advertised group ID on the VCH. If an SU determines the received group address does not match the group ID obtained from the VCH grant message and the group ID is non-zero, the radio shall return to the control channel. For individual calls, radios shall check the advertised target and source IDs/addresses on the VCH. If an SU determines its own ID/address does not match either the received source or target ID/address in the advertised individual call voice channel user message on the voice channel and the IDs are non-zero, the radio shall return to the control channel.

During the call setup phase of the call, the FNE determines whether listening radios are allowed to use the inbound SACCH. The FNE controls the use of the inbound SACCH by listening radios using the FR bit contained in the I-ISCH. Listening radios shall obey use of the inbound SACCH according to the FR bit.

Reception of one or more of the MAC_PTTs in the outbound transmission completes the call setup phase for the listening radios. Further voice procedures describing operation during the call are detailed in 7.3.2.

7.3.2 Assigned VCH Maintenance Procedures (Traffic Mode)

After a talker radio completes the inbound transmission of the MAC_PTTs, the talker radio begins sending voice bursts and SACCHs. Voice burst types and sequencing is described in 6.1. A talker radio indicates voice framing in the offset field of MAC_ACTIVE PDUs and in any MAC_PTT PDUs transmitted.

After completing the outbound transmission of MAC_PTTs on the FACCH, the BR stops sending FACCH and begins outbound transmission of the received voice bursts associated with the call's audio source as determined by the FNE. The outbound audio source establishes voice framing and the FNE advertises the voice framing as described in 7.2.4.2. BR transmission of voice bursts constitutes the start of the outbound traffic mode phase of the call.

After completing the outbound transmission of MAC_PTTs, the FNE continues placing MAC_ACTIVE PDUs in the outbound SACCH. When a talker radio is the source of outbound audio, the FNE sends voice channel user messages containing the identifier of the talker radio in outbound SACCH intended for listening radios and the talker radio. When the FNE is the source of outbound audio and there is no inbound talker, the FNE sends voice channel user messages containing the WUID of the FNE audio source in outbound SACCHs intended for listening radios and voice channel user messages containing the zero ID in outbound SACCHs intended for the talker radio. The outbound SACCH for the talker radio containing the talker ID information is required at the talker radio site and optional at other sites. See 7.3.5 for procedures associated with audio preemption scenarios.

After completing the inbound transmissions of MAC_PTTs and following the ultraframe rules for the use of inbound SACCH, the talker radio uses the inbound SACCH opportunities to send information related to the assigned call itself, information related to the talker radio itself such as Talker ID, or information in response to messages received from the FNE in the outbound SACCH intended for the talker radio. The talker radio adheres to the ultraframe rules for sending inbound SACCH bursts as described in 3.2.2.

The FNE has a fixed SACCH ultraframe schedule as described in 3.2.2. During the traffic mode of the call, the FNE's use of the outbound SACCH is as described in 7.2.2.2. Following the rules of the SACCH ultraframe in 3.2.2 the FNE may use outbound SACCHs in an ultraframe for signaling intended for listening radios or the talker radio. When sending a VCU message in an outbound SACCH intended for listening radios the FNE inserts the ID of the outbound audio source in the VCU message. When sending a VCU message in an outbound SACCH intended for the talker radio, the FNE inserts the ID of the FNE selected inbound audio source in the VCU message. The talker radio uses the ID of the FNE selected inbound audio source to determine if it should continue transmitting. If an outbound SACCH defined by the ultraframe rules as intended for the talker radio contains a zero ID or an ID matching the ID of the talker radio, either in a MAC_PTT PDU[3] or VCU of a MAC_ACTIVE PDU, the talker radio continues to transmit. If there is an ID mismatch, the talker radio has not been selected by the FNE as the inbound audio source and the talker radio ceases transmissions, optionally sending MAC_END_PTTs per 7.3.3 before reverting to a listening radio. In cases where the ID in the outbound SACCH intended for the talker radio contains the reserved ID of zero, the talker radio continues transmitting and monitors the next outbound SACCH intended for the talker radio.

During the traffic mode of the call, listening radios may use the inbound SACCH for audio preemption signaling as described in 7.3.5.

7.3.3 Assigned VCH Termination (Call Teardown)

A voice sequence may be stopped at any voice burst within the voice framing sequence (See Figure C-6), i.e., it is not necessary for the talker or the BR to wait for the end of a voice sequence (superframe) to transmit the terminator message.

Upon sending the last voice burst, the talker radio shall send at least two inbound MAC_END_PTT PDUs on the FACCH but may send up to three. The talker radio may transmit an additional MAC_END_PTT PDU on the SACCH if the SACCH is adjacent to a FACCH that a MAC_END_PTT PDU was transmitted on.

---

[3] Normally no SACCH should contain a MAC_PTT during the maintenance portion of a call, however there may be some transitional cases where this may occur, thus the reference.

After completion of its initial voice transmission, the SU shall remain on the channel in receive/idle mode awaiting further voice transmissions or the call termination message.

When the FNE has decided to release the assignment of the VCH, it shall send at least two MAC_END_PTT PDUs on the outbound FACCH, however the total number of MAC_END_PTTs to send on the FACCH is left up to the manufacturer. The FNE may transmit additional MAC_END_PTTs on the SACCH if the SACCH is adjacent to a FACCH that a MAC_END_PTT was transmitted on. For a group call, the group address in the MAC_END PTT PDU matches the call and the source address is 0xFFFFFF. For an individual call, the group address in the MAC_END PTT PDU is 0 and the source address is either 0xFFFFFF, or it matches either the source or target address of the call.

Upon receipt of a MAC_END_PTT PDU on the assigned VCH, and having verified it contains the correct color code, the SU shall return to the idle state on the control channel.

7.3.3.1 Transmission Trunked Termination

Transmission trunking applies to group or individual voice services and is based on a single transmission from the service initiator. The voice service is requested and granted per the detailed procedures of the specific call type [R1]. When the FNE detects the end of the transmission from the initiating SU or FNE audio source, the FNE shall finish transmitting any buffered audio. The FNE terminates the call by sending a minimum of two MAC_END_PTT PDUs on the outbound FACCH, however the total number of MAC_END_PTTs to send on the FACCH is left up to the manufacturer. The FNE may send additional MAC_END_PTTs on the SACCH, if the SACCH is adjacent to a FACCH that a MAC_END_PTT was transmitted on.

7.3.3.2 Message Trunked Termination

Message trunking applies to group or individual voice services and allows multiple SUs to exchange voice messages on the assigned traffic channel, prior to the voice service being terminated. The voice service is requested and granted per the detailed procedures of the specific call type.

When the FNE detects the end of the transmission from the initiating SU or FNE audio source, the FNE shall finish transmitting any buffered audio before beginning to send MAC_HANGTIME PDUs on the outbound FACCH and SACCH. These PDUs contain messages which may include either Group Voice Channel User, Unit to Unit Voice Channel User or Telephone Interconnect Voice Channel User, (depending on call type) to signal the individual/group in use, and may include other MAC PDU messages as described in 8.2.3.

The MAC_HANGTIME PDU messages are sent until either:

a) a predetermined number of MAC_HANGTIME PDUs have been sent, or an FNE hang timer has expired. In either case the FNE shall terminate the call per the procedures in 7.3.3.1
or;

b) one of the participant SUs of the call in progress initiates another voice transmission (call continuation) Refer to 7.3.4 for procedures related to call continuation during hang time.

7.3.4 Assigned VCH Message Trunking Call Continuation Procedures (Hangtime continuation)

Message trunked group calls and message trunked individual unit to unit calls require that listening radios first verify that the call is in the hangtime state prior to attempting call continuation. This verification consists of determining the presence of the outbound FACCH containing MAC_HANGTIME PDUs instead of outbound voice bursts. MAC_HANGTIME PDUs may also be found on the SACCH. Message trunked individual telephone interconnect calls do not require that listening radios first verify that the call is in the hangtime state prior to attempting call continuation.

There are two methods for participant SUs to continue the assigned call during message trunking hangtime. The first method consists of requesting the right to talk on the CCH, whereas the second one consists of beginning a voice transmission directly on the VCH. These methods are described in the following subclauses. The choice between the types of call continuation to be used for group and individual unit to unit calls is the responsibility of the FNE. The SUs shall support both methods of call continuation for group and individual unit to unit calls. The FNE advertises the method to be used for group and individual unit to unit calls in RFSS status broadcast messages sent on the CCH and optionally on the VCH. The SUs shall determine the FNE advertised method prior to attempting a group or an individual unit to unit call continuation. For individual telephone interconnect calls the VCH method shall be used.

7.3.4.1 Call Continuation on CCH

The SU assigned to the traffic channel during hangtime receives MAC_HANGTIME PDUs that may contain a voice channel user message. During Hangtime, a minimum of one voice channel user message for the call shall be sent a minimum of once per superframe. During hangtime:

a) listening SUs remain on the assigned traffic channel in the receive state until a MAC_END_PTT PDU message is received,
or

b) listening SUs may use the control channel method of call continuation by returning to the control channel and issuing a voice service request for the same call in which case the FNE shall respond to the request per the detailed procedures of the specific service type.

When a request for a message trunked service is received on the control channel before the service is terminated, the FNE shall respond to the request per the detailed procedures of the specific service type. If the request is granted, the RFSS sends the service grant message on the control channel, and the initiating SU shall then tune to the designated traffic channel and slot and begin its transmission following the initial access procedures described in 7.3.1. The FNE procedures for call continuation also follow the initial access procedures described in 7.3.1. Once voice traffic begins, the traffic mode procedures are as described in 7.3.2.

If the response to the service request is anything but a service request grant, the requesting SU shall remain on the control channel, following the detailed procedures associated with the particular call type. Note that the Control Channel signaling may direct the SU to rejoin the call as a listener either through a channel assignment update or assignment to another SU. In either scenario, the SU shall move to the VCH as a listening radio following the procedures described in 7.3.1.

If the FNE receives multiple requests for continuation of the same call (i.e., at different sites within the system) the FNE may grant the call to the first request received. Optionally, the FNE may grant the call to the unit with the highest configured user priority or highest priority call option (such as an emergency call on the same working group). The method for the FNE determining which requestor to grant is left to the FNE manufacturer.

7.3.4.2 Call Continuation on VCH

The SU assigned to the traffic channel during hangtime receives MAC_HANGTIME PDUs that may contain a voice channel user message. During Hangtime, a minimum of one voice channel user message for the call shall be sent a minimum of once per superframe.

During hangtime:

a) listening SUs remain on the assigned traffic channel in the receive state until a MAC_END_PTT PDU message is received,

or

b) listening SUs may use the voice channel method of call continuation by beginning a voice transmission directly on the VCH.

When the call continuation uses the voice channel method, the talker radio begins the TDMA VCH transmissions by sending MAC_PTT PDUs per 7.3.1 before sending any voice bursts.

A talker radio shall also listen to all the outbound SACCH timeslots within the SACCH ultraframe that are dedicated to the talker. Once the talker SU decodes an outbound SACCH, the SU does one of the following:

a) If the SACCH burst intended for a talker radio carries a MAC_PTT PDU or MAC_ACTIVE PDU that contains a non-zero WUID that does not match the WUID of the talker radio, the radio SU shall consider it has lost the right to talk on this VCH and may optionally send MAC_END_PTTs on the inbound path of the VCH per 7.3.3 and optionally notify the user that the transmission failed.
b) If the SU cannot detect a SACCH burst with which to determine whether it has, or has not, won the right to talk on this VCH then it shall finish the current voice burst and send MAC_END_PTTs on the inbound path of the VCH per 7.3.3 and optionally notify the user that the transmission failed. The SU shall wait a minimum of two ultraframes before assuming it has not won the right to transmit, but may optionally wait more than two ultraframes before assuming it has not won the right to transmit.
c) If the SACCH burst intended for a talker radio carries a MAC_PTT PDU or MAC_ACTIVE PDU that contains a WUID that does match the WUID of the talker radio, the radio SU shall consider it has the right to talk on this VCH and continues to do so until some other event occurs which prompts the SU to stop transmitting (user unkey, etc.). Note that since subscribers have non-zero values for their WUID, any matching WUID is also non-zero.

Note: If the FNE detects multiple transmissions for the same call (i.e., at different sites within the system) the FNE shall select only one audio source to be routed to the sites involved in the call for repeat transmission. The method for determining which audio source to select is left to the FNE manufacturer.

7.3.5 Assigned VCH Preemption

Two types of assigned VCH preemption can occur as follows:

- VCH Audio Preemption (Audio Takeover) – the call continues, but the talker audio is replaced with another talker on the same group
- VCH Call Preemption (Call Takeover) – the current call is terminated and the RF resource is assigned to a different call

For each type of VCH preemption, there are two procedures by which to signal and set up the preemption:

- Control channel (CCH) method – the preemption request/grant is made via the control channel, with additional voice channel signaling to control the transition.

- Voice channel (VCH) method – the preemption request/grant is made via the voice channel, with additional voice channel signaling to control the transition.

VCH Audio and VCH Call preemption are signaled on the voice channel using the C/A bit as follows:

- Audio Preemption: C/A=1

- Call Preemption: C/A=0

If the FNE receives multiple requests for preemption of the same call (i.e., at different sites within the system) the FNE may grant the preemption to the first request received. Optionally, the FNE may grant the preemption to the unit with the highest configured user priority or highest priority call option (such as an emergency call on the same working group). The method for the FNE determining whether to grant and, if so, which requestor to grant is left to the FNE manufacturer.

In any of the subsequent preemption procedures, the method of user notification of preemption is left up to the SU manufacturer. The U/F and C/A bit values that are given here are specifically defined in 8.4.6 and 8.4.7 respectively.

In the following descriptions, a talker radio is denoted for sake of brevity as a talker.

7.3.5.1 VCH Audio Preemption

Audio Preemption occurs within a talkgroup call at the discretion of the infrastructure. This type of preemption switches the outbound audio source during the call. This allows a talkgroup member with a higher individual priority than the currently assigned talker to become the source of outbound audio. Some examples of this are console or supervisory SU preemption on the same group.

The previously assigned talker may be allowed to continue transmitting, or may be signaled to stop transmitting. For example, when the new talker is at a different site or is a console, the previous talker’s audio may be routed to a dispatch device. Alternatively, the previous talker may be signaled to stop transmitting, for example, when the new and previous talkers are located at the same site.

7.3.5.1.1 VCH Audio Preemption Procedure

For VCH Audio Preemption:

- The FNE may grant or deny the request. The decision to allow, or deny, a VCH Audio Preemption is left to the FNE manufacturer.

- Console sourced audio shall always take outbound audio path priority over repeat audio from an SU.

7.3.5.1.1.1 Audio Preemption Request

An SU listening to an assigned VCH transmission shall request an audio preemption using either the control channel or the assigned voice channel as follows.

a) Control Channel method: An SU requesting audio preemption of an active voice call using the control channel method returns to the control channel and issues a voice service request for the same call.
b) Voice Channel method: An SU requesting preemption of an active voice call using the voice channel method begins by transmitting a voice service request for the same call on the next available listener inbound SACCH slot.

Requests initiated by the FNE are not described in this document.

7.3.5.1.1.2 System Response

Upon receiving an audio preemption request the FNE responds using a matching control channel or assigned voice channel method as follows:

a) Control Channel method: The FNE shall respond to the request per the detailed procedures of the specific service type. The following messages are valid responses to a voice service request, though a FNE need not generate all these messages:

    - A channel grant (e.g. GRP_V_CH_GRANT) if the FNE determines that the preemption request can be granted;
    - A QUE_RSP if the FNE cannot proceed with audio preemption establishment due to temporary lack of resources. The QUE_RSP shall quiet SU retries until a grant or deny is issued by the FNE. The FNE may issue a QUE_RSP before the grant while performing a forced talker preempt on the talk channel to free up the resources (see 7.3.5.1.1 for this process); or
    - A DENY_RSP if the FNE determines that the audio preemption cannot be permitted.

- An ACK_RSP_FNE if the FNE wishes to quiet SU retries until a grant, queue, or deny is issued by the FNE.

The above messages are considered valid audio preemption responses if they address the WUID of the unit initiating the request.

b) Voice Channel method: The FNE may grant or deny the request and provides this response through the outbound listener SACCH using messaging defined in 8.2. The FNE shall provide a valid response in an outbound listener SACCH within one ultraframe time. The following messages are valid responses to a voice service request, though a FNE need not generate all these messages:
    - A GRANT if the FNE determines that the preemption request can be granted;
    - A DENY if the FNE determines that the audio preemption cannot be permitted.
    - An ACK_RSP_FNE if the FNE wishes to quiet SU retries until a grant or deny is issued by the FNE.

When the FNE grants a request for an audio preemption the FNE shall begin routing the audio of the newly granted SU.

7.3.5.1.1.3 Requesting Subscriber Unit Actions

SU actions to a valid response are as follows:

a) Control Channel method:
    - If a channel grant is received, the SU shall tune to the channel/slot specified in the channel grant message and begin transmitting MAC_PTT PDUs per 7.3.1 containing encryption sync information followed by voice bursts; or
    - If a QUE_RSP is received, the SU shall wait for further signaling, and may indicate to the user the progress of the request. The QUE_RSP shall quiet SU retries until a grant or deny is issued by the FNE; or
    - If a DENY_RSP is received, the SU shall return to the idle state, and may indicate to the user the reason for the failure of the audio preemption request. The SU may subsequently be directed to rejoin the call as a listener through a channel assignment update, or assignment to another SU.
    - If an ACK_RSP_FNE is received, the SU shall stop retries of the current request and shall wait for further signaling from the FNE.

b) Voice Channel method:

- If a grant is received, the SU shall then tune to the transmit slot and begin transmitting MAC_PTT PDUs per 7.3.1 containing encryption sync information followed by voice bursts.
- If the request is denied the SU shall continue as a receiver in the current call, and may indicate to the user the reason for the failure of the audio preemption request.
- If the request is ACK_RSP_FNE, the SU remains in receive mode waiting for a Grant or Deny and does not retry the request. While waiting for a Grant or Deny, if the requesting SU decodes a MAC_ACTIVE PDU in an outbound SACCH intended for a talking radio that contains a voice channel user message with the requesting SUs ID, the SU shall assume it failed to decode the Grant and the SU shall then tune to the transmit slot and begin transmitting MAC_PTT PDUs per 7.3.1 containing encryption sync information followed by voice bursts.
- If no response is received, then the SU shall wait a minimum of one ultraframes, but may optionally wait more than two ultraframes, before determining that the FNE failed to decode the request. During this time the SU monitors the outbound transmission for either a grant or deny or Ack response, or, in the case of SU response decode failure, a MAC_ACTIVE PDU in an outbound SACCH intended for a talking radio that contains a voice channel user message with the requesting SUs ID that indicates that the FNE has granted the audio preemption. At the end of this period, if it is determined that the FNE has failed to decode the request, the SU may retry the request, or indicate the failure of the audio preemption request to the user.

7.3.5.1.1.4 Voice Channel Transition and Signaling

During the VCH transition time between talkers, the FNE behaves as a message trunked channel, but disallows users other than the SU requesting preemption from gaining access by using the ISCH FR bit set to zero to disallow inbound SACCH preemption requests.

The FNE signals the current talker on the voice channel that a preemption is occurring in an outbound SACCH destined for the talker. This signaling shall indicate:

- Audio preemption (C/A=1): The talker is permitted to remain on the voice channel.

During an audio preemption by FNE sourced audio, the FNE may optionally decide to either signal the talker to stop transmitting (forced audio preemption) or allow the talker to continue transmitting (unforced audio preemption) as follows:

- Forced preemption (U/F=1): The SU shall cease transmitting,
- Unforced preemption (U/F=0): The SU may continue transmitting.

The FNE may inform a talker of the audio preemption by sending a MAC_Release with U/F = 0/1 (continue/stop transmitting) and C/A = 1 (stay on the channel) in an outbound SACCH destined for the talker. The talker behaves as follows:

a) When the talker SU receives a MAC_Release with U/F=1 on the outbound SACCH, it shall end the voice bursts currently in progress and subsequently transmit MAC_END_PTTs per 7.3.3. It then begins to listen to the outbound voice channel.

b) When the talker SU receives a MAC_Release with U/F=0 on the outbound SACCH, it may still continue to transmit, or it may terminate the transmission and begin to listen to the outbound voice channel. The specific choice of action is left to the discretion of the SU manufacturer.

The voice channel audio preemption transition to the new talker begins with the FNE terminating repeat of the current transmission and sending either MAC_ACTIVE or MAC_PTT PDUs, whichever the FNE has, followed by repeat of the new talker's transmission. The listening radios see this and pick up the new talker ID and new crypto sync.

- In an audio preemption, the WUID in voice channel user messages inserted into MAC_ACTIVE PDUs intended for listener radios is the WUID of the new outbound audio source.
- In an audio preemption with forced preemption, the WUID in voice channel user messages inserted into MAC_ACTIVE PDUs intended for the talker is the WUID of the new outbound audio source.
- In an audio preemption with an unforced preemption, there is only one outbound talker but there may be more than one inbound talker, each at different sites. In this scenario, the WUID in voice channel user messages inserted into MAC_ACTIVE PDUs intended for the talker is the WUID of the talker at that site.

If a talker decodes a MAC_PTT or a voice channel user message containing a non-zero talker ID that does not match its ID, the talker should stop transmitting and continue as a receiver.

The FNE at non-talker sites may optionally send an outbound SACCH containing MAC_Release intended for the talker.

In a forced audio preemption scenario, the FNE sends voice channel user messages containing the new talker's WUID in MAC_ACTIVE PDUs contained in outbound SACCHs intended for a talker.

In an unforced audio preemption scenario, the FNE continues sending voice channel user messages containing the original talker's WUID in MAC_ACTIVE PDUs contained in outbound SACCHs intended for the talker at the site of the original talker and voice channel user messages containing the new talker's WUID in MAC_ACTIVE PDUs contained in outbound SACCHs intended for the talker at the site of the new talker. Note that in this scenario, the WUID in voice channel user messages inserted into MAC_ACTIVE PDUs intended for listening radios is the WUID of the outbound audio source.

If the audio preemption ends before the original talker has completed its transmission, the FNE returns the outbound audio path to the original (still transmitting) radio if possible and uses the talker's WUID in voice channel user messages inserted in MAC_ACTIVE PDUs contained in the outbound SACCHs intended for both listener and talker.

7.3.5.2 VCH Call Preemption

VCH Call Preemption occurs when the infrastructure determines that a channel is needed to service a higher priority call. This type of preemption ends an assigned call. Certain high priority calls (like an emergency) on a site with all channels assigned may trigger this type of preemption scenario.

7.3.5.2.1 VCH Call Preemption Procedure

For VCH Call Preemption:

- The FNE may grant or deny the request. The decision to allow, or deny, a VCH Audio Preemption is left to the FNE manufacturer.

7.3.5.2.1.1 Call Preemption Request

An SU listening on a voice channel shall request a new call using either the control channel or the assigned voice channel as follows.

a) Control Channel method: An SU listening on a voice channel shall return to the control channel and issue a voice service request for a different call.

b) Voice Channel method: An SU requesting preemption of an active voice call using the voice channel method begins by transmitting a service request for a different call on the next available listener inbound SACCH slot using messaging defined in 8.2.

    - The voice channel method for call preemption shall not be used when a control channel is available at the site.

Call preemption requests initiated by the FNE, or initiated by SUs already on the control channel, are not described in this document.

7.3.5.2.1.2 System Response

Upon receiving the new call request the FNE responds using a matching control channel or assigned voice channel method as follows:

a) Control Channel method: The FNE shall respond to the request per the detailed procedures of the specific service type. The following messages are valid responses to a voice service request, though a FNE need not generate all these messages.

   - A channel grant (e.g. GRP_V_CH_GRANT) if the FNE determines that the service request can be granted;
   - A QUE_RSP if the FNE cannot proceed with call preemption establishment due to temporary lack of resources. The QUE_RSP shall quiet SU retries until a grant or deny is issued by the FNE. The FNE may issue a QUE_RSP before the grant while performing a forced talker preempt on the talk channel to free up the resources (see 7.3.5.1.1 for this process); or
   - A DENY_RSP if the FNE determines that the call request cannot be permitted.
   - An ACK_RSP_FNE if the FNE wishes to quiet SU retries until a grant, queue, or deny is issued by the FNE.

   The above messages are considered valid call preemption responses if they address the WUID of the unit initiating the request.

b) Voice Channel method: The FNE may grant or deny the request and provides this response through the outbound listener SACCH using messaging defined in 8.2. The FNE shall provide a valid response in an outbound listener SACCH within one ultraframe time. The following messages are valid responses to a voice service request, though a FNE need not generate all these messages

   - A GRANT if the FNE determines that the new call request can be granted (see below for VHC transition procedures);
   - A DENY if the FNE determines that the new call request cannot be permitted. The FNE shall send the DENY_RSP message to the requesting SU in the listener outbound SACCH.
   - An ACK_RSP_FNE if the FNE wishes to quiet SU retries until a grant or deny is issued by the FNE.

After the FNE grants a request for a call preemption the FNE shall begin routing the audio of the newly granted SU.

7.3.5.2.1.3 Requesting Subscriber Unit Actions

SU actions to a valid response are as follows:

a) Control Channel method:

- If a channel GRANT is received (e.g. GRP_V_CH_GRANT), the SU shall tune to the channel/slot specified in the channel grant message and begin transmitting MAC_PTT PDUs per 7.3.1 containing encryption sync information followed by voice bursts; or
- If a QUE_RSP is received, the SU shall wait for further signaling, and may indicate to the user the progress of the call. The QUE_RSP shall quiet SU retries until a grant or deny is issued by the FNE; or
- If a DENY_RSP is received, the SU shall return to the idle state, and may indicate to the user the reason for the failure of the call. The SU may subsequently be directed to rejoin a call as a listener through a channel assignment update, or assignment to another SU.
- If an ACK_RSP_FNE is received, the SU shall stop retries of the current request and shall wait for further signaling from the FNE.

Note that other SUs monitoring the control channel may respond to the control channel signaling and join the new call as listeners.

b) Voice Channel method:

- If a grant is received, the SU shall then tune to the transmit slot and begin transmitting MAC_PTT PDUs per 7.3.1 containing encryption sync information followed by voice bursts.
- If the request is denied the SU shall return to the state prior to the request, and may indicate to the user the reason for the failure of the call preemption request.
- If the request is ACK_RSP_FNE, the SU remains in receive mode waiting for a Grant or Deny and does not retry the request. While waiting for a Grant or Deny, if the requesting SU decodes a MAC_ACTIVE PDU in an outbound SACCH intended for a talking radio that contains a voice channel user message with the requesting SUs ID, the SU shall assume it failed to decode the Grant and the SU shall then tune to the transmit slot and begin transmitting MAC_PTT PDUs per 7.3.1 containing encryption sync information followed by voice bursts.
- If no response is received, then the SU shall wait a minimum of one ultraframes, but may optionally wait more than two ultraframes, before determining that the FNE failed to decode the request. During this time the SU monitors the outbound

transmission for either a grant or deny or ack response, or, in the case of SU response decode failure, a MAC_ACTIVE PDU in an outbound SACCH intended for a talking radio that contains a voice channel user message with the requesting SUs ID that indicates that the FNE has granted the call preemption. At the end of this period, if it is determined that the FNE has failed to decode the request, the SU may retry the request, or indicate the failure of the call preemption request to the user.

7.3.5.2.1.4 Voice Channel Transition and Signaling

Depending on the circumstances of the call preemption such as the relative importance of the new call and whether both talkers are at the same site, the FNE may determine to use a polite transition or an impolite transition. In either case, the voice channel call preemption transition begins with the FNE terminating repeat of the current transmission.

a) FNE polite transition signaling:

- The FNE sends MAC_END_PTT PDUs per 7.3.3.1 in the outbound FACCH and optionally the outbound listener SACCH prior to granting the preemption request
- The FNE sends a MAC_Release message with C/A=0, the forced bit set (U/F=1), and the current talker's ID on the next talker outbound SACCH
- Having completed the outbound transmission of the MAC_END_PTT PDUs per 7.3.3.1 and at least one MAC_Release message, the FNE grants the call preemption request
- The FNE sends MAC_ACTIVE PDUs on the outbound FACCH containing a voice channel user message for the new call.
- The FNE sends MAC_ACTIVE PDUs on the outbound listener SACCH containing a voice channel user message with the WUID of the new outbound audio source
- The FNE begins transmission of the new outbound call beginning with MAC_PTT PDUs per 7.3.1 containing encryption sync information followed by voice bursts

b) FNE impolite transition signaling:

- The FNE grants the call preemption request
- The FNE sends MAC_ACTIVE PDUs on the outbound FACCH and outbound listener SACCH containing a voice channel user message with the WUID of the outbound audio source
- The FNE begins transmission of the new outbound call beginning with MAC_PTT PDUs per 7.3.1 containing encryption sync information followed by voice bursts

c) SU transition signaling responses:

- Upon receiving a MAC_END_PTT a listening SU shall leave the channel.
- If listening radios decode a MAC_PTT or a voice channel user message containing non-zero ID information that does not match the current assignment, the listening radios shall leave the voice channel. For group calls the group ID/Address is to be verified. For unit to unit calls the ID/Address of either the source

or target is to be verified. For individual telephone interconnect calls, the Source/Target ID/Address is to be verified.

- If a talker receives a MAC_Release message with Forced preemption (U/F=1) and with Call preemption (C/A=0): The talker SU shall send in two END_PTT PDUs on the inbound FACCH, stop transmitting and leave the channel.
- If a talker receives an outbound talker SACCH with a MAC_PTT PDU or MAC_ACTIVE PDU with a voice channel user message containing a non-zero WUID that does not match the WUID of the talker SU, the talker SU shall stop transmitting. Refer to 7.3.5.2 for further details.

8 MAC PDUs

8.1 MAC PDUs General Description

All MAC PDUs begin with an 8 bit MAC Header that consists of a 3 bit Opcode, a 3 bit Offset, and two Reserved bits and end with a 12 bit CRC. The 3 bit Opcode values are defined in 8.4.1 and the 12 bit CRC is defined in 8.4.5. The octets between the MAC Header and CRC depend on the value of the opcode.

The contents of the MAC_PTT PDU and the MAC_END_PTT PDU carry pre-defined information fields specific to beginning and ending calls. In contrast, the contents of the MAC_ACTIVE PDU, MAC_HANGTIME PDU and MAC_IDLE PDU are not predefined. The PDU type itself conveys information about the state of the voice channel and the PDU contents contain one or more generic MAC messages. The general structure of the MAC PDU is shown in Figure 8-1.

Note that all reserved bits are set to zero unless otherwise specified.

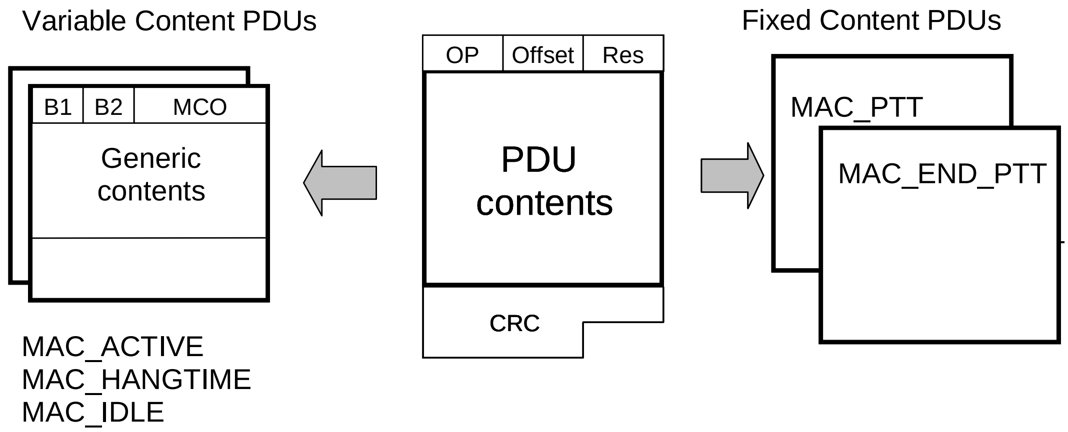


Figure 8-1 Structure of MAC PDU

8.1.1 Outbound MAC PDU

There are two types of outbound MAC PDUs. The first type of MAC PDU is carried by the I-OEMI, an outbound signaling burst without synchronization having a length of 22.5 octets. The second type of MAC PDU is carried by the S-OEMI, an outbound signaling burst with synchronization having a length of 19.5 octets. Both types of Outbound MAC PDUs are shown in Figure 8-2.

The outbound MAC PDU is composed of a MAC header field and a MAC information field. The MAC header is the first octet of the PDU.

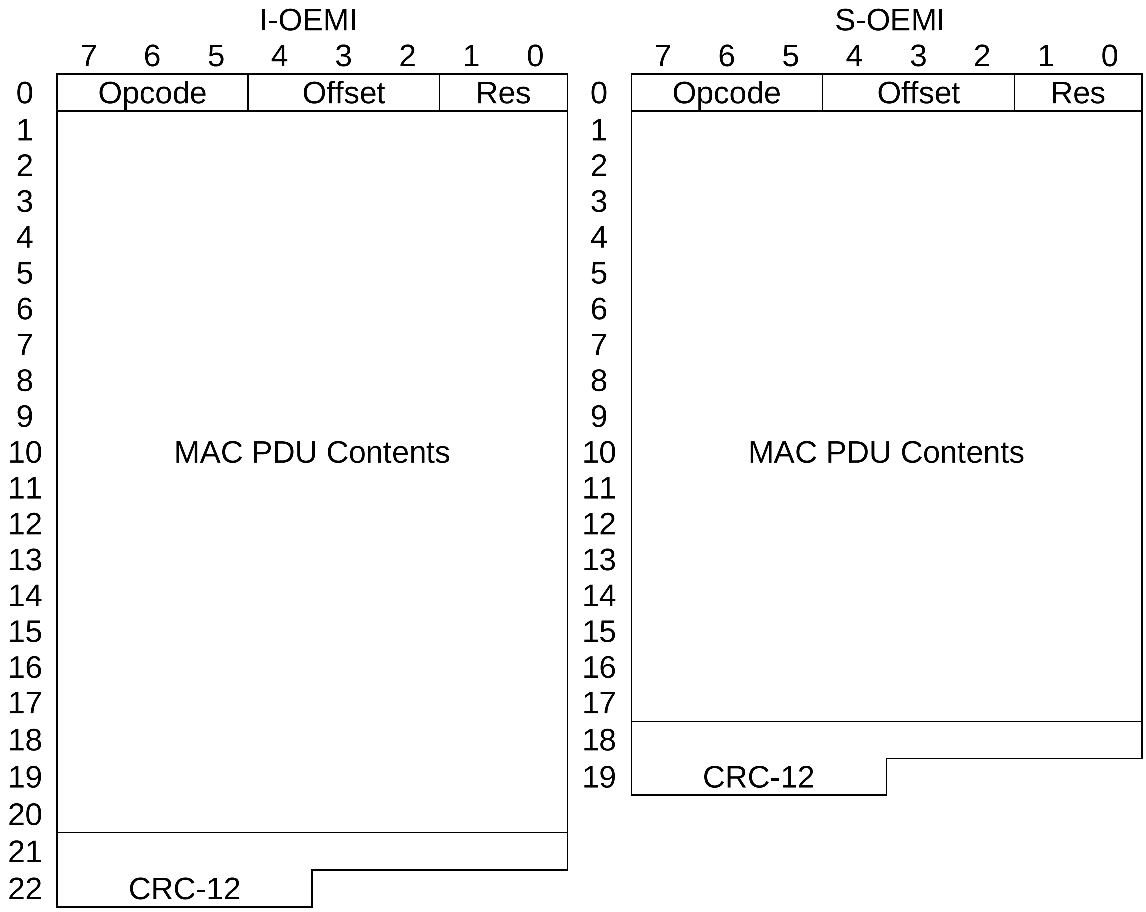


Figure 8-2 Outbound MAC PDU Formats

8.1.2 Inbound MAC PDU

The inbound MAC PDU is carried by an inbound signaling burst (i.e., with synchronization) in the IEMI and has a length of 19.5 octets. The inbound MAC PDU is shown in Figure 8-3. The MAC header is the first octet of the PDU.

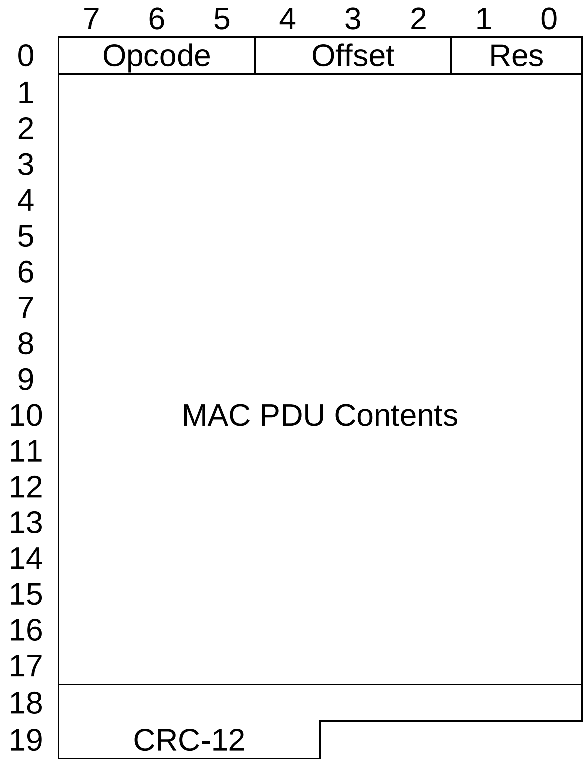


Figure 8-3 Inbound MAC PDU in IEMI (19.5 octets)

8.2 Exhaustive Description of MAC PDUs

8.2.1 MAC_PTT PDU

The MAC_PTT PDUs are the equivalent of the Header Data Unit (HDU) in Phase 1. They provide the Message Indicator for, the Algorithm ID, and Key ID for encrypted voice calls as well as the source and target (Group) addresses. All of this information uses a CRC for validation.

<table>
<tr><th></th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>0</td><td colspan="3">Opcode</td><td colspan="3">Offset</td><td colspan="2">Res</td></tr>
<tr><td>1
2
3
4
5
6
7
8
9</td><td colspan="8">Message Indicator (MI)</td></tr>
<tr><td>10</td><td colspan="8">Algorithm ID</td></tr>
<tr><td>11
12</td><td colspan="8">Key ID</td></tr>
<tr><td>13
14
15</td><td colspan="8">Source Address</td></tr>
<tr><td>16
17</td><td colspan="8">Group Address</td></tr>
<tr><td>18</td><td colspan="8" rowspan="1">CRC-12</td></tr>
<tr><td>19</td><td colspan="4">CRC-12</td><td colspan="4"></td></tr>
</table>

Figure 8-4 Inbound MAC_PTT PDU (19.5 octets)

	7	6	5	4	3	2	1	0
0	Opcode			Offset			Res	
1	Message Indicator (MI)							
2								
3								
4								
5								
6								
7								
8								
9								
10	Algorithm ID							
11	Key ID							
12								
13	Source Address							
14								
15								
16	Group Address							
17								
18	CRC-12							
19								

Figure 8-5 Outbound MAC_PTT PDU (19.5 octets)

<table>
<tr><th></th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>0</td><td colspan="3">Opcode</td><td colspan="3">Offset</td><td colspan="2">Res</td></tr>
<tr><td>1</td><td colspan="8" rowspan="9">Message Indicator (MI)</td></tr>
<tr><td>2</td></tr>
<tr><td>3</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td><td colspan="8">Algorithm ID</td></tr>
<tr><td>11</td><td colspan="8" rowspan="2">Key ID</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td colspan="8" rowspan="3">Source Address</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td colspan="8" rowspan="2">Group Address</td></tr>
<tr><td>17</td></tr>
<tr><td>18</td><td colspan="8" rowspan="3">Reserved</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td><td colspan="8">CRC-12</td></tr>
<tr><td>22</td><td colspan="4">CRC-12</td><td colspan="4"></td></tr>
</table>

Figure 8-6 Outbound MAC_PTT PDU (22.5 octets)

8.2.2 MAC_END_PTT PDU

The MAC_END_PTT PDUs are the equivalent of the Expanded Terminator Data Unit (ETDU) in Phase 1 and provides the source and group address of the caller that has released its PTT. They are put out on FACCH slots and optionally on a SACCH slot in a manner similar to the MAC_PTT PDUs.

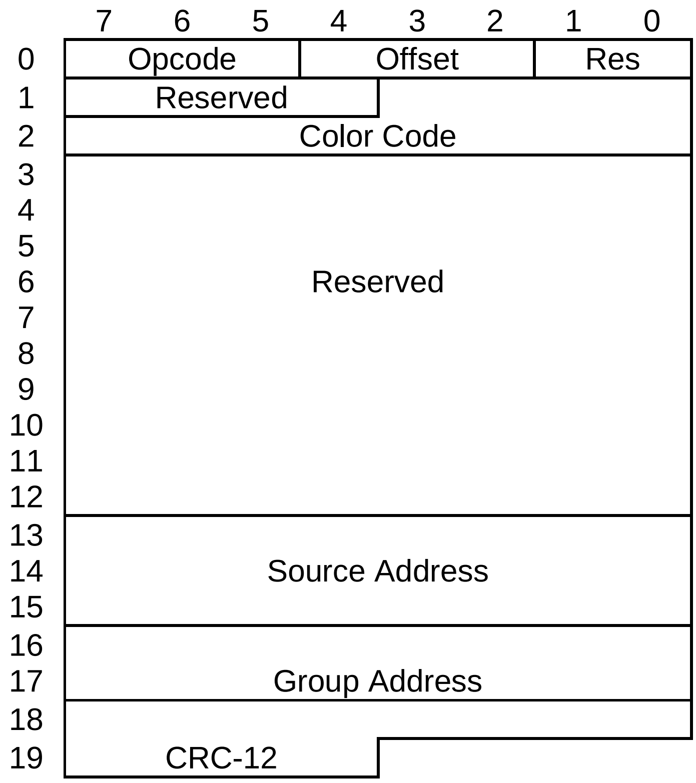


Figure 8-7 Inbound MAC_END_PTT PDU (19.5 octets)

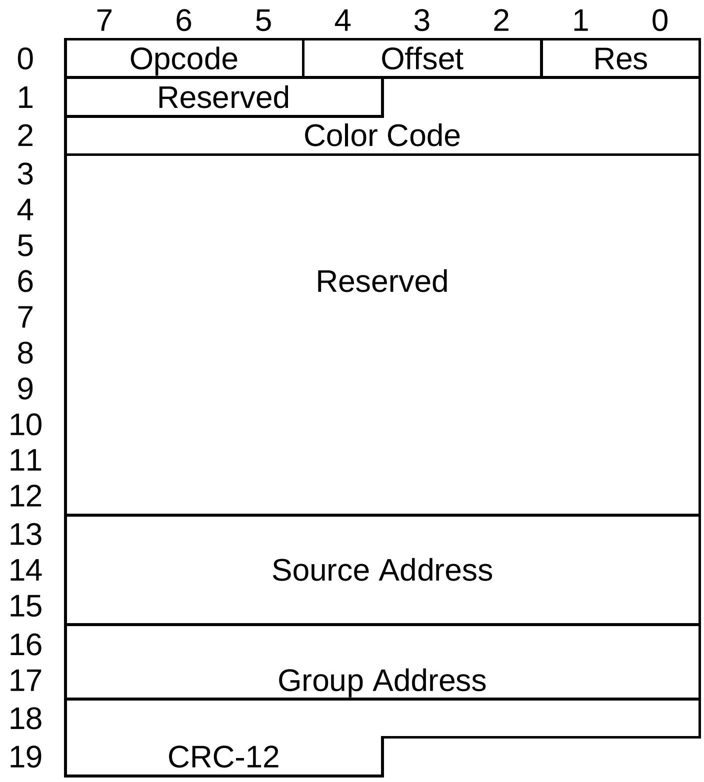


Figure 8-8 Outbound MAC_END_PTT PDU (19.5 octets)

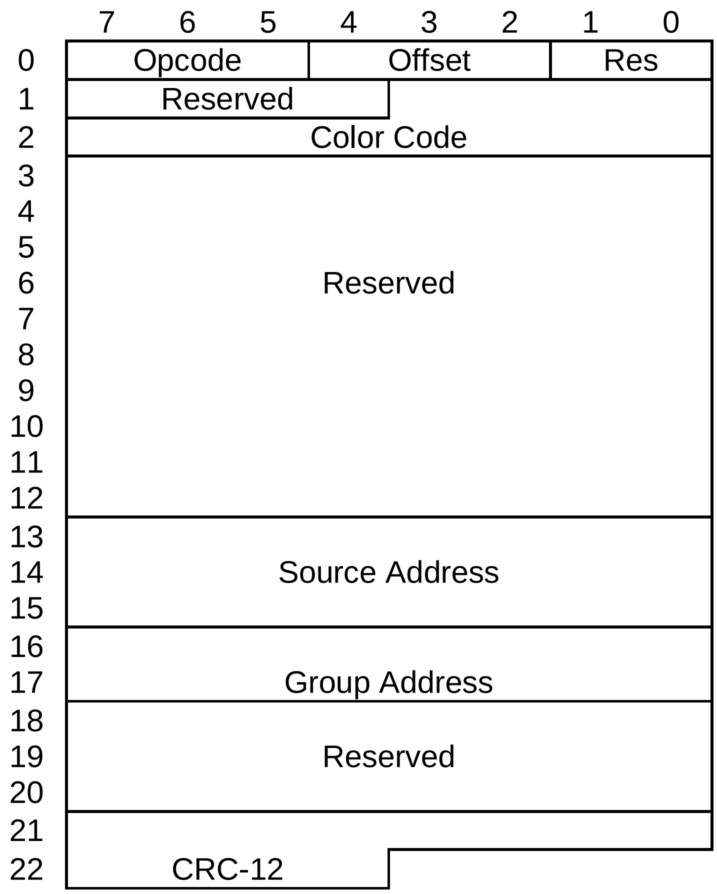


Figure 8-9 Outbound MAC_END_PTT PDU (22.5 octets)

8.2.3 MAC_IDLE, MAC_ACTIVE, and MAC_HANGTIME PDU Formats

The general structure of the MAC_IDLE PDU, MAC_ACTIVE PDU, and MAC_HANGTIME PDU is shown in Figure 8-10. The first octet is the MAC header which contains the 3-bit opcode, 3-bit offset, and 2-bit reserved field in common with other MAC PDUs. The next octet has two bits designated B1 and B2 and a 6-bit MAC Opcode (MCO) which indicate the contents of the remaining octets of the message.

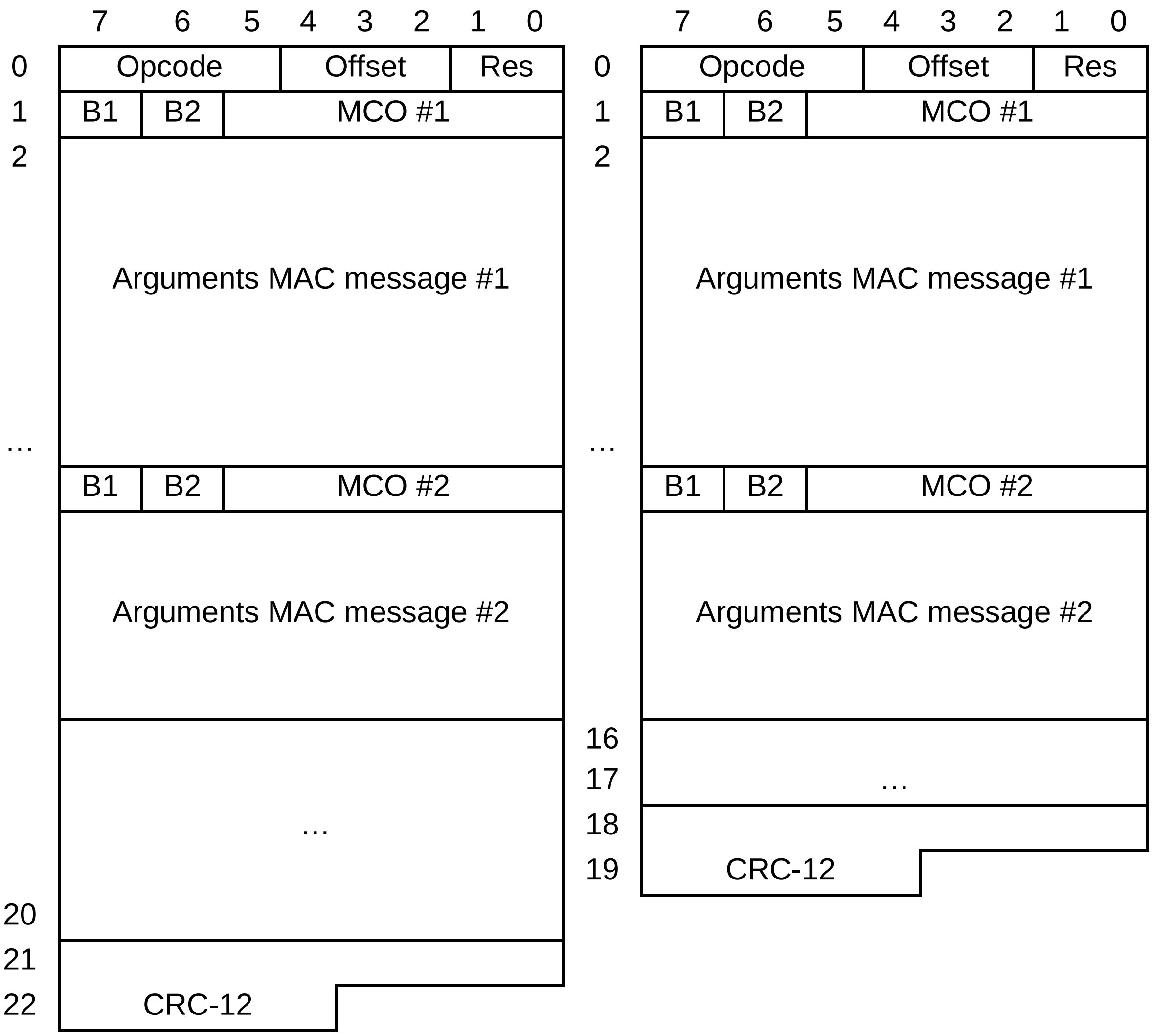


Figure 8-10 Generic Outbound MAC Information Formats

The majority of the generic messages required for TDMA voice channel signaling are already defined in [R2], however, due to the limited bandwidth on the voice channel, an abbreviated version of these messages is appropriate. Specifically, these abbreviated messages were constructed without the Manufacturers ID (MFID), CRC and some reserved fields. Note that while the MFID concept is still supported, it is done in a different manner. The CRC in each of the Outbound Signaling Packet / Inbound Signaling Packet (OSP/ISP) messages from [R2] is replaced with the CRC-12 over the entire PDU as illustrated in Figure 8-10. References for field definitions can be found 8.4.

In order to maintain consistency with the existing ISP/OSP messages, the MAC opcode (MCO) structure was constructed to re-use the exact ISP/OSP opcodes from [R2] for the abbreviated messages while maintaining an ability to extend this set for new functionality. This was done by partitioning the opcode space into four different sets, defined by the B1 and B2 bits. Note that this implies that the 6-bit MCO may be re-used within the different sets and that the B1 and B2 bits are examined in conjunction with the MCO to determine the actual message. The following list describes the four partitions:

- One group contains messages that were created specifically for TDMA that have no counterpart in the existing Phase 1 OSP/ISP message set.
- One group contains messages derived from abbreviated format of the Phase 1 OSP and ISPs.
- One group contains any manufacturer specific signaling messages.
- One group contains messages derived from extended format of the Phase 1 OSP and ISPs.

This is summarized in Table 8-1:

Table 8-1 MCO Opcode Partitioning

B1	B2	Partition Description
0	0	Unique TDMA Message
0	1	Derived from Phase 1 OSP/ISP abbreviated format
1	0	Manufacturer's Message
1	1	Derived from Phase 1 OSP/ISP extended or explicit formats

Multiple MAC messages may be sent within any given MAC_IDLE, MAC_ACTIVE, or MAC_HANGTIME PDU as message size allows, with any unused space within the PDU being filled using the Null Information Message.

The format shown in Figure 8-11 is used to provide the complete SUID of a unit for certain other messages that require the extended address. It is used in some of the message details that follow.

	7	6	5	4	3	2	1	0
1	Network ID (b19-b12)							
2	Network ID (b11-b4)							
3	Network ID (b3-b0)				System ID (b11-b8)			
4	System ID (b7-b0)							
5	Source ID							
6								
7								

Figure 8-11 Subscriber Unit Identification format

8.3 MAC Message Details

MAC message lengths are determined in one of four ways:

- The message length is inherent based on the opcode (see Table 8-2)
- The message length is variable and the length is determined by parsing out additional fields in the message such as in the following messages:
    - Individual Paging Message with Priority
    - Indirect Group Paging Message without Priority
- The message length is variable and it fills out remaining space in the PDU such as in the following messages:
    - Null Information Message
    - Manufacturer's Specific Message
- A specific length octet is included in the message that contains the message length. The message length is always contained in the least significant 6 bits of the 2^{nd} octet in the message, that is, the octet that immediately follows the B1/B2/MCO octet.

In order to avoid future compatibility problems for older SUs with new messages, all new messages added after the initial publication of this specification shall contain a length octet as is discussed in the fourth major bullet above. This allows older SUs to skip over opcodes that may be defined in future releases of this specification.

Note also that the Null Information Message, if included, shall always be in the last message within the PDU. Any manufacturer specific messages shall be inserted after the standard defined messages and before the null information message since an SU may not be able to decode the length of a manufacturer specific message.

Table 8-2 MAC Message Lengths

B1	B2	MCO	Length	Name	Subclause
0	0	%000000	Variable	NULL INFORMATION MESSAGE	8.3.1.1
0	0	%000001	7	GROUP VOICE CHANNEL USER MESSAGE - ABBREVIATED FORMAT	8.3.1.2
0	0	%100001	14	GROUP VOICE CHANNEL USER MESSAGE - EXTENDED FORMAT	8.3.1.2
0	0	%000010	8	UNIT TO UNIT VOICE CHANNEL USER MESSAGE – ABBREVIATED FORMAT	8.3.1.3
0	0	%100010	15	UNIT TO UNIT VOICE CHANNEL USER MESSAGE – EXTENDED FORMAT	8.3.1.3
0	0	%000011	7	TELEPHONE INTERCONNECT VOICE CHANNEL USER MESSAGE	8.3.1.4
0	1	%000100	5	UNIT TO UNIT VOICE REQUEST – ABBREVIATED FORMAT	8.3.1.5
1	1	%000100	16	UNIT TO UNIT VOICE REQUEST – EXTENDED FORMAT	8.3.1.5
0	0	%000101	16	GROUP VOICE CHANNEL GRANT UPDATE MULTIPLE	8.3.1.6
0	0	%100101	15	GROUP VOICE CHANNEL GRANT UPDATE MULTIPLE - EXPLICIT	8.3.1.6
0	1	%000000	9	GROUP VOICE CHANNEL GRANT - ABBREVIATED FORMAT	8.3.1.7
1	1	%000000	11	GROUP VOICE CHANNEL GRANT - EXTENDED FORMAT	8.3.1.7
0	1	%000010	9	GROUP VOICE CHANNEL GRANT UPDATE	8.3.1.8
1	1	%000011	8	GROUP VOICE CHANNEL GRANT UPDATE - EXPLICIT	8.3.1.9
0	1	%000100	9	UNIT TO UNIT VOICE CHANNEL GRANT - ABBREVIATED FORMAT	8.3.1.10
1	1	%000100	15	UNIT TO UNIT VOICE CHANNEL GRANT - EXTENDED FORMAT	8.3.1.10
0	1	%000101	8	UNIT TO UNIT ANSWER REQUEST - ABBREVIATED FORMAT	8.3.1.11
1	1	%000101	12	UNIT TO UNIT ANSWER REQUEST - EXTENDED FORMAT	8.3.1.11
0	1	%011110	14	RADIO UNIT MONITOR ENHANCED COMMAND – ABBREVIATED FORMAT	8.3.1.12
0	1	%001010	9	TELEPHONE INTERCONNECT ANSWER REQUEST	8.3.1.13
0	1	%000110	9	UNIT TO UNIT VOICE CHANNEL GRANT UPDATE - ABBREVIATED FORMAT	8.3.1.14
1	1	%000110	15	UNIT TO UNIT VOICE CHANNEL GRANT UPDATE - EXTENDED FORMAT	8.3.1.14
0	1	%100000	9	ACK RESPONSE - ABBREVIATED FORMAT	8.3.1.15
0	1	%010100	9	SNDCP DATA CHANNEL GRANT	8.3.1.16
0	1	%010101	7	SNDCP DATA PAGE REQUEST	8.3.1.17
1	1	%010110	9	SNDCP DATA CHANNEL ANNOUNCEMENT - EXPLICIT	8.3.1.18
0	1	%111100	9	ADJACENT STATUS BROADCAST - ABBREVIATED FORMAT	8.3.1.19
1	1	%111100	11	ADJACENT STATUS BROADCAST - EXTENDED FORMAT	8.3.1.19
0	1	%011111	7	CALL ALERT - ABBREVIATED FORMAT	8.3.1.20
1	1	%011111	11	CALL ALERT - EXTENDED FORMAT	8.3.1.20
0	1	%100100	9	EXTENDED FUNCTION COMMAND	8.3.1.21
0	1	%101010	7	GROUP AFFILIATION QUERY - ABBREVIATED FORMAT	8.3.1.22
1	1	%101010	11	GROUP AFFILIATION QUERY - EXTENDED FORMAT	8.3.1.22
0	1	%111101	9	IDENTIFIER UPDATE	8.3.1.23
0	1	%110101	9	TIME AND DATE ANNOUNCEMENT	8.3.1.24
0	1	%111011	11	NETWORK STATUS BROADCAST - ABBREVIATED FORMAT	8.3.1.25
1	1	%111011	13	NETWORK STATUS BROADCAST - EXTENDED FORMAT	8.3.1.25
0	1	%000001	7	GROUP VOICE SERVICE REQUEST	8.3.1.26
0	1	%111010	9	RFSS STATUS BROADCAST - ABBREVIATED FORMAT	8.3.1.27
1	1	%111010	11	RFSS STATUS BROADCAST - EXTENDED FORMAT	8.3.1.27
0	1	%111001	9	SECONDARY CONTROL CHANNEL BROADCAST	8.3.1.28
0	1	%011010	7	STATUS QUERY - ABBREVIATED FORMAT	8.3.1.29
1	1	%011010	11	STATUS QUERY - EXTENDED FORMAT	8.3.1.29
0	1	%100001	9	QUEUED RESPONSE	8.3.1.30
0	1	%100111	9	DENY RESPONSE	8.3.1.31
0	1	%111000	9	SYSTEM SERVICE BROADCAST	8.3.1.32
0	1	%101101	7	UNIT REGISTRATION COMMAND - ABBREVIATED FORMAT	8.3.1.33
0	1	%011101	8	RADIO UNIT MONITOR COMMAND	8.3.1.34
0	1	%110100	9	IDENTIFIER UPDATE FOR VHF/UHF BANDS	8.3.1.35
1	1	%101001	8	SECONDARY CONTROL CHANNEL BROADCAST - EXPLICIT	8.3.1.28
0	1	%110011	9	IDENTIFIER UPDATE FOR TDMA	8.3.1.36
1	0	Undefined	Variable	MANUFACTURER MESSAGE	8.3.1.37
0	0	%010010	Variable	INDIVIDUAL PAGING MESSAGE WITH PRIORITY	8.3.1.38
0	0	%010001	Variable	INDIRECT GROUP PAGING MESSAGE WITHOUT PRIORITY	8.3.1.39
0	0	%110000	5	POWER CONTROL SIGNAL QUALITY	8.3.1.40
0	0	%110001	7	MAC_Release	8.3.1.41

8.3.1.1 Null Information Message

The Null information message is shown in Figure 8-12. It is used to fill any unused portion of a PDU. The length is sufficient to fill the PDU.

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	Null field							
…								

B1 = 0, B2 = 0, MCO = %00 0000

Figure 8-12 Null Information Message

8.3.1.2 Group Voice Channel User Message

The Group Voice Channel User messages are shown in Figure 8-13 and Figure 8-14. It indicates the user of this channel for group voice traffic on both inbound and outbound messages.

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	Service Options							
3	Group Address							
4								
5	Source Address							
6								
7								

B1 = 0, B2 = 0, MCO =%00 0001.

Figure 8-13 Group Voice Channel User Message – Abbreviated Format

Octet			
1	B1	B2	MCO
2	Service Options		
3–4	Group Address		
5–7	Source Address		
8–14	Source SUID		

B1 = 0, B2 = 0, MCO =%10 0001.

Figure 8-14 Group Voice Channel User Message – Extended Format

8.3.1.3 Unit to Unit Voice Channel User Message

The Unit to Unit Voice Channel User messages are shown in Figure 8-15. This indicates the user of this channel for unit to unit voice traffic. This is used on both inbound and outbound messages.

Octet	7	6	5 4 3 2 1 0
1	B1	B2	MCO
2	Service Options		
3–5	Target Address		
6–8	Source Address		

B1 = 0, B2 = 0, MCO =%00 0010.

Figure 8-15 Unit to Unit Voice Channel User Message – Abbreviated Format

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	Service Options							
3	Target Address							
4								
5								
6	Source Address							
7								
8								
9	Source SUID							
10								
11								
12								
13								
14								
15								

B1 = 0, B2 = 0, MCO =%10 0010.

Figure 8-16 Unit to Unit Voice Channel User Message – Extended Format

8.3.1.4 Telephone Interconnect Voice Channel User Message

The Telephone Interconnect Voice Channel User message is shown in Figure 8-17. This indicates the user of this channel for telephone interconnect voice traffic. This is used on both inbound an outbound messages.

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	Service Options							
3	Call Timer							
4								
5	Source/Target Address							
6								
7								

B1 = 0, B2 = 0, MCO =%00 0011.

Figure 8-17 Telephone Interconnect Voice Channel User Message

8.3.1.5 Unit to Unit Voice Request

This is the service request for a voice call between two specified SUs. The extended format shall always be acceptable. The abbreviated format is only applicable if the requesting SU is currently in its HOME system and the target SU is a member of the same HOME system.

<table>
<tr><th></th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>1</td><td>B1</td><td>B2</td><td colspan="6">MCO</td></tr>
<tr><td>2</td><td colspan="8">Service Options</td></tr>
<tr><td>3
4
5</td><td colspan="8">Target ID</td></tr>
<tr><td>6
7
8</td><td colspan="8">Source Address</td></tr>
</table>

B1 = 0, B2 = 1, MCO =%00 0100.

Figure 8-18 Unit to Unit Voice Request – Abbreviated Format

<table>
<tr><th></th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>1</td><td>B1</td><td>B2</td><td colspan="6">MCO</td></tr>
<tr><td>2</td><td colspan="8">Service Options</td></tr>
<tr><td>3
4
5</td><td colspan="8">Source Address</td></tr>
<tr><td>6</td><td colspan="8">WACN ID (b19-b12)</td></tr>
<tr><td>7</td><td colspan="8">(b11-b4)</td></tr>
<tr><td>8</td><td colspan="4">(b3-b0)</td><td colspan="4">(b11-b8)</td></tr>
<tr><td>9</td><td colspan="8">System ID (b7-b0)</td></tr>
<tr><td>10
11
12</td><td colspan="8">Target ID</td></tr>
</table>

B1 = 1, B2 = 1, MCO =%00 0100.

Figure 8-19 Unit to Unit Voice Request – Extended Format

8.3.1.6 Group Voice Channel Grant Update Multiple

The Group Voice Channel Grant Update Multiple message transmits up to three group call channel assignments for the abbreviated form, or up to 2 channel assignments for the explicit form. This message also transmits the Service Options with each channel assignment. This indicates the updates of other group voice traffic on this system and may be used to move directly to the specified channel.

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	Service Options 1							
3								
4	Channel 1							
5								
6	Group Address 1							
7	Service Options 2							
8								
9	Channel 2							
10								
11	Group Address 2							
12	Service Options 3							
13								
14	Channel 3							
15								
16	Group Address 3							

B1 = 0, B2 = 0, MCO =%00 0101.

Figure 8-20 Group Voice Channel Grant Update Multiple

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	Service Options 1							
3								
4	Channel (T) 1							
5								
6	Channel (R) 1							
7								
8	Group Address 1							
9	Service Options 2							
10								
11	Channel (T) 2							
12								
13	Channel (R) 2							
14								
15	Group Address 2							

B1 = 0, B2 = 0, MCO =%10 0101.

Figure 8-21 Group Voice Channel Grant Update Multiple - Explicit

8.3.1.7 Group Voice Channel Grant

This message indicates that voice service for a group audience is assigned to the specified channel resource on the system.

<table>
<tr><th></th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>1</td><td>B1</td><td>B2</td><td colspan="6">MCO</td></tr>
<tr><td>2</td><td colspan="8">Service Options</td></tr>
<tr><td>3
4</td><td colspan="8">Channel</td></tr>
<tr><td>5
6</td><td colspan="8">Group Address</td></tr>
<tr><td>7
8
9</td><td colspan="8">Source Address</td></tr>
</table>

B1 = 0, B2 = 1. MCO = %00 0000.

Figure 8-22 Group Voice Channel Grant - Abbreviated Format

<table>
<tr><th></th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>1</td><td>B1</td><td>B2</td><td colspan="6">MCO</td></tr>
<tr><td>2</td><td colspan="8">Service Options</td></tr>
<tr><td>3
4</td><td colspan="8">Channel (T)</td></tr>
<tr><td>5
6</td><td colspan="8">Channel (R)</td></tr>
<tr><td>7
8</td><td colspan="8">Group Address</td></tr>
<tr><td>9
10
11</td><td colspan="8">Source Address</td></tr>
</table>

B1 = 1, B2 = 1. MCO = %00 0000.

Figure 8-23 Group Voice Channel Grant - Extended Format

8.3.1.8 Group Voice Channel Grant Update

This message indicates the updates of other group voice traffic on this system and may be used to move directly to the specified channel.

<table>
<tr><th></th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>1</td><td>B1</td><td>B2</td><td colspan="6">MCO</td></tr>
<tr><td>2</td><td colspan="8" rowspan="2">Channel 1</td></tr>
<tr><td>3</td></tr>
<tr><td>4</td><td colspan="8" rowspan="2">Group Address 1</td></tr>
<tr><td>5</td></tr>
<tr><td>6</td><td colspan="8" rowspan="2">Channel 2</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td><td colspan="8" rowspan="2">Group Address 2</td></tr>
<tr><td>9</td></tr>
</table>

B1 = 0, B2 = 1. MCO = %00 0010.

Figure 8-24 Group Voice Channel Grant Update

8.3.1.9 Group Voice Channel Grant Update – Explicit

This message indicates the updates of other group voice traffic on this system and may be used to move directly to the specified channel. The explicit form is used when both the transmit and receive frequencies need to be provided.

<table>
<tr><th></th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>1</td><td>B1</td><td>B2</td><td colspan="6">MCO</td></tr>
<tr><td>2</td><td colspan="8">Service Options</td></tr>
<tr><td>3</td><td colspan="8" rowspan="2">Channel (T)</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td colspan="8" rowspan="2">Channel (R)</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td><td colspan="8" rowspan="2">Group Address</td></tr>
<tr><td>8</td></tr>
</table>

B1 = 1, B2 = 1. MCO = %00 0011

Figure 8-25 Group Voice Channel Grant Update - Explicit

8.3.1.10 Unit to Unit Voice Channel Grant

This message indicates the particular channel assignment for a requested voice call between individual units of the system. This message comes in two forms: the abbreviated and extended formats. The abbreviated format is used in all cases except where the transmit and receive channel identifiers are different.

<table>
<tr><th></th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>1</td><td>B1</td><td>B2</td><td colspan="6">MCO</td></tr>
<tr><td>2</td><td colspan="8" rowspan="2">Channel</td></tr>
<tr><td>3</td></tr>
<tr><td>4</td><td colspan="8" rowspan="3">Target Address</td></tr>
<tr><td>5</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td><td colspan="8" rowspan="3">Source Address</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td></tr>
</table>

B1 = 0, B2 = 1. MCO = %00 0100.

Figure 8-26 Unit to Unit Voice Channel Grant - Abbreviated Format

<table>
<tr><th></th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>1</td><td>B1</td><td>B2</td><td colspan="6">MCO</td></tr>
<tr><td>2</td><td colspan="8" rowspan="2">Channel (T)</td></tr>
<tr><td>3</td></tr>
<tr><td>4</td><td colspan="8" rowspan="2">Channel (R)</td></tr>
<tr><td>5</td></tr>
<tr><td>6</td><td colspan="8" rowspan="7">Source SUID</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td colspan="8" rowspan="3">Target Address</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td></tr>
</table>

B1 = 1, B2 = 1. MCO = %00 0100.

Figure 8-27 Unit to Unit Voice Channel Grant - Extended Format

8.3.1.11 Unit to Unit Answer Request

This message indicates to the target unit that a unit to unit call has been requested involving the target unit.

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	Service Options							
3	Target Address							
4								
5								
6	Source ID							
7								
8								

B1 = 0, B2 = 1. MCO = %00 0101.

Figure 8-28 Unit to Unit Answer Request - Abbreviated Format

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	Service Options							
3	Target Address							
4								
5								
6	Source SUID							
7								
8								
9								
10								
11								
12								

B1 = 1, B2 = 1. MCO = %00 0101.

Figure 8-29 Unit to Unit Answer Request - Extended Format

8.3.1.12 Radio Unit Monitor Enhanced Command

This message is to be used to command a radio to execute an enhanced radio unit monitor operation. The target SU may initiate either a clear or encrypted unit-to-unit call, or a clear or encrypted group call. See Table 8-10 for the field definitions.

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2–4	Target Address							
5–6	Talkgroup ID							
7–9	Source Address							
10	SM	TG	Reserved					
11	TX Time							
12–13	Key ID							
14	Alg ID							

B1 = 0, B2 = 1. MCO = %01 1110.

Figure 8-30 Radio Unit Monitor Enhanced Command - Abbreviated Format

8.3.1.13 Telephone Interconnect Answer Request

This message informs the target unit of a pending PSTN call and solicits a response from the target unit. It may optionally indicate the calling party's 10 digit telephone number.

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	Digit 1				Digit 2			
3	Digit 3				Digit 4			
4	Digit 5				Digit 6			
5	Digit 7				Digit 8			
6	Digit 9				Digit 10			
7	Target Address							
8								
9								

B1 = 0, B2 = 1. MCO = %00 1010.

Figure 8-31 Telephone Interconnect Answer Request

8.3.1.14 Unit to Unit Voice Channel Grant Update

This message indicates the updates of unit to unit voice traffic on this system and may be used to move directly to the specified channel.

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	Channel							
3								
4	Target Address							
5								
6								
7	Source Address							
8								
9								

B1 = 0, B2 = 1. MCO = %00 0110.

Figure 8-32 Unit to Unit Voice Channel Grant Update - Abbreviated Format

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	Channel (T)							
3								
4	Channel (R)							
5								
6	Source SUID							
7								
8								
9								
10								
11								
12								
13	Target Address							
14								
15								

B1 = 1, B2 = 1. MCO = %00 0110.

Figure 8-33 Unit to Unit Voice Channel Grant Update - Extended Format

8.3.1.15 ACK Response

This message is the generic response supplied to a unit to acknowledge an action when there is no other expected response. It is sent to a subscriber unit in response to an earlier action or service request. See Table 8-10 for the field definitions.

<table>
<tr><th></th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>1</td><td>B1</td><td>B2</td><td colspan="6">MCO</td></tr>
<tr><td>2</td><td>AIV</td><td>EX</td><td colspan="6">Service Type</td></tr>
<tr><td>3
4
5
6</td><td colspan="8">Additional Information</td></tr>
<tr><td>7
8
9</td><td colspan="8">Target Address / ID</td></tr>
</table>

B1 = 0, B2 = 1. MCO = %10 0000.

Figure 8-34 ACK Response - Abbreviated Format

8.3.1.16 SNDCP Data Channel Grant

This is the DCH grant (channel assignment) for an SNDCP trunked data service operation. This is the packet format utilized when the assigned working DCH requires a unique designation for transmit and receive frequency values. This is accommodated with an explicit channel field for the FNE transmit [Channel (T)], and FNE receive [Channel (R)] frequency component.

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	Data Service Options							
3	Channel (T)							
4								
5	Channel (R)							
6								
7	Target Address							
8								
9								

B1 = 0, B2 = 1. MCO = %01 0100.

Figure 8-35 SNDCP Data Channel Grant

8.3.1.17 SNDCP Data Page Request

This message is used to indicate to the target that trunked data service has been requested.

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	Data Service Options							
3	Data Access Control							
4								
5	Target Address							
6								
7								

B1 = 0, B2 = 1. MCO = %01 0101.

Figure 8-36 SNDCP Data Page Request

8.3.1.18 SNDCP Data Channel Announcement – Explicit

This announcement message indicates current trunked data service working channel assignments and access permissions for the indicate data access control group(s). References for field definitions can be found in Table 8-10 .

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	Data Service Options							
3	AA	RA	Reserved					
4 5	Channel (T)							
6 7	Channel (R)							
8 9	Data Access Control							

B1 = 1, B2 = 1. MCO = %01 0110.

Figure 8-37 SNDCP Data Channel Announcement - Explicit

8.3.1.19 Adjacent Status Broadcast

This message informs the subscriber unit of the presence and status of sites adjacent to this particular site.

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	LRA ID							
3	C	F	V	A				
4	System ID							
5	RFSS ID							
6	Site ID							
7	Channel							
8								
9	System Service Class							

B1 = 0, B2 = 1. MCO = %11 1100.

Figure 8-38 Adjacent Status Broadcast - Abbreviated Format

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	LRA ID							
3	C	F	V	A				
4	System ID							
5	RFSS ID							
6	Site ID							
7	Channel (T)							
8								
9	Channel (R)							
10								
11	System Service Class							

B1 = 1, B2 = 1. MCO = %11 1100.

Figure 8-39 Adjacent Status Broadcast - Extended Format

8.3.1.20 Call Alert

This message is the request for a target SU to call a source SU.

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2 3 4	Target Address							
5 6 7	Source ID							

B1 = 0, B2 = 1. MCO = %01 1111.

Figure 8-40 Call Alert - Abbreviated Format

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2 3 4	Target Address							
5 6 7 8 9 10 11	Source SUID							

B1 = 1, B2 = 1. MCO = %01 1111.

Figure 8-41 Call Alert - Extended Format

8.3.1.21 Extended Function Command

This message is the transaction addressed to an SU for an extended function. See Table 8-10 for definition of the Extended Function field.

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2								
3								
4	Extended Function							
5								
6								
7								
8	Target Address							
9								

B1 = 0, B2 = 1. MCO = %10 0100.

Figure 8-42 Extended Function Command

8.3.1.22 Group Affiliation Query

This message is to be used to determine what a targeted subscriber unit maintains as the group affiliation data for the unit.

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2								
3	Target Address							
4								
5								
6	Source Address							
7								

B1 = 0, B2 = 1. MCO = %10 1010.

Figure 8-43 Group Affiliation Query - Abbreviated Format

Octet	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2–4	Target Address							
5–11	Source SUID							

B1 = 1, B2 = 1. MCO = %10 1010.

Figure 8-44 Group Affiliation Query - Extended Format

8.3.1.23 Identifier Update

This message should be used to inform the subscriber units of the channel parameters to associate with a specific channel identifier. This format is to be used for base frequencies outside the VHF and UHF bands. See Table 8-10 for further definitions of the fields.

Octet	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	Identifier				BW			
3	BW					Transmit Offset		
4	Transmit Offset						Channel Spacing	
5	Channel Spacing							
6–9	Base Frequency							

B1 = 0, B2 = 1. MCO = %11 1101.

Figure 8-45 Identifier Update

8.3.1.24 Time and Date Announcement

This message is sent by the FNE to inform SUs of what the current time and date are. See Table 8-10 for the definition of the Message field.

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	VD	VT	VL	res	Local Time Offset			
3	Local Time Offset							
4	Date							
5								
6								
7	Time							
8								
9								

B1 = 0, B2 = 1. MCO = %11 0101.

Figure 8-46 Time and Date Announcement

8.3.1.25 Network Status Broadcast

This message provides the current WACN and System ID to the SU's monitoring the channel. See Table 8-10 for definitions of the LRA and System Service Class fields.

Octet	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	LRA							
3	WACN ID							
4	WACN ID							
5	WACN ID				System ID			
6	System ID							
7	Channel							
8	Channel							
9	System Service Class							
10	Reserved				Color Code			
11	Color Code							

B1 = 0, B2 = 1. MCO = %11 1011.

Figure 8-47 Network Status Broadcast - Abbreviated Format

Octet	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	LRA							
3	WACN ID							
4	WACN ID							
5	WACN ID				System ID			
6	System ID							
7	Channel (T)							
8	Channel (T)							
9	Channel (R)							
10	Channel (R)							
11	System Service Class							
12	Reserved				Color Code			
13	Color Code							

B1 = 1, B2 = 1. MCO = %11 1011.

Figure 8-48 Network Status Broadcast - Extended Format

8.3.1.26 Group Voice Service Request

This message is used to request voice service targeting a group reference.

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	Service Options							
3	Group Address							
4								
5	Source Address							
6								
7								

B1 = 0, B2 = 1. MCO = %00 0001.

Figure 8-49 Group Voice Service Request

8.3.1.27 RFSS Status Broadcast

This message provides the current RF sub-system and site identity to the SU's monitoring this channel. See Table 8-10 for the field definitions.

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	LRA							
3	Reserved		R	A	System ID			
4	System ID							
5	RFSS ID							
6	Site ID							
7	Channel							
8								
9	System Service Class							

B1 = 0, B2 = 1. MCO = %11 1010.

Figure 8-50 RFSS Status Broadcast - Abbreviated Format

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	LRA							
3	Reserved		R	A				
4	System ID							
5	RFSS ID							
6	Site ID							
7	Channel (T)							
8								
9	Channel (R)							
10								
11	System Service Class							

B1 = 1, B2 = 1. MCO = %11 1010.

Figure 8-51 RFSS Status Broadcast - Extended Format

8.3.1.28 Secondary Control Channel Broadcast

This message addresses the current secondary control channel assignments for this site. See Table 8-10 for the System Service Class definition.

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	RFSS ID							
3	Site ID							
4	Channel 1							
5								
6	System Service Class 1							
7	Channel 2							
8								
9	System Service Class 2							

B1 = 0, B2 = 1. MCO = %11 1001.

Figure 8-52 Secondary Control Channel Broadcast - Abbreviated

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	RFSS ID							
3	Site ID							
4	Channel (T)							
5								
6	Channel (R)							
7								
8	System Service Class							

B1 = 1, B2 = 1. MCO = %10 1001.

Figure 8-53 Secondary Control Channel Broadcast - Explicit

8.3.1.29 Status Query

An SU may request the current status condition of another SU.

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	Target Address							
3								
4								
5	Source Address							
6								
7								

B1 = 0, B2 = 1. MCO = %01 1010.

Figure 8-54 Status Query - Abbreviated Format

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	Target Address							
3								
4								
5	Source SUID							
6								
7								
8								
9								
10								
11								

B1 = 1, B2 = 1. MCO = %01 1010.

Figure 8-55 Status Query - Extended Format

8.3.1.30 Queued Response

This message is the response to indicate a requested service can not be granted at this time. See Table 8-10 for the field definitions.

<table>
<tr><th></th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>1</td><td>B1</td><td>B2</td><td colspan="6">MCO</td></tr>
<tr><td>2</td><td>AIV</td><td>0</td><td colspan="6">Service Type</td></tr>
<tr><td>3</td><td colspan="8">Reason Code</td></tr>
<tr><td>4</td><td colspan="8" rowspan="3">Additional Information</td></tr>
<tr><td>5</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td><td colspan="8" rowspan="3">Target Address</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td></tr>
</table>

B1 = 0, B2 = 1. MCO = %10 0001.

Figure 8-56 Queued Response

8.3.1.31 Deny Response

This message is the response to a service requesting unit to indicate a problem with the request. See Table 8-10 for the field definitions.

<table>
<tr><th></th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>1</td><td>B1</td><td>B2</td><td colspan="6">MCO</td></tr>
<tr><td>2</td><td>AIV</td><td>0</td><td colspan="6">Service Type</td></tr>
<tr><td>3</td><td colspan="8">Reason Code</td></tr>
<tr><td>4</td><td colspan="8" rowspan="3">Additional Information</td></tr>
<tr><td>5</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td><td colspan="8" rowspan="3">Target Address</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td></tr>
</table>

B1 = 0, B2 = 1. MCO = %10 0111.

Figure 8-57 Deny Response

8.3.1.32 System Service Broadcast

This broadcast message informs the SU's of the current system services supported and currently offered on this site. See Table 8-10 for the field definitions.

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	Twuid Validity							
3	System Services Available							
4								
5								
6	System Services Supported							
7								
8								
9	Request Priority Level							

B1 = 0, B2 = 1. MCO = %11 1000.

Figure 8-58 System Service Broadcast

8.3.1.33 Unit Registration Command

This message is used to force an SU to initiate unit registration.

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	Target ID							
3								
4								
5	Source Address							
6								
7								

B1 = 0, B2 = 1. MCO = %10 1101.

Figure 8-59 Unit Registration Command – Abbreviated Format

8.3.1.34 Radio Unit Monitor Command

This message is used to command a radio to execute a radio unit monitor operation. See Table 8-10 for field definitions.

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	Reserved						Tx Mult	
3	Source Address							
4								
5								
6	Target Address							
7								
8								

B1 = 0, B2 = 1. MCO = %01 11 01.

Figure 8-60 Radio Unit Monitor Command

8.3.1.35 Identifier Update for VHF/UHF Bands

This message should be used to inform the subscriber units of the channel parameters to associate with a specific channel identifier. This format is to be used for base frequencies within the VHF and UHF bands. See Table 8-10 for field definitions.

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	Identifier				BW VU			
3	Transmit Offset VU							
4	Transmit Offset VU						Channel Spacing	
5	Channel Spacing							
6	Base Frequency							
7								
8								
9								

B1 = 0, B2 = 1. MCO = %11 0100.

Figure 8-61 Identifier Update for VHF/UHF Bands

8.3.1.36 Identifier Update for TDMA

This message should be used to inform the subscriber units of a P25 TDMA system of the channel parameters to associate with a specific channel identifier. See Table 8-10 for field definitions.

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	Identifier				Channel Type			
3	Transmit Offset TDMA							
4	Transmit Offset TDMA						Channel Spacing	
5	Channel Spacing							
6	Base Frequency							
7	Base Frequency							
8	Base Frequency							
9	Base Frequency							

B1 = 0, B2 = 1. MCO = %11 0011.

Figure 8-62 Identifier Update for TDMA

8.3.1.37 Manufacturer Message

The Manufacturer message is shown in Figure 8-63. The length up to the limit of the message format, depends on the manufacturer definition.

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	Manufacturer's ID							
3	Manufacturer dependent information							
…								

B1 = 1, B2 = 0, MCO values are defined by the manufacturer.

Figure 8-63 Manufacturer Message

8.3.1.38 Individual Paging Message

Individual Paging messages are used to request that an individual unit move from a voice channel to the control channel. A variable number of individual IDs up to four, along with a corresponding priority level may be signaled in this message, see 7.2.3 for procedures associated with receiving this message. The message length is dependent upon the number of targeted individuals.

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	PRIO1	PRIO2	PRIO3	PRIO4	RES		LEN	
3	Individual ID1							
4								
5								
6	Individual ID2 (optional)							
7								
8								
9	Individual ID3 (optional)							
10								
11								
12	Individual ID4 (optional)							
13								
14								

B1 = 0, B2 = 0, MCO =%01 0010.

Figure 8-64 Individual Paging Message with Priority

Table 8-3 PRIO Bit Definitions

PRIO bit	%0	%1
PRIO1	ID1 page is Low Priority	ID1 page is High Priority
PRIO2	ID2 page is Low Priority	ID2 page is High Priority
PRIO3	ID3 page is Low Priority	ID3 page is High Priority
PRIO4	ID4 page is Low Priority	ID4 page is High Priority

Fields marked with RES are reserved.

The LEN field determines the number of IDs present in the message.

Table 8-4 below provides the message length, number of units to be paged and details the valid PRIO bits as a function of LEN.

Table 8-4 Indirect Individual Paging Message Length

LEN	Number of Units to be Paged	Valid PRIO bits	Message Length (Octets)
%00	1	PRIO1	5
%01	2	PRIO1, PRIO2	8
%10	3	PRIO1, PRIO2, PRIO3	11
%11	4	PRIO1, PRIO2, PRIO3, PRIO4	14

8.3.1.39 Group Paging Message

Group Paging messages are used to notify radios of other talkgroup activity at the site. The decision to leave the current channel and move to the control channel for specific assignment information is optional. A variable number of IDs up to four may be signaled in this message.

<table>
<tr><th></th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>1</td><td>B1</td><td>B2</td><td colspan="6">MCO</td></tr>
<tr><td>2</td><td colspan="6">RES</td><td colspan="2">LEN</td></tr>
<tr><td>3
4</td><td colspan="8">Group ID1</td></tr>
<tr><td>5
6</td><td colspan="8">Group ID2 (optional)</td></tr>
<tr><td>7
8</td><td colspan="8">Group ID3 (optional)</td></tr>
<tr><td>9
10</td><td colspan="8">Group ID4 (optional)</td></tr>
</table>

B1 = 0, B2 = 0, MCO =%01 0001

Figure 8-65 Indirect Group Paging Message without Priority

Fields marked with RES are reserved.

The LEN field determines the number of IDs present in the message. Table 8-5 below provides the message length and number of units to be paged as a function of LEN.

Table 8-5 Indirect Paging Message without Priority Length

LEN	Number of Units to be Paged	Message Length (Octets)
%00	1	4
%01	2	6
%10	3	8
%11	4	10

8.3.1.40 Power Control Signal Quality

This is used for closed loop power control for an SU.

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	Destination Address							
3								
4								
5	RF Level				BER			

B1 = 0, B2 = 0. MCO = %11 0000.

Figure 8-66 Power Control Signal Quality

8.3.1.41 MAC_Release

The MAC_Release message is used on the outbound SACCH channel. It is used for signaling a keyed unit that some sort of call preemption scenario is occurring. The preempt may be forced or unforced as indicated by the U/F bit. The message is shown in Figure 8-67.

	7	6	5	4	3	2	1	0
1	B1	B2	MCO					
2	U/F	C/A	Reserved					
3	Target Address							
4								
5								
6	Reserved				Color Code			
7	Color Code							

B1 = 0, B2 = 0. MCO = %11 0001.

Figure 8-67 MAC Release

8.4 MAC Fields Definition

8.4.1 Opcode

The opcode field is a 3 bit field that indicates what type of MAC PDU is forthcoming. All PDUs have the opcode field. This opcode is required to be able to correctly interpret the message. A list of the opcodes is presented in Table 8-6 :

Table 8-6 Opcode Values

Opcode value	MAC PDU
%000	Reserved
%001	MAC_PTT
%010	MAC_END_PTT
%011	MAC_IDLE
%100	MAC_ACTIVE
%101	Reserved
%110	MAC_HANGTIME
%111	Reserved

8.4.2 Offset

The offset field is a 3 bit field that that tells the number of non-SACCH bursts between the current FACCH or SACCH and the first 4V burst in the next voice frame associated with the slot the MAC_PDU occurs in. Special values are also provided for use in the random access SACCH and in cases where no voice frames are anticipated or voice framing is unknown. The offset field is present in all MAC PDUs, both on the FACCH and SACCH and for either inbound or outbound. Table 8-7 provides the valid definitions for the offset field.

Table 8-7 Offset Values

Offset value	Position of the first 4V within the voice burst sequence
%000	First 4V is in the next non-SACCH burst on this slot
%001	First 4V is in the 2nd non-SACCH burst from this position on this slot
%010	First 4V is in the 3rd non-SACCH burst from this position on this slot
%011	First 4V is in the 4th non-SACCH burst from this position on this slot
%100	First 4V is in the 5th non-SACCH burst from this position on this slot
%101	Reserved
%110	Inbound: For use by SUs transmitting in the Random Access SACCH Outbound: Reserved
%111	No voice framing or unknown voice framing

Note that the offset value of %111 is used when either there is no voice framing or voice framing is not known. For outbound, this could be either during call setup prior to receiving any voice for transmission or during call hangtime when voice has ended. For inbound this value is used the when the SU is transmitting the MAC_END_PTT as no voice follows that signaling burst.

If a change a voice context occurs after it has been signaled in a FACCH or SACCH burst, such as may happen in a console interrupt of a repeated SU transmission, the voice framing is updated to reflect the voice framing of the new call audio source through the insertion of a MAC PDU with an updated offset field at the time of the audio source change.

Figure 8-68 gives examples of how the offset field defined in Table 8-7 would be applied to the full set of voice framing possibilities.

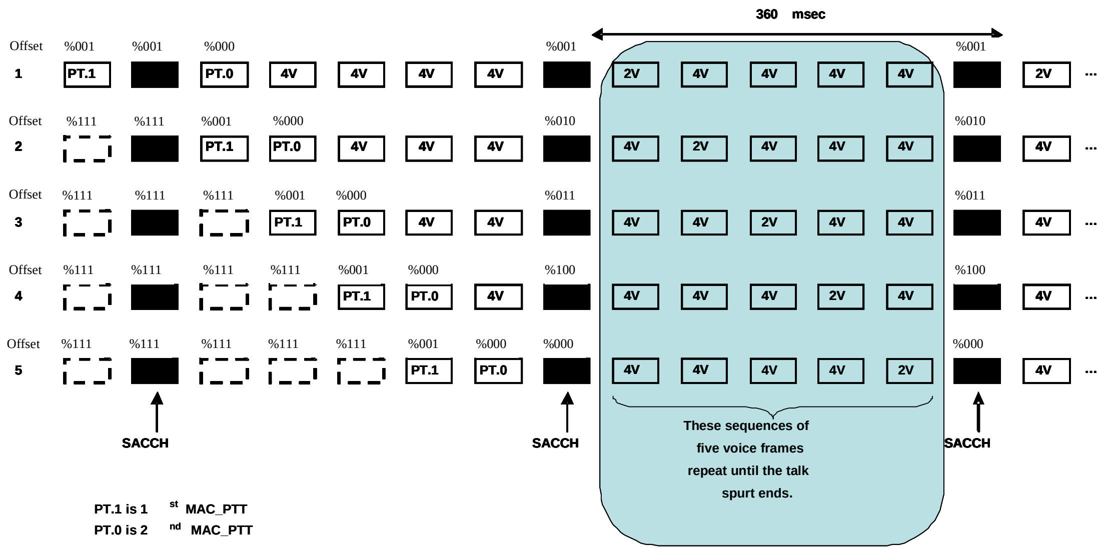


Figure 8-68 Offset Field Usage

8.4.3 RF Level

The RF Level field has a fixed length of 4 bits.

Table 8-8 RF Level Field

Coding	RF Level field
%0000	Unknown
%0001	S – 15 dBm
%0010	S – 12 dBm
%0011	S – 9 dBm
%0100	S – 6 dBm
%0101	S – 3 dBm
%0110	S dBm
%0111	S + 3 dBm
%1000	S + 6 dBm
%1001	S + 9 dBm
%1010	S + 12 dBm
%1011	S + 15 dBm
%1100	S + 18 dBm
%1101	S + 21 dBm
%1110	S + 24 dBm
%1111	S + 27 dBm

S is the signal strength that produces approximately 1% static BER as measured at the FNE.

8.4.4 BER

The BER field has a fixed length of 4 bits.

Table 8-9 BER Field

Coding	BER field
%0000	0% <= BER < 0.08%
%0001	0.08% <= BER < 0.12%
%0010	0.12% <= BER < 0.18%
%0011	0.18% <= BER < 0.27%
%0100	0.27% <= BER < 0.39%
%0101	0.39% <= BER < 0.57%
%0110	0.57% <= BER < 0.84%
%0111	0.84% <= BER < 1.25%
%1000	1.25% <= BER < 1.35%
%1001	1.35% <= BER < 2.7%
%1010	2.7% <= BER < 3.9%
%1011	3.9% <= BER < 5.7%
%1100	5.7% <= BER < 8.4%
%1101	8.4% <= BER < 12.5%
%1110	12.5% <= BER
%1111	Unused

Using the BER field in the Power Control message is optional. The field should be set to %1111 (Unused) if BER measurement is not supported by the FNE.

8.4.5 CRC

The MAC PDUs use a 12-bit CRC denoted as CRC-12. The generator polynomial is denoted a $g_{12}(x)$. The redundancy, r, is 12. The CRC generator polynomial is as follows.

$$g_{12}(x) = x^{12} + x^{11} + x^7 + x^4 + x^2 + x + 1 \qquad (9)$$

The information bits are arranged into a vector. The first 3 bits consist of the 3-bit opcode. The next 3 bits consist of the 3-bit offset. The next 2 bits consist of the 2 reserved bits of the first octet. The remaining octets, up to, but not including the CRC, are then arranged in order as shown in Figure 8-2 or Figure 8-3. For example, in the left side on Figure 8-2, the MAC PDU has 22.5 octets in total and 21 octets without the CRC. The information bits, in that case, form a vector of 168 bits, consisting of the 3-bit opcode, the 3-bit offset, the 2-bit reserved field, and 160 bits in octets 1 through 20. The k bits in the vector (k=168 in the example) then correspond to k binary coefficients in a polynomial representation denoted as M(x):

$$M(x) = m_{k-1}x^{k-1} + m_{k-2}x^{k-2} + \dots m_2x^2 + m_1x + m_0 \qquad (10)$$

Coefficient m_{k-1} corresponds to the MSB of the 3-bit opcode, bit m_{k-2} corresponds to the middle bit of the 3-bit opcode, bit m_{k-3} corresponds to the LSB of the 3-bit opcode, etc.

The CRC is computed by dividing M(x) * x^r by the CRC generator polynomial $g_{CRC}(x) = g_{12}(x)$ to compute the quotient, q(x), and the remainder, p(x). The degree of p(x) is r-1 or less.

$$M(x)\, x^r = q(x)\, g_{CRC}(x) + p(x) \qquad (11)$$

such that degree(p) < degree(g_{CRC})

The CRC then corresponds to the inverted coefficients of p(x), namely p_{r-1}*, p_{r-2}*, … p_1*, p_0*; where binary inversion is denoted with a "*" character. The bits in the penultimate octet correspond to: p_{r-1}*, p_{r-2}*, … p_{r-7}*, p_{r-8}*. The LSB's of the last octet correspond to p_{r-9}*, p_{r-10}*, … p_1* and p_0*.

8.4.6 Unforced/Forced (U/F) Field

The Unforced/Forced (U/F) field indicates the type of preemption:

- U/F = 0 for an unforced preemption (See 7.3.5.1.1.4),
- U/F = 1 for a forced preemption (See 7.3.5.1.1.4).

8.4.7 Call Preemption/Audio Preemption (C/A) Field

The C/A field indicates whether a call preemption or talker preemption is taking place. This field is used to signal the current talker that a change in the call has taken place.

- C/A = 0, the call is no longer for the talker, so the talker SU should go back to CCH,
- C/A = 1, the call is still for the talker's group, however, the outbound audio is no longer the talkers. In this case the talker SU is allowed to stay on VCH.

8.4.8 Color Code

The Color Code is the same value as the NAC for Phase 1 FDMA channels, specifically the Phase 1 FDMA Control Channel if this is used. The NAC code in Phase 1 and the color code in Phase 2 are used to identify and reject co-channel interfering sources. Co-channel rejection in Phase 1 systems on FDMA channels is accomplished through detection of an invalid NAC code. Co-channel rejection in Phase 2 systems on TDMA channels is accomplished through the process of scrambling, and the color code field is one of the unique elements used to initialize the scrambling sequence. See 7.2.5 for the complete description of the scrambling process.

On systems having TDMA voice channels and Phase 1 control channels, the color code of the TDMA traffic channel can be determined by monitoring NAC code associated with Trunking Signaling Blocks (TSBK) transmitted on the Phase 1 CCH. Additionally, the color code is transmitted in the Network Status Broadcast MAC messages sent on a Phase 2 TDMA VCH.

The color code is also embedded within the non-scrambled MAC_END_PTT PDUs to allow simple identification of the system of an interfering TDMA VCH.

8.4.9 Other Fields from Phase 1

The following field names are used in the MAC PDU field definitions. These field names correspond to information fields by the same name defined in reference [R2]. The subclause in reference [R2] that defines the field contents is listed in Table 8-10 .

Table 8-10 Field Name definition reference

Name	Size bits	Reference [R2] Subclause definition	Name	Size bits	Reference [R2] Subclause definition
A	1	6.2.2.1 / 6.2.15	RAND1	40	6.2.27
AA	1	5.2.7	Request Priority Level	8	6.2.19
AE	1	6.2.1.1	RFSS ID	8	2.3.23
Alg ID	8	6.2.34	RS	80	6.2.27
Base Frequency	32	2.3.5	Service Options	8	2.3.24
BW	9	2.3.6	Service Type	6	6.2.1.1
BW VU	4	2.3.7	Site ID	8	2.3.26
C	1	6.2.2.1	SM	1	6.2.34
Call Timer	16	2.3.8	Source Address	24	2.3.27
Channel	16	2.3.9	Source ID	24	2.3.38
Channel (T)	16	2.3.9	Source SUID	56	2.3.38
Channel (R)	16	2.3.9	Status	16	2.3.29
Channel Spacing	10	2.3.9.2	System ID	12	2.3.31
Channel Type	4	3.2.1	System Service Class	8	2.3.32
Data Service Options	8	2.3.12	System Services	24	6.2.19
Data Access Control	16	2.3.11	Target Address	24	2.3.33
Digit	4	2.3.13	TG	1	6.2.34
Extended Function	40	2.3.15	Transmit Offset	9	2.3.35
EX	1	6.2.1.1	Transmit Offset TDMA	14	6.2.32
F	1	6.2.2.1	Transmit Offset VU	14	2.3.36
Group Address	16	2.3.16	Twuid Validity	8	6.2.19
Identifier	4	2.3.9.1	TX Mult	2	6.1.19
Key ID	16	6.2.34	TX Time	8	6.2.34
Local Time Offset	12	6.2.27	V	1	6.2.2.1
LRA	8	2.3.20	VD	1	6.2.27
Message	16	2.3.21	VL	1	6.2.27
R	1	6.2.15	VT	1	6.2.27
RA	1	5.2.7	WACN ID	20	2.3.37

Annex A Galois Field for Reed Solomon Codes (Informative)

This annex defines the Galois Field with 64 elements used in the Reed-Solomon codes in clause 5. This finite field is usually abbreviated as GF(64). There are 64 elements in the field, and any element can be represented with a 6-bit number, which can also be called a hexbit. A hexbit can be conveniently represented with two octal digits (e.g., %110011 is also 63 octal).

A.1 GF(64) Arithmetic

A primitive element called α is used as an extension of the GF(2) field to provide all 63 roots of the $x^{63}+1$ polynomial. The element α is the root of a minimum polynomial, which is one of the factors of $x^{63}+1$. The minimum polynomial which this document uses is called the characteristic polynomial, c(x), for the field. The following statements are then true.

$c(x) = x^6 + x + 1$ the defined characteristic polynomial

$c(\alpha) = \alpha^6 + \alpha + 1 = 0$ the constitutive relation for GF(64)

$\alpha^6 = \alpha + 1$

$\alpha^7 = \alpha^2 + \alpha$

$\alpha^{10} = \alpha^5 + \alpha^4$

$\alpha^{11} = \alpha^5 + \alpha + 1$

These equations suggest that elements in GF(64) can be expressed in two ways, either as a polynomial in α with degree 5 or less, or as an exponent of α where the exponent is in the range 0 to 62 decimal. The polynomial form is conveniently represented as a hexbit with 2 octal digits. Note that the zero element of the field does not have an exponential representation, so exponents only range up to 62 decimal.

A.2 Exponential and Logarithm Tables

Arithmetic in GF(64) consists of addition and multiplication. Addition is easy for the polynomial form since each term adds, modulo 2. Addition is harder for the exponent form since the exponent form is converted to a polynomial for addition and converted back to an exponent, typically through a lookup table. Multiplication is easy for the exponent form since the exponents add modulo 63. Multiplication is harder for the polynomial form, since the polynomials have to be multiplied to yield a higher degree polynomial, and this has to be reduced to a residue modulo $\alpha^6+\alpha+1$. These operations can be aided with exponential and logarithm lookup Table A-1 and Table A-2 given below. In Table A-1 and Table A-2, and throughout this document, the exponents are given as decimal numbers and the polynomials are expressed as octal numbers.

$$\alpha^{e} = b_5\, \alpha^5 + b_4\, \alpha^4 + \ldots b_1\, \alpha + b_0 \tag{12}$$

e = exponent expressed in decimal radix
b = octal representation of bits (b_7, b_6, ... b_1, b_0)

Table A-1 Exponential and Logarithm table for GF(64)

Exponential: b = α^e									Logarithm: e = log(b)								
e	0	1	2	3	4	5	6	7	b	0	1	2	3	4	5	6	7
0	01	02	04	10	20	40	03	06	00	-	0	1	6	2	12	7	26
8	14	30	60	43	05	12	24	50	10	3	32	13	35	8	48	27	18
16	23	46	17	36	74	73	65	51	20	4	24	33	16	14	52	36	54
24	21	42	07	16	34	70	63	45	30	9	45	49	38	28	41	19	56
32	11	22	44	13	26	54	33	66	40	5	62	25	11	34	31	17	47
40	57	35	72	67	55	31	62	47	50	15	23	53	51	37	44	55	40
48	15	32	64	53	25	52	27	56	60	10	61	46	30	50	22	39	43
56	37	76	77	75	71	61	41	01	70	29	60	42	21	20	59	57	58

A.3 Mother Code Generator Matrix for (63,35,29) RS Code

The mother code used in clause 5 is a (63,35,29) RS code. The generator matrix for this code, G, has 35 rows and 63 columns. The G matrix is tabulated in this annex in three parts: columns 1 through 21 are the left third, then columns 22 through 42 are the middle third, and finally columns 43 through 63 are the right third. The matrix element values are octal. The left hand 35 columns of the matrix is a 35x35 identity matrix.

Table A-2 Mother Code Generator Matrix for (63,35,29) RS code

01	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00	01	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00	00	01	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00	00	00	01	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00	00	00	00	01	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00	00	00	00	00	01	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00	00	00	00	00	00	01	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	01	00	00	00	00	00	00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00	01	00	00	00	00	00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00	00	01	00	00	00	00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00	00	00	01	00	00	00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00	00	00	00	01	00	00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00	00	00	00	00	01	00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00	00	00	00	00	00	01	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00	00	00	00	00	00	00	01	00	00	00	00	00	00
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	01	00	00	00	00	00
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	01	00	00	00	00
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	01	00	00	00
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	01	00	00
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	01	00
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	01
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00

Mother Code Generator Matrix, Left Third

```
00 00 00 00 00 00 00 00 00 00 00 00 00 00 13 14 23 76 15 77 50
00 00 00 00 00 00 00 00 00 00 00 00 00 00 72 43 45 21 20 11 12
00 00 00 00 00 00 00 00 00 00 00 00 00 00 41 61 24 36 24 45 63
00 00 00 00 00 00 00 00 00 00 00 00 00 00 15 32 11 22 57 30 71
00 00 00 00 00 00 00 00 00 00 00 00 00 00 63 05 71 34 45 05 50
00 00 00 00 00 00 00 00 00 00 00 00 00 00 03 11 61 45 02 35 37
00 00 00 00 00 00 00 00 00 00 00 00 00 00 37 73 45 31 46 21 13
00 00 00 00 00 00 00 00 00 00 00 00 00 00 22 34 57 13 53 71 33
00 00 00 00 00 00 00 00 00 00 00 00 00 00 22 21 10 01 71 64 63
00 00 00 00 00 00 00 00 00 00 00 00 00 00 24 46 56 36 17 25 12
00 00 00 00 00 00 00 00 00 00 00 00 00 00 11 64 54 71 07 41 20
00 00 00 00 00 00 00 00 00 00 00 00 00 00 34 13 54 30 44 54 55
00 00 00 00 00 00 00 00 00 00 00 00 00 00 35 10 76 55 17 46 27
00 00 00 00 00 00 00 00 00 00 00 00 00 00 22 36 34 20 37 20 54
00 00 00 00 00 00 00 00 00 00 00 00 00 00 55 64 74 24 56 17 01
00 00 00 00 00 00 00 00 00 00 00 00 00 00 24 31 13 52 32 02 61
00 00 00 00 00 00 00 00 00 00 00 00 00 00 56 10 17 37 12 62 11
00 00 00 00 00 00 00 00 00 00 00 00 00 00 46 04 71 71 54 45 13
00 00 00 00 00 00 00 00 00 00 00 00 00 00 44 40 54 46 36 22 61
00 00 00 00 00 00 00 00 00 00 00 00 00 00 67 67 61 50 71 26 73
00 00 00 00 00 00 00 00 00 00 00 00 00 00 26 57 21 16 62 04 05
01 00 00 00 00 00 00 00 00 00 00 00 00 00 54 46 40 54 72 13 42
00 01 00 00 00 00 00 00 00 00 00 00 00 00 71 76 73 76 34 06 44
00 00 01 00 00 00 00 00 00 00 00 00 00 00 66 74 02 12 53 75 30
00 00 00 01 00 00 00 00 00 00 00 00 00 00 71 44 41 34 72 27 22
00 00 00 00 01 00 00 00 00 00 00 00 00 00 13 65 67 37 21 05 77
00 00 00 00 00 01 00 00 00 00 00 00 00 00 53 32 74 07 35 62 40
00 00 00 00 00 00 01 00 00 00 00 00 00 00 35 77 57 75 20 37 11
00 00 00 00 00 00 00 01 00 00 00 00 00 00 05 20 40 13 37 33 61
00 00 00 00 00 00 00 00 01 00 00 00 00 00 03 77 44 74 25 47 01
00 00 00 00 00 00 00 00 00 01 00 00 00 00 52 04 33 41 64 37 65
00 00 00 00 00 00 00 00 00 00 01 00 00 00 15 21 74 35 20 70 03
00 00 00 00 00 00 00 00 00 00 00 01 00 00 54 75 36 01 51 51 36
00 00 00 00 00 00 00 00 00 00 00 00 01 00 65 23 65 63 12 60 55
00 00 00 00 00 00 00 00 00 00 00 00 00 01 26 55 65 12 51 67 43
```

Mother Code Generator Matrix, Middle Third

62	15	14	12	07	74	45	23	71	50	64	10	16	22	71	77	20	51	61	32	06
02	34	45	60	30	11	47	14	03	14	26	04	54	41	02	75	34	43	11	56	16
72	07	27	12	32	77	66	20	35	71	30	45	23	25	60	67	30	50	01	03	12
16	13	74	20	74	10	22	16	40	01	70	13	12	41	45	74	21	16	13	40	77
44	71	03	60	53	24	17	61	40	20	30	11	76	26	17	17	35	36	21	46	44
16	72	03	44	11	74	20	73	24	72	53	64	70	56	63	67	24	43	27	55	73
17	15	02	47	03	24	51	74	64	02	66	72	71	57	41	40	25	71	75	21	61
46	75	16	41	66	14	54	75	03	76	17	64	30	34	20	76	44	56	04	32	61
66	24	76	55	60	71	64	70	02	11	63	15	26	75	43	17	72	37	23	43	72
21	70	40	20	15	21	11	13	16	74	61	52	16	23	13	17	75	76	60	17	71
75	10	30	20	71	53	15	03	65	13	33	60	73	75	55	45	15	01	01	02	37
46	40	12	33	16	63	72	25	51	71	74	46	14	74	27	06	34	36	26	73	03
70	61	64	24	22	11	37	17	35	22	46	44	64	72	64	25	66	44	16	70	61
72	12	62	27	05	35	61	13	60	27	37	44	06	21	05	53	21	15	31	51	30
02	04	54	07	34	75	62	23	10	41	52	32	62	74	22	25	41	30	13	46	72
43	14	60	02	47	75	15	15	45	66	31	63	31	67	12	76	47	45	67	27	74
71	03	20	42	60	10	26	33	53	56	60	60	24	63	21	42	57	20	52	64	31
25	12	51	57	56	64	02	47	41	22	47	75	50	74	11	76	70	17	47	17	41
22	62	14	54	15	60	07	52	32	65	10	43	72	41	01	67	66	15	66	52	14
46	15	41	67	10	21	06	26	12	63	12	53	50	47	01	11	62	23	16	10	02
34	74	25	65	71	63	30	40	47	31	30	32	67	14	26	74	51	43	62	72	04
10	50	14	75	51	14	41	27	01	01	14	70	42	74	55	57	77	13	42	31	42
56	70	72	27	26	60	23	74	42	56	04	20	55	35	11	21	27	62	42	01	20
20	73	75	34	44	07	73	57	76	74	71	02	65	01	37	50	35	31	66	10	42
24	40	51	46	67	75	30	46	32	21	71	45	27	12	64	43	20	20	60	25	01
40	31	54	43	41	13	30	13	37	62	45	61	53	05	63	13	63	71	41	52	23
36	42	10	24	31	67	54	21	01	72	72	73	06	61	17	20	67	05	55	45	03
65	11	66	26	35	36	33	31	31	72	45	42	51	60	71	15	40	17	25	03	57
40	27	04	34	36	44	22	04	65	67	64	22	62	31	34	62	40	41	24	22	44
27	76	55	43	45	11	40	46	41	57	14	30	43	42	74	44	51	36	50	50	17
03	37	71	10	16	76	23	04	16	63	17	67	01	10	12	66	21	64	15	70	12
10	62	44	76	76	34	23	53	64	22	62	34	30	63	70	06	20	07	27	54	04
16	74	02	14	42	13	16	34	12	22	07	22	44	23	22	01	05	62	06	74	64
14	05	03	03	06	44	04	06	73	16	76	55	06	30	64	13	26	65	77	20	02
12	26	35	27	15	75	55	42	67	50	45	56	61	42	51	11	53	07	24	13	34

Mother Code Generator Matrix, Right Third

Table A-2 concluded

The generator polynomial g(x) is given below with octal coefficients:

$$\begin{aligned} G(x) = x^{28} &+ 26\,x^{27} + 55\,x^{26} + 65\,x^{25} + 12\,x^{24} + 51\,x^{23} + 67\,x^{22} + \\ &43\,x^{21} + 12\,x^{20} + 26\,x^{19} + 35\,x^{18} + 27\,x^{17} + 15\,x^{16} + \\ &75\,x^{15} + 55\,x^{14} + 42\,x^{13} + 67\,x^{12} + 50\,x^{11} + 45\,x^{10} + \\ &56\,x^{9} + 61\,x^{8} + 42\,x^{7} + 51\,x^{6} + 11\,x^{5} + 53\,x^{4} + 07\,x^{3} + \\ &24\,x^{2} + 13\,x + 34 \end{aligned} \tag{13}$$

Annex B OSP MCO Opcode List (Informative)

Table B-1 lists the opcodes from reference [R2] for Outbound Signaling Packets (OSPs). The opcodes used as MCO values in clause 8 are listed in the right-most column with the pertinent subclause number.

Table B-1 Reference 2 OSP opcode summary

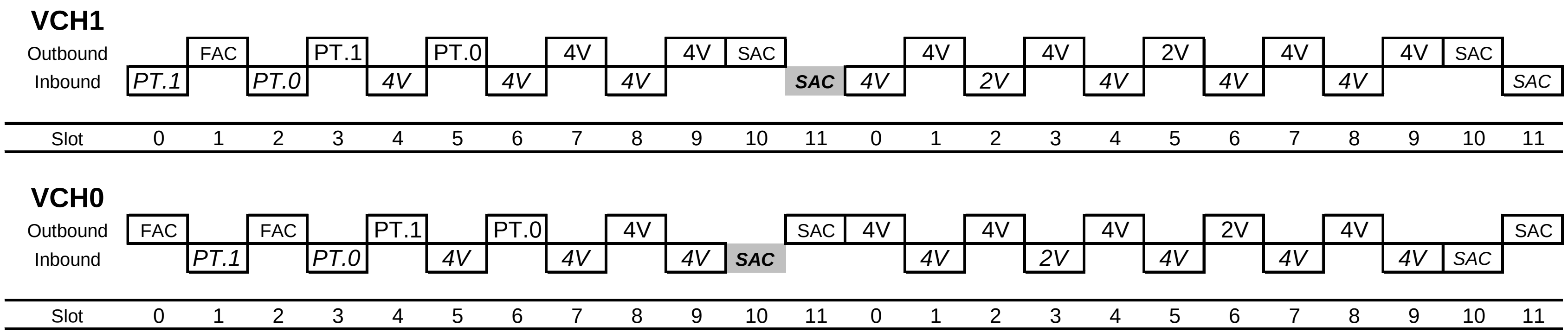
OSP List			
Opcode	Description	Alias	Subclause
%000000	Group Voice Channel Grant	GRP_V_CH_GRANT	8.2.4.7
%000001	Reserved		
%000010	Group Voice Channel Grant Update	GRP_V_CH_GRANT_UPDT	8.2.4.8
%000011	Group Voice Channel Grant Update - Explicit	GRP_V_CH_GRANT_UPDT_EXP	8.2.4.9
%000100	Unit To Unit Voice Channel Grant	UU_V_CH_GRANT	8.2.4.10
%000101	Unit To Unit Answer Request	UU_ANS_REQ	8.2.4.11
%000110	Unit To Unit Voice Channel Grant Update	UU_V_CH_GRANT_UPDT	8.2.4.14
%000111	Reserved		
%001000	Telephone Interconnect Voice Channel Grant	TELE_INT_CH_GRANT	8.2.4.12
%001001	Telephone Interconnect Voice Channel Grant Update	TELE_INT_CH_GRANT_UPDT	8.2.4.15
%001010	Telephone Interconnect Answer Request	TELE_INT_ANS_REQ	8.2.4.13
%001011	Reserved		
%001100	Reserved		
%001101	Reserved		
%001110	Reserved		
%001111	Reserved		
%010000	Obsolete		
%010001	Obsolete		
%010010	Obsolete		
%010011	Obsolete		
%010100	SNDCP Data Channel Grant	SN-DATA_CHN_GNT	8.2.4.16
%010101	SNDCP Data Page Request	SN-DATA_PAGE_REQ	8.2.4.17
%010110	SNDCP Data Channel Announcement - Explicit	SN-DATA_CHN_ANN_EXP	8.2.4.18
%010111	Reserved		
%011000	Status Update	STS_UPDT	8.2.4.31
%011001	Reserved		
%011010	Status Query	STS_Q	8.2.4.30
%011011	Reserved		
%011100	Message Update	MSG_UPDT	8.2.4.25
%011101	Radio Unit Monitor Command	RAD_MON_CMD	8.2.4.34
%011110	Reserved		
%011111	Call Alert	CALL_ALRT	8.2.4.21

Table B - 1 (concluded)

OSP List			
Opcode	Description	Alias	Subclause
%100000	Acknowledge Response - FNE	ACK_RSP_FNE	
%100001	Queued Response	QUE_RSP	
%100010	Reserved		
%100011	Reserved		
%100100	Extended Function Command	EXT_FNCT_CMD	8.2.4.22
%100101	Reserved		
%100110	Reserved		
%100111	Deny Response	DENY_RSP	
%101000	Group Affiliation Response	GRP_AFF_RSP	
%101001	Secondary Control Channel Broadcast - Explicit	SCCB_EXP	8.2.4.36
%101010	Group Affiliation Query	GRP_AFF_Q	8.2.4.23
%101011	Location Registration Response	LOC_REG_RSP	
%101100	Unit Registration Response	U_REG_RSP	
%101101	Unit Registration Command	U_REG_CMD	8.2.4.33
%101110	Authentication Command	AUTH_CMD	8.2.4.20
%101111	De-Registration Acknowledge	U_DE_REG_ACK	
%110000	Synchronization Broadcast	SYNC_BCST	
%110001	Authentication Demand	AUTH_DMD	
%110010	Authentication FNE Response	AUTH_FNE_RESP	
%110011	Identifier Update for TDMA	IDEN_UP_TDMA	8.2.4.37
%110100	Identifier Update for VHF/UHF Bands	IDEN_UP_VU	8.2.4.35
%110101	Time and Date Announcement	TIME_DATE_ANN	
%110110	Roaming Address Command	ROAM_ADDR_CMD	
%110111	Roaming Address Update	ROAM_ADDR_UPDT	
%111000	System Service Broadcast	SYS_SRV_BCST	8.2.4.32
%111001	Secondary Control Channel Broadcast	SCCB	8.2.4.29
%111010	RFSS Status Broadcast	RFSS_STS_BCST	8.2.4.28
%111011	Network Status Broadcast	NET_STS_BCST	8.2.4.26
%111100	Adjacent Status Broadcast	ADJ_STS_BCST	8.2.4.19
%111101	Identifier Update	IDEN_UP	8.2.4.24
%111110	Protection Parameter Broadcast	P_PARM_BCST	
%111111	Protection Parameter Update	P_PARM_UPDT	8.2.4.27

Annex C Examples of PTT and Call Termination on VCH0 and VCH1 (Informative)

All examples in this annex (see Figure C-1 through Figure C-6) show a fixed delay between the inbound data and the outbound repeated data. The delay shown is only for clarity and the actual delay may vary from this and from manufacturer to manufacturer.



PT.1	First MAC_PTT on inbound FACCH	*4/2V*	Inbound Voice
PT.0	Second MAC_PTT on inbound FACCH	4/2V	Outbound Voice
PT.1	First MAC_PTT on outbound FACCH	*SAC*	Inbound SACCH reserved for the talker
PT.0	Second MAC_PTT on outbound FACCH	SAC	Outbound SACCH
		S/FAC	Free inbound SACCH/FACCH

Figure C-1 Example of PTT Initiated on the First Inbound FACCH

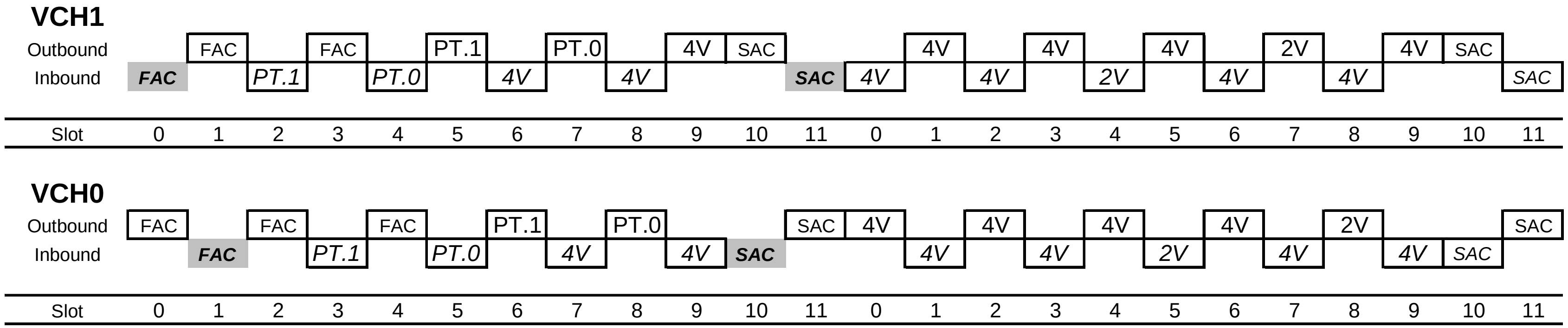


Figure C-2 Example of PTT Initiated on the Second Inbound FACCH

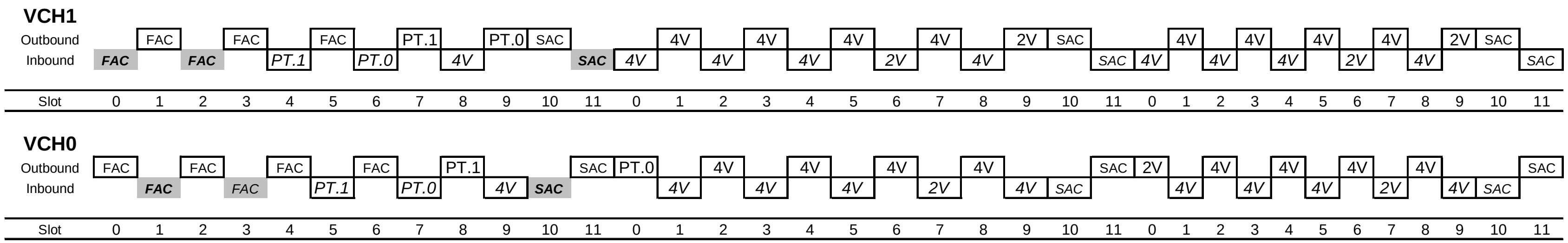


Figure C-3 Example of PTT Initiated on the Third Inbound FACCH

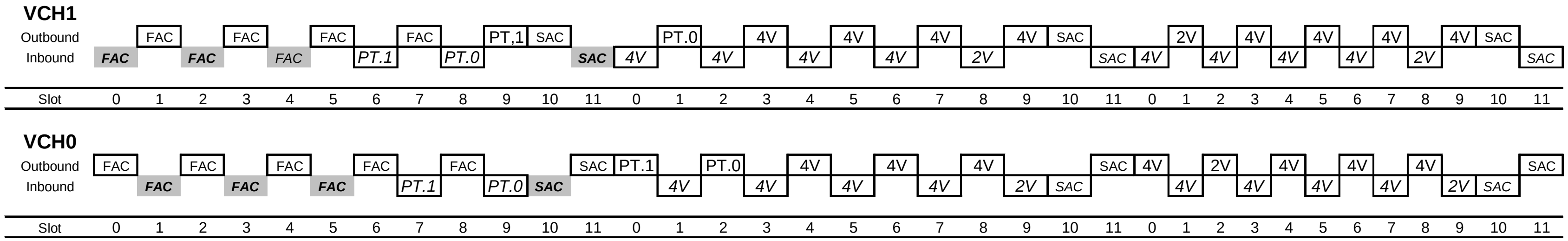


Figure C-4 Example of PTT Initiated on the Fourth Inbound FACCH

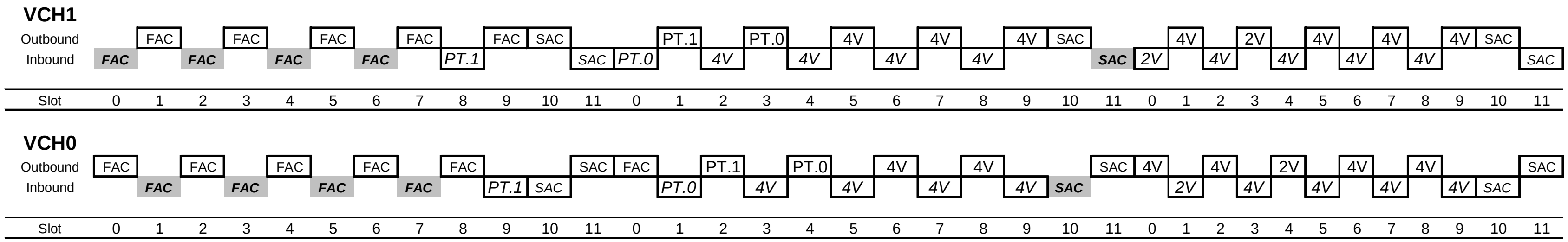


Figure C-5 Example of PTT Initiated on the Fifth Inbound FACCH

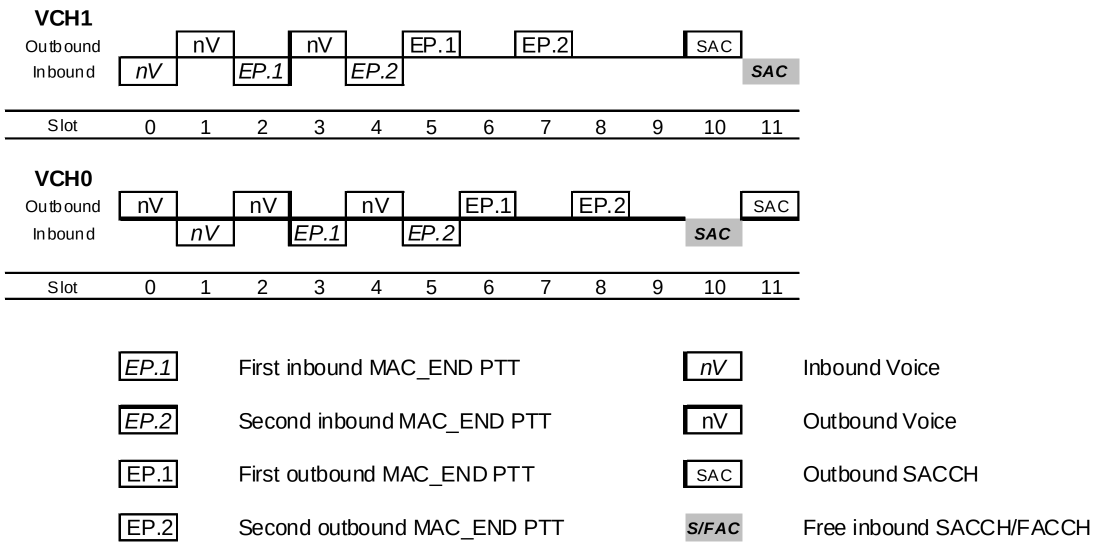


Figure C-6 Example of Call Termination

Annex D Examples of Call Setup on VCH0 (Informative)

All examples in this annex (see Figure D-1 through Figure D-8) show a fixed delay between the inbound data and the outbound repeated data. The delay shown is only for clarity and the actual delay may vary from this and from manufacturer to manufacturer.

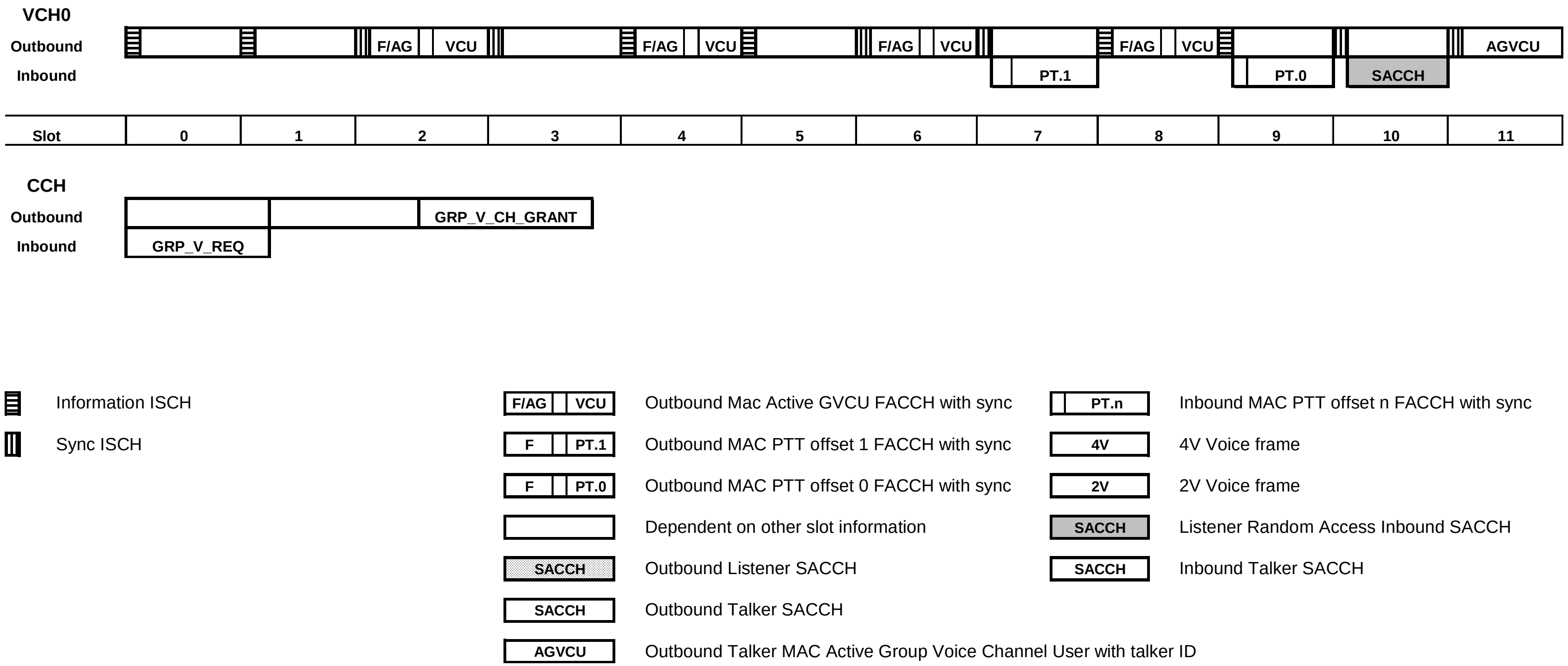


Figure D-1 Detailed Example of VCH 0 group call entry with an unsynchronized control and traffic channel

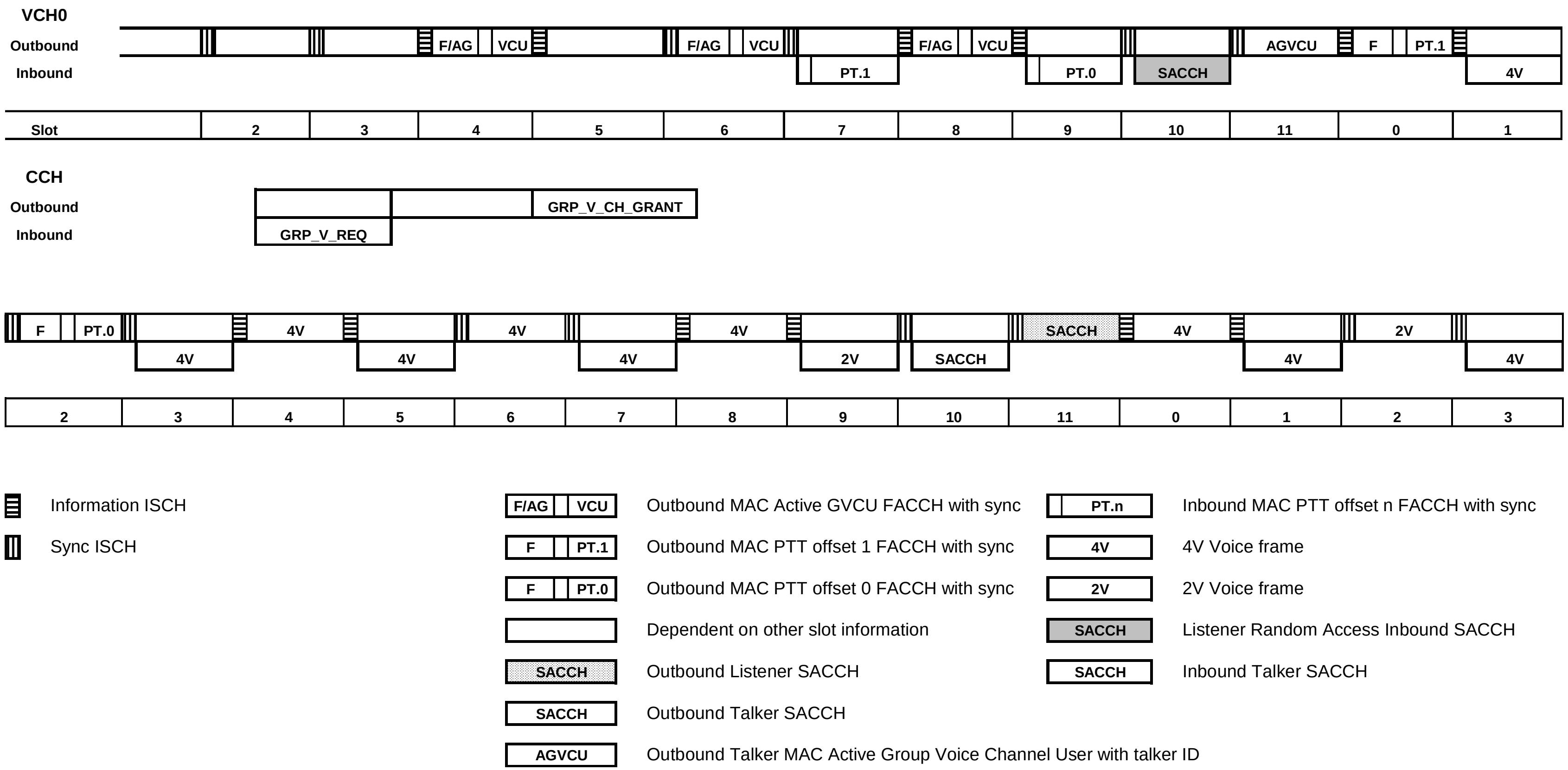


Figure D-2 Detailed Example of VCH 0 group call entry with a synchronized control and traffic channel

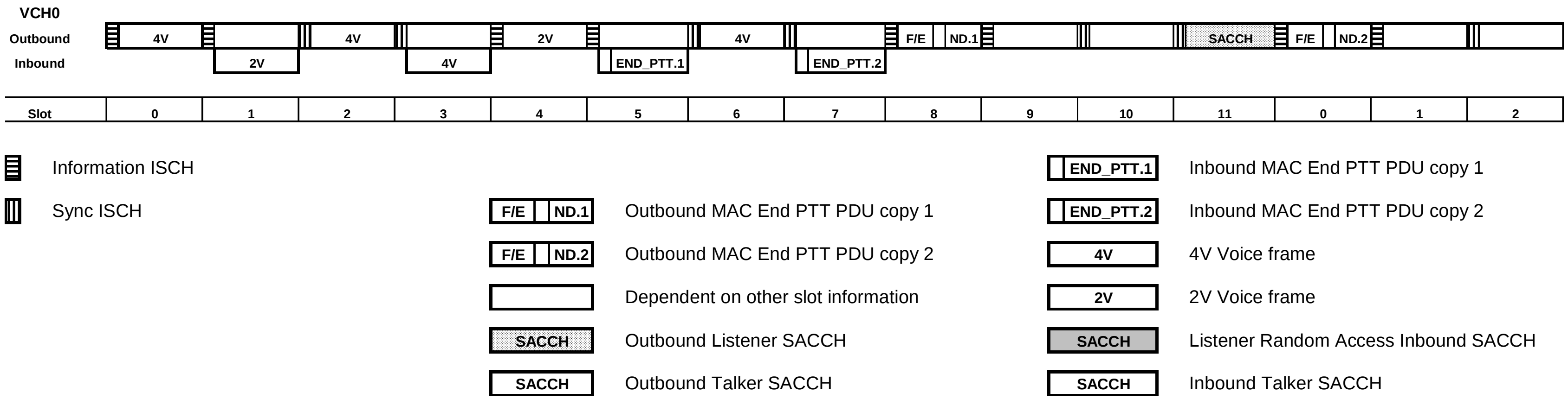


Figure D-3 Detailed Example of transmission trunked VCH 0 group call unkey

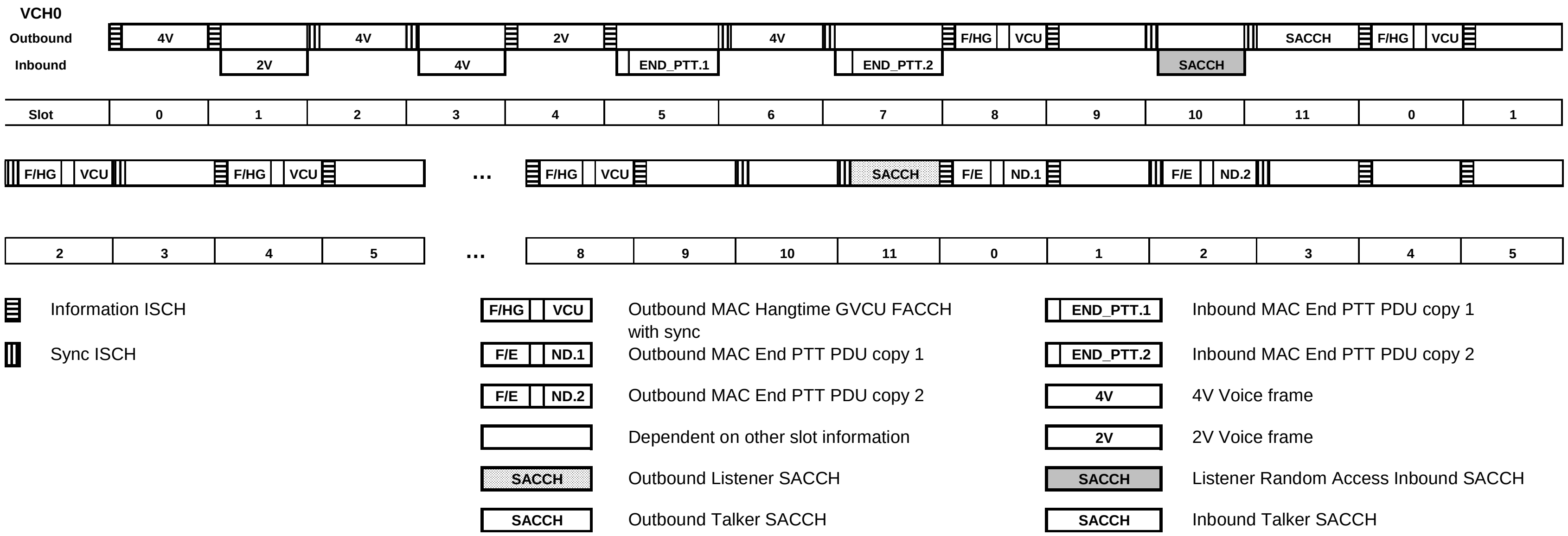
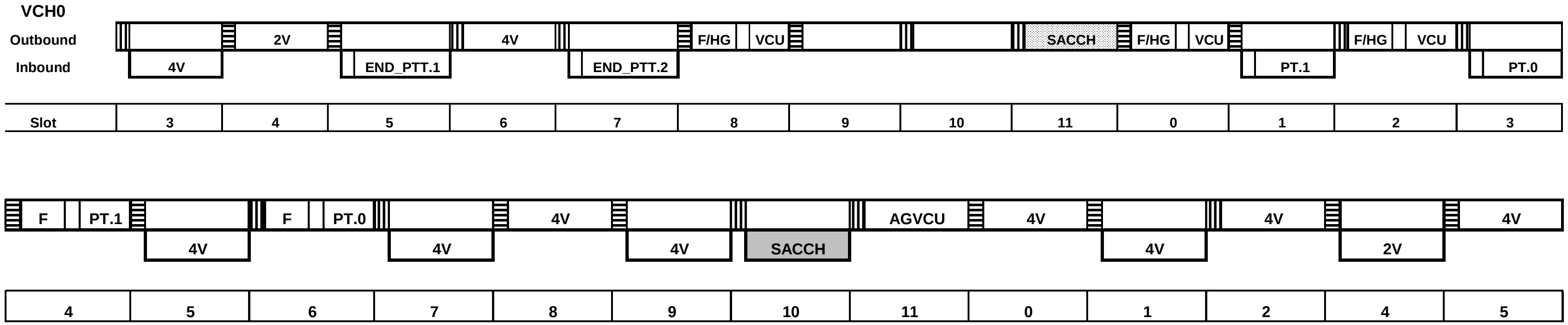


Figure D-4 Detailed Example of message trunked VCH 0 group call unkey with no call continuation



Information ISCH	
Sync ISCH	
F/HG VCU	Outbound MAC Hangtime GVCU FACCH with sync
F PT.1	Outbound MAC PTT offset 1 FACCH with sync
F PT.0	Outbound MAC PTT offset 0 FACCH with sync
	Dependent on other slot information
SACCH	Outbound Listener SACCH
SACCH	Outbound Talker SACCH
AGVCU	Outbound Talker MAC Active Group Voice Channel User
END_PTT.1	Inbound MAC End PTT PDU copy 1
END_PTT.2	Inbound MAC End PTT PDU copy 2
4V	4V Voice frame
2V	2V Voice frame
SACCH	Listener Random Access Inbound SACCH
SACCH	Inbound Talker SACCH
PT.n	Inbound MAC PTT offset n FACCH with sync

Figure D-5 Detailed Example of message trunked VCH 0 group call unkey with call continuation via Traffic Channel

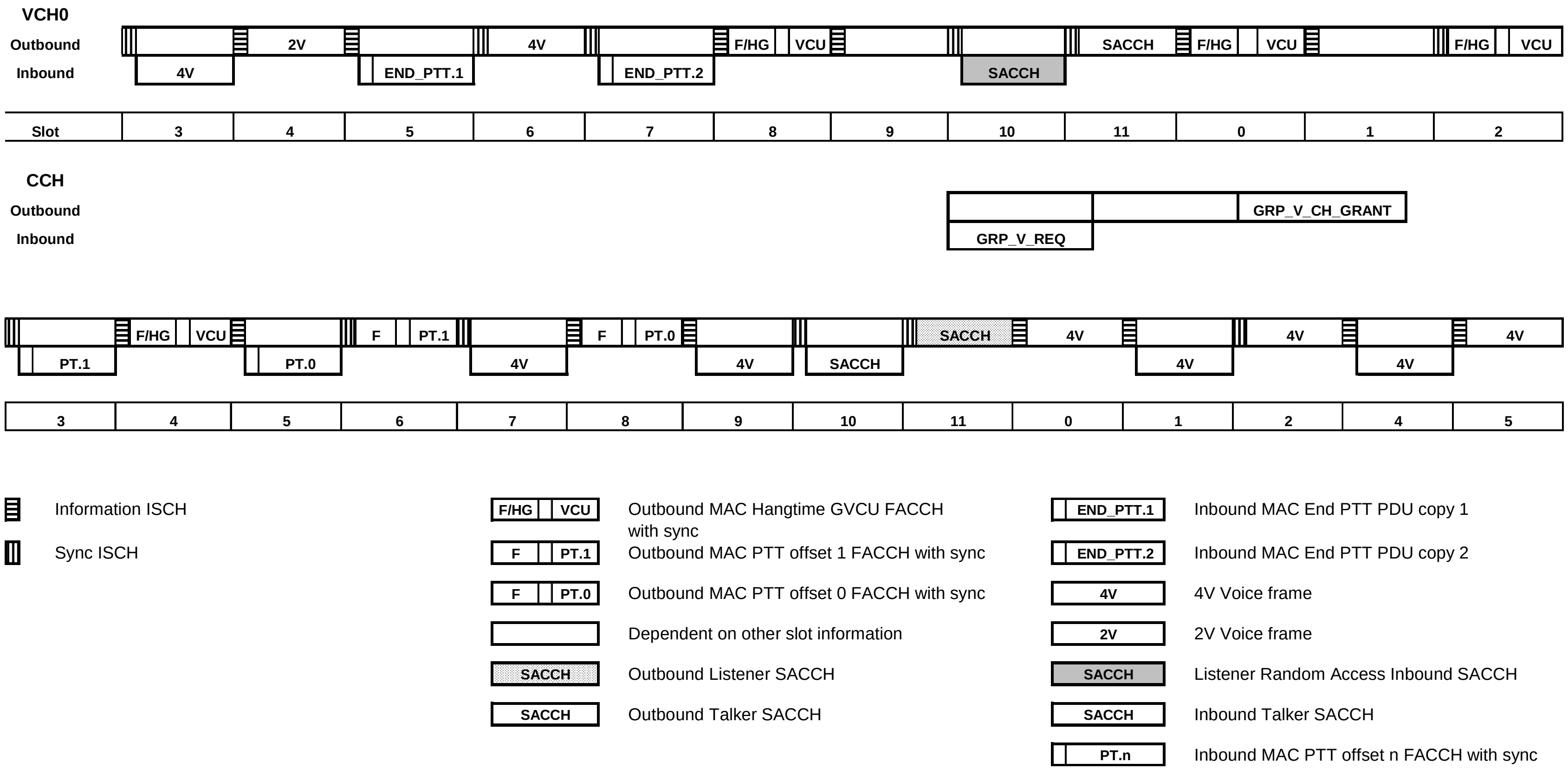
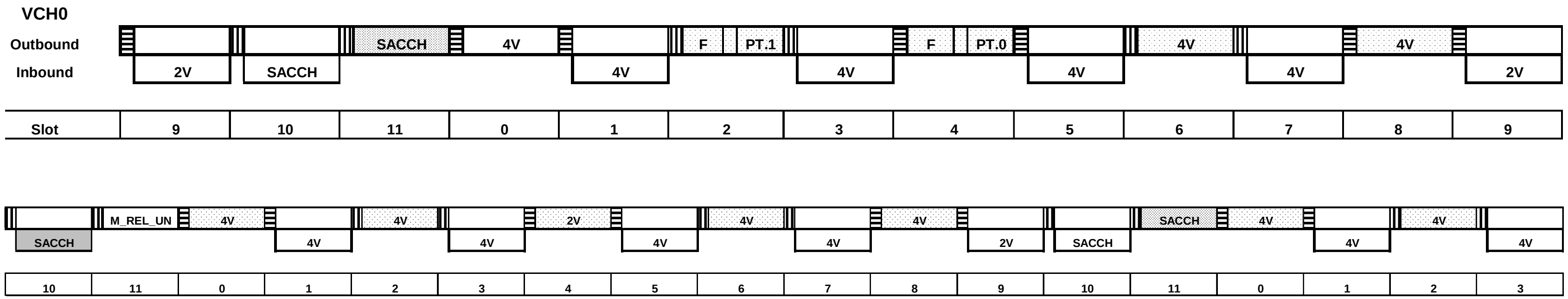


Figure D-6 Detailed Example of message trunked VCH 0 group call unkey with call continuation via Control Channel



Note: Inbound SACCH schedule still set by Original Talker

Information ISCH

Sync ISCH

FNE does not have to wait for outbound talker SACCH to interrupt the outbound audio stream since it is an unforced pre-emption.

In this example, original talker continues to transmit during pre-empt

F PT.1 — New Talker Outbound MAC PTT

F PT.0 — New Talker Outbound MAC PTT

Dependent on other slot information

SACCH — Outbound Listener SACCH

SACCH — Outbound Talker SACCH

4V — New Talker 4V Voice frame

2V — New Talker 2V Voice frame

M_REL_UN — MAC Release with Unforced Pre-empt

PT.n — Inbound MAC PTT offset n FACCH with sync

4V — Original Talker 4V Voice frame

2V — Original Talker 2V Voice frame

SACCH — Listener Random Access Inbound SACCH

SACCH — Inbound Talker SACCH

Figure D-7 Detailed Example of VCH 0 group call undergoing console initiated talker preempt (unforced)

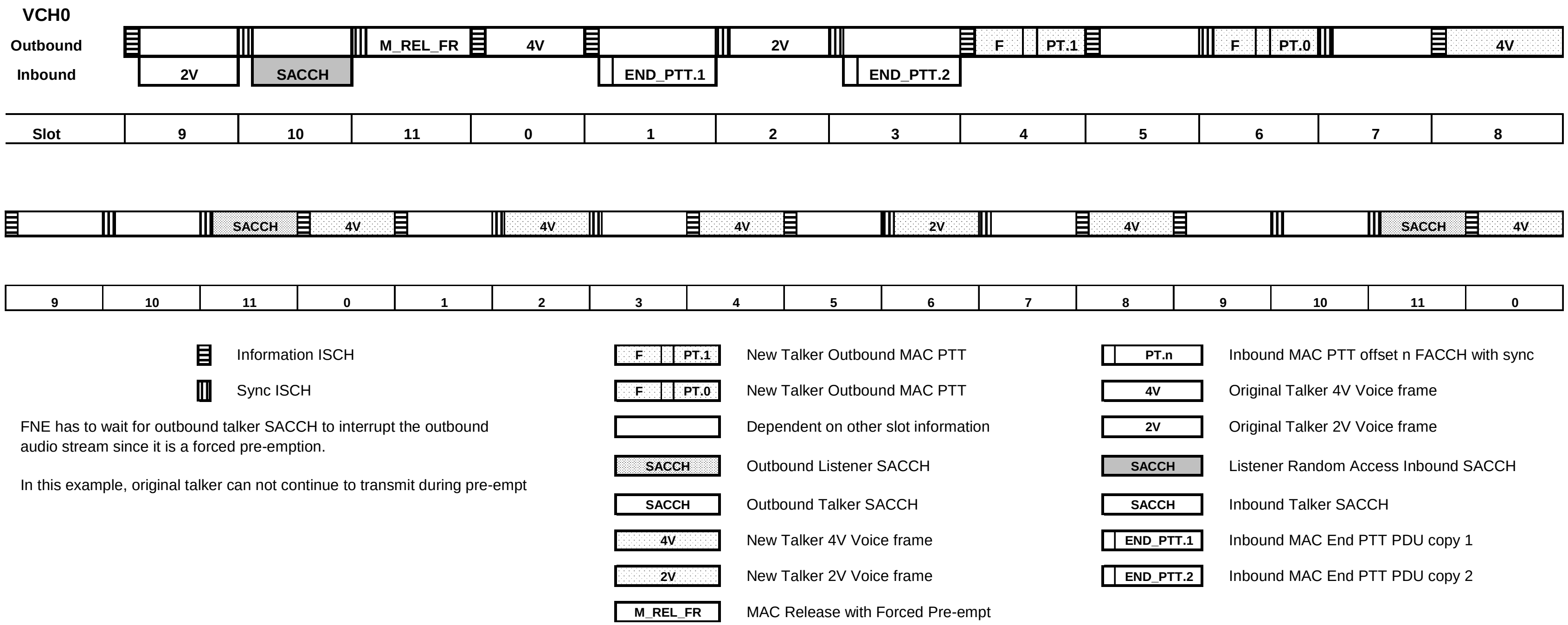


Figure D-8 Detailed Example of VCH 0 group call undergoing console initiated call preempt (forced)

This Page intentionally left blank

Annex E Burst Bit locations (Normative)

This annex contains the precise bit allocations for each of the burst types in Table E- 1 through Table E- 9. The order in which the vocoder bits are placed in the MAC frames is identical to the output of the vocoder as specified in Annex H of TIA102.BABA-1.

Table E- 1: Inbound 4V Burst Bit Allocations

Symbol	Field	Bit 1	Bit 0		Symbol	Field	Bit 1	Bit 0
0	Ramp-up/Guard	Z			45	Voice Frame 1 con't	$c_2(4)$	$c_3(0)$
1		Z			46	DUID 0	0	0
2		Z			47	Voice Frame 2	$c_0(23)$	$c_0(5)$
3		Z			48		$c_1(10)$	$c_2(3)$
4		Z			49		$c_0(22)$	$c_0(4)$
5		Z			50		$c_1(9)$	$c_2(2)$
6	Pilot	0	0		51		$c_0(21)$	$c_0(3)$
7		1	0		52		$c_1(8)$	$c_2(1)$
8		0	0		53		$c_0(20)$	$c_0(2)$
9		1	0		54		$c_1(7)$	$c_2(0)$
10	Voice Frame 1	$c_0(23)$	$c_0(5)$		55		$c_0(19)$	$c_0(1)$
11		$c_1(10)$	$c_2(3)$		56		$c_1(6)$	$c_3(13)$
12		$c_0(22)$	$c_0(4)$		57		$c_0(18)$	$c_0(0)$
13		$c_1(9)$	$c_2(2)$		58		$c_1(5)$	$c_3(12)$
14		$c_0(21)$	$c_0(3)$		59		$c_0(17)$	$c_1(22)$
15		$c_1(8)$	$c_2(1)$		60		$c_1(4)$	$c_3(11)$
16		$c_0(20)$	$c_0(2)$		61		$c_0(16)$	$c_1(21)$
17		$c_1(7)$	$c_2(0)$		62		$c_1(3)$	$c_3(10)$
18		$c_0(19)$	$c_0(1)$		63		$c_0(15)$	$c_1(20)$
19		$c_1(6)$	$c_3(13)$		64		$c_1(2)$	$c_3(9)$
20		$c_0(18)$	$c_0(0)$		65		$c_0(14)$	$c_1(19)$
21		$c_1(5)$	$c_3(12)$		66		$c_1(1)$	$c_3(8)$
22		$c_0(17)$	$c_1(22)$		67		$c_0(13)$	$c_1(18)$
23		$c_1(4)$	$c_3(11)$		68		$c_1(0)$	$c_3(7)$
24		$c_0(16)$	$c_1(21)$		69		$c_0(12)$	$c_1(17)$
25		$c_1(3)$	$c_3(10)$		70		$c_2(10)$	$c_3(6)$
26		$c_0(15)$	$c_1(20)$		71		$c_0(11)$	$c_1(16)$
27		$c_1(2)$	$c_3(9)$		72		$c_2(9)$	$c_3(5)$
28		$c_0(14)$	$c_1(19)$		73		$c_0(10)$	$c_1(15)$
29		$c_1(1)$	$c_3(8)$		74		$c_2(8)$	$c_3(4)$
30		$c_0(13)$	$c_1(18)$		75		$c_0(9)$	$c_1(14)$
31		$c_1(0)$	$c_3(7)$		76		$c_2(7)$	$c_3(3)$
32		$c_0(12)$	$c_1(17)$		77		$c_0(8)$	$c_1(13)$
33		$c_2(10)$	$c_3(6)$		78		$c_2(6)$	$c_3(2)$
34		$c_0(11)$	$c_1(16)$		79		$c_0(7)$	$c_1(12)$
35		$c_2(9)$	$c_3(5)$		80		$c_2(5)$	$c_3(1)$
36		$c_0(10)$	$c_1(15)$		81		$c_0(6)$	$c_1(11)$
37		$c_2(8)$	$c_3(4)$		82		$c_2(4)$	$c_3(0)$
38		$c_0(9)$	$c_1(14)$		83	DUID 1	0	0
39		$c_2(7)$	$c_3(3)$		84	ESS-B	ESS-B(23)	ESS-B(22)
40		$c_0(8)$	$c_1(13)$		85		ESS-B(21)	ESS-B(20)
41		$c_2(6)$	$c_3(2)$		86		ESS-B(19)	ESS-B(18)
42		$c_0(7)$	$c_1(12)$		87		ESS-B(17)	ESS-B(16)
43		$c_2(5)$	$c_3(1)$		88		ESS-B(15)	ESS-B(14)
44		$c_0(6)$	$c_1(11)$		89		ESS-B(13)	ESS-B(12)

Table E- 1: Inbound 4V Burst Bit Allocations (concluded)

Symbol	Field	Bit 1	Bit 0
90	ESS-B con't	ESS-B(11)	ESS-B(10)
91		ESS-B(9)	ESS-B(8)
92		ESS-B(7)	ESS-B(6)
93		ESS-B(5)	ESS-B(4)
94		ESS-B(3)	ESS-B(2)
95		ESS-B(1)	ESS-B(0)
96	Voice Frame 3	$c_0(23)$	$c_0(5)$
97		$c_1(10)$	$c_2(3)$
98		$c_0(22)$	$c_0(4)$
99		$c_1(9)$	$c_2(2)$
100		$c_0(21)$	$c_0(3)$
101		$c_1(8)$	$c_2(1)$
102		$c_0(20)$	$c_0(2)$
103		$c_1(7)$	$c_2(0)$
104		$c_0(19)$	$c_0(1)$
105		$c_1(6)$	$c_3(13)$
106		$c_0(18)$	$c_0(0)$
107		$c_1(5)$	$c_3(12)$
108		$c_0(17)$	$c_1(22)$
109		$c_1(4)$	$c_3(11)$
110		$c_0(16)$	$c_1(21)$
111		$c_1(3)$	$c_3(10)$
112		$c_0(15)$	$c_1(20)$
113		$c_1(2)$	$c_3(9)$
114		$c_0(14)$	$c_1(19)$
115		$c_1(1)$	$c_3(8)$
116		$c_0(13)$	$c_1(18)$
117		$c_1(0)$	$c_3(7)$
118		$c_0(12)$	$c_1(17)$
119		$c_2(10)$	$c_3(6)$
120		$c_0(11)$	$c_1(16)$
121		$c_2(9)$	$c_3(5)$
122		$c_0(10)$	$c_1(15)$
123		$c_2(8)$	$c_3(4)$
124		$c_0(9)$	$c_1(14)$
125		$c_2(7)$	$c_3(3)$
126		$c_0(8)$	$c_1(13)$
127		$c_2(6)$	$c_3(2)$
128		$c_0(7)$	$c_1(12)$
129		$c_2(5)$	$c_3(1)$
130		$c_0(6)$	$c_1(11)$
131		$c_2(4)$	$c_3(0)$
132	DUID 3	0	0
133	Voice Frame 4	$c_0(23)$	$c_0(5)$
134		$c_1(10)$	$c_2(3)$
135	Voice Frame 4 con't	$c_0(22)$	$c_0(4)$
136		$c_1(9)$	$c_2(2)$
137		$c_0(21)$	$c_0(3)$
138		$c_1(8)$	$c_2(1)$
139		$c_0(20)$	$c_0(2)$
140		$c_1(7)$	$c_2(0)$
141		$c_0(19)$	$c_0(1)$
142		$c_1(6)$	$c_3(13)$
143		$c_0(18)$	$c_0(0)$
144		$c_1(5)$	$c_3(12)$
145		$c_0(17)$	$c_1(22)$
146		$c_1(4)$	$c_3(11)$
147		$c_0(16)$	$c_1(21)$
148		$c_1(3)$	$c_3(10)$
149		$c_0(15)$	$c_1(20)$
150		$c_1(2)$	$c_3(9)$
151		$c_0(14)$	$c_1(19)$
152		$c_1(1)$	$c_3(8)$
153		$c_0(13)$	$c_1(18)$
154		$c_1(0)$	$c_3(7)$
155		$c_0(12)$	$c_1(17)$
156		$c_2(10)$	$c_3(6)$
157		$c_0(11)$	$c_1(16)$
158		$c_2(9)$	$c_3(5)$
159		$c_0(10)$	$c_1(15)$
160		$c_2(8)$	$c_3(4)$
161		$c_0(9)$	$c_1(14)$
162		$c_2(7)$	$c_3(3)$
163		$c_0(8)$	$c_1(13)$
164		$c_2(6)$	$c_3(2)$
165		$c_0(7)$	$c_1(12)$
166		$c_2(5)$	$c_3(1)$
167		$c_0(6)$	$c_1(11)$
168		$c_2(4)$	$c_3(0)$
169	DUID 4	0	0
170	Pilot	1	0
171		0	0
172		1	0
173		0	0
174	Ramp-Down/Guard	Z	
175		Z	
176		Z	
177		Z	
178		Z	
179		Z	

Table E- 2: Inbound 4V Burst ESS Bit Allocations

Field	4V Burst 1	4V Burst 2	4V Burst 3	4V Burst 4
ESS-B(23)	ALGID(7)	MI(71)	MI(47)	MI(23)
ESS-B(22)	ALGID(6)	MI(70)	MI(46)	MI(22)
ESS-B(21)	ALGID(5)	MI(69)	MI(45)	MI(21)
ESS-B(20)	ALGID(4)	MI(68)	MI(44)	MI(20)
ESS-B(19)	ALGID(3)	MI(67)	MI(43)	MI(19)
ESS-B(18)	ALGID(2)	MI(66)	MI(42)	MI(18)
ESS-B(17)	ALGID(1)	MI(65)	MI(41)	MI(17)
ESS-B(16)	ALGID(0)	MI(64)	MI(40)	MI(16)
ESS-B(15)	KID(15)	MI(63)	MI(39)	MI(15)
ESS-B(14)	KID(14)	MI(62)	MI(38)	MI(14)
ESS-B(13)	KID(13)	MI(61)	MI(37)	MI(13)
ESS-B(12)	KID(12)	MI(60)	MI(36)	MI(12)
ESS-B(11)	KID(11)	MI(59)	MI(35)	MI(11)
ESS-B(10)	KID(10)	MI(58)	MI(34)	MI(10)
ESS-B(9)	KID(9)	MI(57)	MI(33)	MI(9)
ESS-B(8)	KID(8)	MI(56)	MI(32)	MI(8)
ESS-B(7)	KID(7)	MI(55)	MI(31)	MI(7)
ESS-B(6)	KID(6)	MI(54)	MI(30)	MI(6)
ESS-B(5)	KID(5)	MI(53)	MI(29)	MI(5)
ESS-B(4)	KID(4)	MI(52)	MI(28)	MI(4)
ESS-B(3)	KID(3)	MI(51)	MI(27)	MI(3)
ESS-B(2)	KID(2)	MI(50)	MI(26)	MI(2)
ESS-B(1)	KID(1)	MI(49)	MI(25)	MI(1)
ESS-B(0)	KID(0)	MI(48)	MI(24)	MI(0)

The ESS information contained in the inbound 4V bursts is defined in Table E- 2 by which of the four 4V bursts in the sequence as explained in 5.6.2 and 6.1.

Table E- 3: Inbound 2V Burst Bit Allocations

Symbol	Field	Bit 1	Bit 0	Symbol	Field	Bit 1	Bit 0
0		Z		45	Voice Frame 1 con't	$c_2(4)$	$c_3(0)$
1		Z		46	DUID 0	0	0
2	Ramp-up/Guard	Z		47		$c_0(23)$	$c_0(5)$
3		Z		48		$c_1(10)$	$c_2(3)$
4		Z		49		$c_0(22)$	$c_0(4)$
5		Z		50		$c_1(9)$	$c_2(2)$
6		0	0	51		$c_0(21)$	$c_0(3)$
7		1	0	52		$c_1(8)$	$c_2(1)$
8	Pilot	0	0	53		$c_0(20)$	$c_0(2)$
9		1	0	54		$c_1(7)$	$c_2(0)$
10		$c_0(23)$	$c_0(5)$	55		$c_0(19)$	$c_0(1)$
11		$c_1(10)$	$c_2(3)$	56		$c_1(6)$	$c_3(13)$
12		$c_0(22)$	$c_0(4)$	57		$c_0(18)$	$c_0(0)$
13		$c_1(9)$	$c_2(2)$	58		$c_1(5)$	$c_3(12)$
14		$c_0(21)$	$c_0(3)$	59		$c_0(17)$	$c_1(22)$
15		$c_1(8)$	$c_2(1)$	60		$c_1(4)$	$c_3(11)$
16		$c_0(20)$	$c_0(2)$	61		$c_0(16)$	$c_1(21)$
17		$c_1(7)$	$c_2(0)$	62		$c_1(3)$	$c_3(10)$
18		$c_0(19)$	$c_0(1)$	63		$c_0(15)$	$c_1(20)$
19		$c_1(6)$	$c_3(13)$	64	Voice Frame 2	$c_1(2)$	$c_3(9)$
20		$c_0(18)$	$c_0(0)$	65		$c_0(14)$	$c_1(19)$
21		$c_1(5)$	$c_3(12)$	66		$c_1(1)$	$c_3(8)$
22		$c_0(17)$	$c_1(22)$	67		$c_0(13)$	$c_1(18)$
23		$c_1(4)$	$c_3(11)$	68		$c_1(0)$	$c_3(7)$
24		$c_0(16)$	$c_1(21)$	69		$c_0(12)$	$c_1(17)$
25		$c_1(3)$	$c_3(10)$	70		$c_2(10)$	$c_3(6)$
26		$c_0(15)$	$c_1(20)$	71		$c_0(11)$	$c_1(16)$
27	Voice Frame 1	$c_1(2)$	$c_3(9)$	72		$c_2(9)$	$c_3(5)$
28		$c_0(14)$	$c_1(19)$	73		$c_0(10)$	$c_1(15)$
29		$c_1(1)$	$c_3(8)$	74		$c_2(8)$	$c_3(4)$
30		$c_0(13)$	$c_1(18)$	75		$c_0(9)$	$c_1(14)$
31		$c_1(0)$	$c_3(7)$	76		$c_2(7)$	$c_3(3)$
32		$c_0(12)$	$c_1(17)$	77		$c_0(8)$	$c_1(13)$
33		$c_2(10)$	$c_3(6)$	78		$c_2(6)$	$c_3(2)$
34		$c_0(11)$	$c_1(16)$	79		$c_0(7)$	$c_1(12)$
35		$c_2(9)$	$c_3(5)$	80		$c_2(5)$	$c_3(1)$
36		$c_0(10)$	$c_1(15)$	81		$c_0(6)$	$c_1(11)$
37		$c_2(8)$	$c_3(4)$	82		$c_2(4)$	$c_3(0)$
38		$c_0(9)$	$c_1(14)$	83	DUID 1	1	0
39		$c_2(7)$	$c_3(3)$	84		RS_parity(167)	RS_parity(166)
40		$c_0(8)$	$c_1(13)$	85		RS_parity(165)	RS_parity(164)
41		$c_2(6)$	$c_3(2)$	86		RS_parity(163)	RS_parity(162)
42		$c_0(7)$	$c_1(12)$	87	ESS-A (1)	RS_parity(161)	RS_parity(160)
43		$c_2(5)$	$c_3(1)$	88		RS_parity(159)	RS_parity(158)
44		$c_0(6)$	$c_1(11)$	89		RS_parity(157)	RS_parity(156)

Table E- 3: Inbound 2V Burst Bit Allocations (concluded)

Symbol	Field	Bit 1	Bit 0		Symbol	Field	Bit 1	Bit 0
90		RS_parity(155)	RS_parity(154)		135		RS_parity(67)	RS_parity(66)
91		RS_parity(153)	RS_parity(152)		136		RS_parity(65)	RS_parity(64)
92		RS_parity(151)	RS_parity(150)		137		RS_parity(63)	RS_parity(62)
93		RS_parity(149)	RS_parity(148)		138		RS_parity(61)	RS_parity(60)
94		RS_parity(147)	RS_parity(146)		139		RS_parity(59)	RS_parity(58)
95		RS_parity(145)	RS_parity(144)		140		RS_parity(57)	RS_parity(56)
96		RS_parity(143)	RS_parity(142)		141		RS_parity(55)	RS_parity(54)
97		RS_parity(141)	RS_parity(140)		142		RS_parity(53)	RS_parity(52)
98		RS_parity(139)	RS_parity(138)		143		RS_parity(51)	RS_parity(50)
99		RS_parity(137)	RS_parity(136)		144		RS_parity(49)	RS_parity(48)
100		RS_parity(135)	RS_parity(134)		145		RS_parity(47)	RS_parity(46)
101		RS_parity(133)	RS_parity(132)		146		RS_parity(45)	RS_parity(44)
102		RS_parity(131)	RS_parity(130)		147		RS_parity(43)	RS_parity(42)
103		RS_parity(129)	RS_parity(128)		148		RS_parity(41)	RS_parity(40)
104		RS_parity(127)	RS_parity(126)		149		RS_parity(39)	RS_parity(38)
105		RS_parity(125)	RS_parity(124)		150		RS_parity(37)	RS_parity(36)
106		RS_parity(123)	RS_parity(122)		151	ESS-A(2) con't	RS_parity(35)	RS_parity(34)
107		RS_parity(121)	RS_parity(120)		152		RS_parity(33)	RS_parity(32)
108		RS_parity(119)	RS_parity(118)		153		RS_parity(31)	RS_parity(30)
109		RS_parity(117)	RS_parity(116)		154		RS_parity(29)	RS_parity(28)
110		RS_parity(115)	RS_parity(114)		155		RS_parity(27)	RS_parity(26)
111	ESS-A(1) con't	RS_parity(113)	RS_parity(112)		156		RS_parity(25)	RS_parity(24)
112		RS_parity(111)	RS_parity(110)		157		RS_parity(23)	RS_parity(22)
113		RS_parity(109)	RS_parity(108)		158		RS_parity(21)	RS_parity(20)
114		RS_parity(107)	RS_parity(106)		159		RS_parity(19)	RS_parity(18)
115		RS_parity(105)	RS_parity(104)		160		RS_parity(17)	RS_parity(16)
116		RS_parity(103)	RS_parity(102)		161		RS_parity(15)	RS_parity(14)
117		RS_parity(101)	RS_parity(100)		162		RS_parity(13)	RS_parity(12)
118		RS_parity(99)	RS_parity(98)		163		RS_parity(11)	RS_parity(10)
119		RS_parity(97)	RS_parity(96)		164		RS_parity(9)	RS_parity(8)
120		RS_parity(95)	RS_parity(94)		165		RS_parity(7)	RS_parity(6)
121		RS_parity(93)	RS_parity(92)		166		RS_parity(5)	RS_parity(4)
122		RS_parity(91)	RS_parity(90)		167		RS_parity(3)	RS_parity(2)
123		RS_parity(89)	RS_parity(88)		168		RS_parity(1)	RS_parity(0)
124		RS_parity(87)	RS_parity(86)		169	DUID 4	1	0
125		RS_parity(85)	RS_parity(84)		170		1	0
126		RS_parity(83)	RS_parity(82)		171		0	0
127		RS_parity(81)	RS_parity(80)		172	Pilot	1	0
128		RS_parity(79)	RS_parity(78)		173		0	0
129		RS_parity(77)	RS_parity(76)		174		Z	
130		RS_parity(75)	RS_parity(74)		175		Z	
131		RS_parity(73)	RS_parity(72)		176	Ramp-Down/Guard	Z	
132	DUID 3	1	1		177		Z	
133		RS_parity(71)	RS_parity(70)		178		Z	
134	ESS-A (2)	RS_parity(69)	RS_parity(68)		179		Z	

Table E- 4: Inbound Signaling with Sync Burst Bit Allocations

Symbol	Field	Bit 1	Bit 0		Symbol	Field	Bit 1	Bit 0
0	Ramp-up/Guard	Z			45	IEMI (1) con't	IEMI(121)	IEMI(120)
1		Z			46	DUID 0	DUID(3)	DUID(2)
2		Z			47	IEMI(2)	IEMI(119)	IEMI(118)
3		Z			48		IEMI(117)	IEMI(116)
4		Z			49		IEMI(115)	IEMI(114)
5		Z			50		IEMI(113)	IEMI(112)
6	Sync	0	1		51		IEMI(111)	IEMI(110)
7		0	1		52		IEMI(109)	IEMI(108)
8		1	1		53		IEMI(107)	IEMI(106)
9		1	1		54		IEMI(105)	IEMI(104)
10		0	1		55		IEMI(103)	IEMI(102)
11		0	1		56		IEMI(101)	IEMI(100)
12		0	1		57		IEMI(99)	IEMI(98)
13		1	1		58		IEMI(97)	IEMI(96)
14		0	1		59		IEMI(95)	IEMI(94)
15		1	1		60		IEMI(93)	IEMI(92)
16		1	1		61		IEMI(91)	IEMI(90)
17		0	1		62		IEMI(89)	IEMI(88)
18		0	1		63		IEMI(87)	IEMI(86)
19		0	1		64		IEMI(85)	IEMI(84)
20		0	1		65		IEMI(83)	IEMI(82)
21		1	1		66		IEMI(81)	IEMI(80)
22		0	1		67		IEMI(79)	IEMI(78)
23		1	1		68		IEMI(77)	IEMI(76)
24		1	1		69		IEMI(75)	IEMI(74)
25		1	1		70		IEMI(73)	IEMI(72)
26		1	1		71		IEMI(71)	IEMI(70)
27		1	1		72		IEMI(69)	IEMI(68)
28	IEMI (1)	IEMI(155)	IEMI(154)		73		IEMI(67)	IEMI(66)
29		IEMI(153)	IEMI(152)		74		IEMI(65)	IEMI(64)
30		IEMI(151)	IEMI(150)		75		IEMI(63)	IEMI(62)
31		IEMI(149)	IEMI(148)		76		IEMI(61)	IEMI(60)
32		IEMI(147)	IEMI(146)		77		IEMI(59)	IEMI(58)
33		IEMI(145)	IEMI(144)		78		IEMI(57)	IEMI(56)
34		IEMI(143)	IEMI(142)		79		IEMI(55)	IEMI(54)
35		IEMI(141)	IEMI(140)		80		IEMI(53)	IEMI(52)
36		IEMI(139)	IEMI(138)		81		IEMI(51)	IEMI(50)
37		IEMI(137)	IEMI(136)		82		IEMI(49)	IEMI(48)
38		IEMI(135)	IEMI(134)		83	DUID 1	DUID(1)	DUID(0)
39		IEMI(133)	IEMI(132)		84	IEMI(3)	IEMI(47)	IEMI(46)
40		IEMI(131)	IEMI(130)		85		IEMI(45)	IEMI(44)
41		IEMI(129)	IEMI(128)		86		IEMI(43)	IEMI(42)
42		IEMI(127)	IEMI(126)		87		IEMI(41)	IEMI(40)
43		IEMI(125)	IEMI(124)		88		IEMI(39)	IEMI(38)
44		IEMI(123)	IEMI(122)		89		IEMI(37)	IEMI(36)

Table E- 4: Inbound Signaling with Sync Burst Bit Allocations (concluded)

Symbol	Field	Bit 1	Bit 0		Symbol	Field	Bit 1	Bit 0
90		IEMI(35)	IEMI(34)		135		RS_parity(67)	RS_parity(66)
91		IEMI(33)	IEMI(32)		136		RS_parity(65)	RS_parity(64)
92		IEMI(31)	IEMI(30)		137		RS_parity(63)	RS_parity(62)
93		IEMI(29)	IEMI(28)		138		RS_parity(61)	RS_parity(60)
94		IEMI(27)	IEMI(26)		139		RS_parity(59)	RS_parity(58)
95		IEMI(25)	IEMI(24)		140		RS_parity(57)	RS_parity(56)
96		IEMI(23)	IEMI(22)		141		RS_parity(55)	RS_parity(54)
97		IEMI(21)	IEMI(20)		142		RS_parity(53)	RS_parity(52)
98		IEMI(19)	IEMI(18)		143		RS_parity(51)	RS_parity(50)
99		IEMI(17)	IEMI(16)		144		RS_parity(49)	RS_parity(48)
100		IEMI(15)	IEMI(14)		145		RS_parity(47)	RS_parity(46)
101		IEMI(13)	IEMI(12)		146		RS_parity(45)	RS_parity(44)
102		IEMI(11)	IEMI(10)		147		RS_parity(43)	RS_parity(42)
103		IEMI(9)	IEMI(8)		148		RS_parity(41)	RS_parity(40)
104		IEMI(7)	IEMI(6)		149		RS_parity(39)	RS_parity(38)
105		IEMI(5)	IEMI(4)		150		RS_parity(37)	RS_parity(36)
106		IEMI(3)	IEMI(2)		151	IEMI(4) con't	RS_parity(35)	RS_parity(34)
107		IEMI(1)	IEMI(0)		152		RS_parity(33)	RS_parity(32)
108		RS_parity(119)	RS_parity(118)		153		RS_parity(31)	RS_parity(30)
109		RS_parity(117)	RS_parity(116)		154		RS_parity(29)	RS_parity(28)
110	IEMI(3) con't	RS_parity(115)	RS_parity(114)		155		RS_parity(27)	RS_parity(26)
111		RS_parity(113)	RS_parity(112)		156		RS_parity(25)	RS_parity(24)
112		RS_parity(111)	RS_parity(110)		157		RS_parity(23)	RS_parity(22)
113		RS_parity(109)	RS_parity(108)		158		RS_parity(21)	RS_parity(20)
114		RS_parity(107)	RS_parity(106)		159		RS_parity(19)	RS_parity(18)
115		RS_parity(105)	RS_parity(104)		160		RS_parity(17)	RS_parity(16)
116		RS_parity(103)	RS_parity(102)		161		RS_parity(15)	RS_parity(14)
117		RS_parity(101)	RS_parity(100)		162		RS_parity(13)	RS_parity(12)
118		RS_parity(99)	RS_parity(98)		163		RS_parity(11)	RS_parity(10)
119		RS_parity(97)	RS_parity(96)		164		RS_parity(9)	RS_parity(8)
120		RS_parity(95)	RS_parity(94)		165		RS_parity(7)	RS_parity(6)
121		RS_parity(93)	RS_parity(92)		166		RS_parity(5)	RS_parity(4)
122		RS_parity(91)	RS_parity(90)		167		RS_parity(3)	RS_parity(2)
123		RS_parity(89)	RS_parity(88)		168		RS_parity(1)	RS_parity(0)
124		RS_parity(87)	RS_parity(86)		169	DUID 4	DUIDparity(1)	DUIDparity(0)
125		RS_parity(85)	RS_parity(84)		170		1	0
126		RS_parity(83)	RS_parity(82)		171		0	0
127		RS_parity(81)	RS_parity(80)		172	Pilot	1	0
128		RS_parity(79)	RS_parity(78)		173		0	0
129		RS_parity(77)	RS_parity(76)		174		Z	
130		RS_parity(75)	RS_parity(74)		175		Z	
131		RS_parity(73)	RS_parity(72)		176	Ramp-Down/Guard	Z	
132	DUID 3	DUIDparity(3)	DUIDparity(2)		177		Z	
133		RS_parity(71)	RS_parity(70)		178		Z	
134	IEMI(4)	RS_parity(69)	RS_parity(68)		179		Z	

Table E- 5: Outbound 4V Burst Bit Allocations

Symbol	Field	Bit 1	Bit 0		Symbol	Field	Bit 1	Bit 0
0	2nd Half of Previous burst's ISCH	ISCH(19)	ISCH(18)		45	Voice Frame 1 con't	c_0(6)	c_1(11)
1		ISCH(17)	ISCH(16)		46		c_2(4)	c_3(0)
2		ISCH(15)	ISCH(14)		47	DUID 1	0	0
3		ISCH(13)	ISCH(12)		48	Voice Frame 2	c_0(23)	c_0(5)
4		ISCH(11)	ISCH(10)		49		c_1(10)	c_2(3)
5		ISCH(9)	ISCH(8)		50		c_0(22)	c_0(4)
6		ISCH(7)	ISCH(6)		51		c_1(9)	c_2(2)
7		ISCH(5)	ISCH(4)		52		c_0(21)	c_0(3)
8		ISCH(3)	ISCH(2)		53		c_1(8)	c_2(1)
9		ISCH(1)	ISCH(0)		54		c_0(20)	c_0(2)
10	DUID 0	0	0		55		c_1(7)	c_2(0)
11	Voice Frame 1	c_0(23)	c_0(5)		56		c_0(19)	c_0(1)
12		c_1(10)	c_2(3)		57		c_1(6)	c_3(13)
13		c_0(22)	c_0(4)		58		c_0(18)	c_0(0)
14		c_1(9)	c_2(2)		59		c_1(5)	c_3(12)
15		c_0(21)	c_0(3)		60		c_0(17)	c_1(22)
16		c_1(8)	c_2(1)		61		c_1(4)	c_3(11)
17		c_0(20)	c_0(2)		62		c_0(16)	c_1(21)
18		c_1(7)	c_2(0)		63		c_1(3)	c_3(10)
19		c_0(19)	c_0(1)		64		c_0(15)	c_1(20)
20		c_1(6)	c_3(13)		65		c_1(2)	c_3(9)
21		c_0(18)	c_0(0)		66		c_0(14)	c_1(19)
22		c_1(5)	c_3(12)		67		c_1(1)	c_3(8)
23		c_0(17)	c_1(22)		68		c_0(13)	c_1(18)
24		c_1(4)	c_3(11)		69		c_1(0)	c_3(7)
25		c_0(16)	c_1(21)		70		c_0(12)	c_1(17)
26		c_1(3)	c_3(10)		71		c_2(10)	c_3(6)
27		c_0(15)	c_1(20)		72		c_0(11)	c_1(16)
28		c_1(2)	c_3(9)		73		c_2(9)	c_3(5)
29		c_0(14)	c_1(19)		74		c_0(10)	c_1(15)
30		c_1(1)	c_3(8)		75		c_2(8)	c_3(4)
31		c_0(13)	c_1(18)		76		c_0(9)	c_1(14)
32		c_1(0)	c_3(7)		77		c_2(7)	c_3(3)
33		c_0(12)	c_1(17)		78		c_0(8)	c_1(13)
34		c_2(10)	c_3(6)		79		c_2(6)	c_3(2)
35		c_0(11)	c_1(16)		80		c_0(7)	c_1(12)
36		c_2(9)	c_3(5)		81		c_2(5)	c_3(1)
37		c_0(10)	c_1(15)		82		c_0(6)	c_1(11)
38		c_2(8)	c_3(4)		83		c_2(4)	c_3(0)
39		c_0(9)	c_1(14)		84	ESS-B	ESS-B(23)	ESS-B(22)
40		c_2(7)	c_3(3)		85		ESS-B(21)	ESS-B(20)
41		c_0(8)	c_1(13)		86		ESS-B(19)	ESS-B(18)
42		c_2(6)	c_3(2)		87		ESS-B(17)	ESS-B(16)
43		c_0(7)	c_1(12)		88		ESS-B(15)	ESS-B(14)
44		c_2(5)	c_3(1)		89		ESS-B(13)	ESS-B(12)

Table E- 5: Outbound 4V Burst Bit Allocations (concluded)

Symbol	Field	Bit 1	Bit 0	Symbol	Field	Bit 1	Bit 0
90	ESS-B con't	ESS-B(11)	ESS-B(10)	135	Voice Frame 4 con't	$c_0(22)$	$c_0(4)$
91		ESS-B(9)	ESS-B(8)	136		$c_1(9)$	$c_2(2)$
92		ESS-B(7)	ESS-B(6)	137		$c_0(21)$	$c_0(3)$
93		ESS-B(5)	ESS-B(4)	138		$c_1(8)$	$c_2(1)$
94		ESS-B(3)	ESS-B(2)	139		$c_0(20)$	$c_0(2)$
95		ESS-B(1)	ESS-B(0)	140		$c_1(7)$	$c_2(0)$
96	Voice Frame 3	$c_0(23)$	$c_0(5)$	141		$c_0(19)$	$c_0(1)$
97		$c_1(10)$	$c_2(3)$	142		$c_1(6)$	$c_3(13)$
98		$c_0(22)$	$c_0(4)$	143		$c_0(18)$	$c_0(0)$
99		$c_1(9)$	$c_2(2)$	144		$c_1(5)$	$c_3(12)$
100		$c_0(21)$	$c_0(3)$	145		$c_0(17)$	$c_1(22)$
101		$c_1(8)$	$c_2(1)$	146		$c_1(4)$	$c_3(11)$
102		$c_0(20)$	$c_0(2)$	147		$c_0(16)$	$c_1(21)$
103		$c_1(7)$	$c_2(0)$	148		$c_1(3)$	$c_3(10)$
104		$c_0(19)$	$c_0(1)$	149		$c_0(15)$	$c_1(20)$
105		$c_1(6)$	$c_3(13)$	150		$c_1(2)$	$c_3(9)$
106		$c_0(18)$	$c_0(0)$	151		$c_0(14)$	$c_1(19)$
107		$c_1(5)$	$c_3(12)$	152		$c_1(1)$	$c_3(8)$
108		$c_0(17)$	$c_1(22)$	153		$c_0(13)$	$c_1(18)$
109		$c_1(4)$	$c_3(11)$	154		$c_1(0)$	$c_3(7)$
110		$c_0(16)$	$c_1(21)$	155		$c_0(12)$	$c_1(17)$
111		$c_1(3)$	$c_3(10)$	156		$c_2(10)$	$c_3(6)$
112		$c_0(15)$	$c_1(20)$	157		$c_0(11)$	$c_1(16)$
113		$c_1(2)$	$c_3(9)$	158		$c_2(9)$	$c_3(5)$
114		$c_0(14)$	$c_1(19)$	159		$c_0(10)$	$c_1(15)$
115		$c_1(1)$	$c_3(8)$	160		$c_2(8)$	$c_3(4)$
116		$c_0(13)$	$c_1(18)$	161		$c_0(9)$	$c_1(14)$
117		$c_1(0)$	$c_3(7)$	162		$c_2(7)$	$c_3(3)$
118		$c_0(12)$	$c_1(17)$	163		$c_0(8)$	$c_1(13)$
119		$c_2(10)$	$c_3(6)$	164		$c_2(6)$	$c_3(2)$
120		$c_0(11)$	$c_1(16)$	165		$c_0(7)$	$c_1(12)$
121		$c_2(9)$	$c_3(5)$	166		$c_2(5)$	$c_3(1)$
122		$c_0(10)$	$c_1(15)$	167		$c_0(6)$	$c_1(11)$
123		$c_2(8)$	$c_3(4)$	168		$c_2(4)$	$c_3(0)$
124		$c_0(9)$	$c_1(14)$	169	DUID 4	0	0
125		$c_2(7)$	$c_3(3)$	170	First Half of this burst's ISCH	ISCH(39)	ISCH(38)
126		$c_0(8)$	$c_1(13)$	171		ISCH(37)	ISCH(36)
127		$c_2(6)$	$c_3(2)$	172		ISCH(35)	ISCH(34)
128		$c_0(7)$	$c_1(12)$	173		ISCH(33)	ISCH(32)
129		$c_2(5)$	$c_3(1)$	174		ISCH(31)	ISCH(30)
130		$c_0(6)$	$c_1(11)$	175		ISCH(29)	ISCH(28)
131		$c_2(4)$	$c_3(0)$	176		ISCH(27)	ISCH(26)
132	DUID 3	0	0	177		ISCH(25)	ISCH(24)
133	Voice Frame 4	$c_0(23)$	$c_0(5)$	178		ISCH(23)	ISCH(22)
134		$c_1(10)$	$c_2(3)$	179		ISCH(21)	ISCH(20)

Table E- 6: Outbound 4V Burst ESS Bit Allocations

Field	4V Burst 1	4V Burst 2	4V Burst 3	4V Burst 4
ESS-B(23)	ALGID(7)	MI(71)	MI(47)	MI(23)
ESS-B(22)	ALGID(6)	MI(70)	MI(46)	MI(22)
ESS-B(21)	ALGID(5)	MI(69)	MI(45)	MI(21)
ESS-B(20)	ALGID(4)	MI(68)	MI(44)	MI(20)
ESS-B(19)	ALGID(3)	MI(67)	MI(43)	MI(19)
ESS-B(18)	ALGID(2)	MI(66)	MI(42)	MI(18)
ESS-B(17)	ALGID(1)	MI(65)	MI(41)	MI(17)
ESS-B(16)	ALGID(0)	MI(64)	MI(40)	MI(16)
ESS-B(15)	KID(15)	MI(63)	MI(39)	MI(15)
ESS-B(14)	KID(14)	MI(62)	MI(38)	MI(14)
ESS-B(13)	KID(13)	MI(61)	MI(37)	MI(13)
ESS-B(12)	KID(12)	MI(60)	MI(36)	MI(12)
ESS-B(11)	KID(11)	MI(59)	MI(35)	MI(11)
ESS-B(10)	KID(10)	MI(58)	MI(34)	MI(10)
ESS-B(9)	KID(9)	MI(57)	MI(33)	MI(9)
ESS-B(8)	KID(8)	MI(56)	MI(32)	MI(8)
ESS-B(7)	KID(7)	MI(55)	MI(31)	MI(7)
ESS-B(6)	KID(6)	MI(54)	MI(30)	MI(6)
ESS-B(5)	KID(5)	MI(53)	MI(29)	MI(5)
ESS-B(4)	KID(4)	MI(52)	MI(28)	MI(4)
ESS-B(3)	KID(3)	MI(51)	MI(27)	MI(3)
ESS-B(2)	KID(2)	MI(50)	MI(26)	MI(2)
ESS-B(1)	KID(1)	MI(49)	MI(25)	MI(1)
ESS-B(0)	KID(0)	MI(48)	MI(24)	MI(0)

The ESS information contained in the inbound 4V bursts is defined in Table E- 6 by which of the four 4V bursts in the sequence as explained in 5.6.2 and 6.1.

Table E- 7: Outbound 2V Burst Bit Allocations

Symbol	Field	Bit 1	Bit 0	Symbol	Field	Bit 1	Bit 0
0	2nd Half of Previous burst's ISCH	ISCH(19)	ISCH(18)	45	Voice Frame 1 con't	$c_0(6)$	$c_1(11)$
1		ISCH(17)	ISCH(16)	46		$c_2(4)$	$c_3(0)$
2		ISCH(15)	ISCH(14)	47	DUID 1	1	0
3		ISCH(13)	ISCH(12)	48	Voice Frame 2	$c_0(23)$	$c_0(5)$
4		ISCH(11)	ISCH(10)	49		$c_1(10)$	$c_2(3)$
5		ISCH(9)	ISCH(8)	50		$c_0(22)$	$c_0(4)$
6		ISCH(7)	ISCH(6)	51		$c_1(9)$	$c_2(2)$
7		ISCH(5)	ISCH(4)	52		$c_0(21)$	$c_0(3)$
8		ISCH(3)	ISCH(2)	53		$c_1(8)$	$c_2(1)$
9		ISCH(1)	ISCH(0)	54		$c_0(20)$	$c_0(2)$
10	DUID 0	0	0	55		$c_1(7)$	$c_2(0)$
11	Voice Frame 1	$c_0(23)$	$c_0(5)$	56		$c_0(19)$	$c_0(1)$
12		$c_1(10)$	$c_2(3)$	57		$c_1(6)$	$c_3(13)$
13		$c_0(22)$	$c_0(4)$	58		$c_0(18)$	$c_0(0)$
14		$c_1(9)$	$c_2(2)$	59		$c_1(5)$	$c_3(12)$
15		$c_0(21)$	$c_0(3)$	60		$c_0(17)$	$c_1(22)$
16		$c_1(8)$	$c_2(1)$	61		$c_1(4)$	$c_3(11)$
17		$c_0(20)$	$c_0(2)$	62		$c_0(16)$	$c_1(21)$
18		$c_1(7)$	$c_2(0)$	63		$c_1(3)$	$c_3(10)$
19		$c_0(19)$	$c_0(1)$	64		$c_0(15)$	$c_1(20)$
20		$c_1(6)$	$c_3(13)$	65		$c_1(2)$	$c_3(9)$
21		$c_0(18)$	$c_0(0)$	66		$c_0(14)$	$c_1(19)$
22		$c_1(5)$	$c_3(12)$	67		$c_1(1)$	$c_3(8)$
23		$c_0(17)$	$c_1(22)$	68		$c_0(13)$	$c_1(18)$
24		$c_1(4)$	$c_3(11)$	69		$c_1(0)$	$c_3(7)$
25		$c_0(16)$	$c_1(21)$	70		$c_0(12)$	$c_1(17)$
26		$c_1(3)$	$c_3(10)$	71		$c_2(10)$	$c_3(6)$
27		$c_0(15)$	$c_1(20)$	72		$c_0(11)$	$c_1(16)$
28		$c_1(2)$	$c_3(9)$	73		$c_2(9)$	$c_3(5)$
29		$c_0(14)$	$c_1(19)$	74		$c_0(10)$	$c_1(15)$
30		$c_1(1)$	$c_3(8)$	75		$c_2(8)$	$c_3(4)$
31		$c_0(13)$	$c_1(18)$	76		$c_0(9)$	$c_1(14)$
32		$c_1(0)$	$c_3(7)$	77		$c_2(7)$	$c_3(3)$
33		$c_0(12)$	$c_1(17)$	78		$c_0(8)$	$c_1(13)$
34		$c_2(10)$	$c_3(6)$	79		$c_2(6)$	$c_3(2)$
35		$c_0(11)$	$c_1(16)$	80		$c_0(7)$	$c_1(12)$
36		$c_2(9)$	$c_3(5)$	81		$c_2(5)$	$c_3(1)$
37		$c_0(10)$	$c_1(15)$	82		$c_0(6)$	$c_1(11)$
38		$c_2(8)$	$c_3(4)$	83		$c_2(4)$	$c_3(0)$
39		$c_0(9)$	$c_1(14)$	84	ESS-A (1)	RS_parity(167)	RS_parity(166)
40		$c_2(7)$	$c_3(3)$	85		RS_parity(165)	RS_parity(164)
41		$c_0(8)$	$c_1(13)$	86		RS_parity(163)	RS_parity(162)
42		$c_2(6)$	$c_3(2)$	87		RS_parity(161)	RS_parity(160)
43		$c_0(7)$	$c_1(12)$	88		RS_parity(159)	RS_parity(158)
44		$c_2(5)$	$c_3(1)$	89		RS_parity(157)	RS_parity(156)

Table E- 7: Outbound 2V Burst Bit Allocations (concluded)

Symbol	Field	Bit 1	Bit 0		Symbol	Field	Bit 1	Bit 0
90	ESS-A (1) con't	RS_parity(155)	RS_parity(154)		135	ESS-A (2) con't	RS_parity(67)	RS_parity(66)
91		RS_parity(153)	RS_parity(152)		136		RS_parity(65)	RS_parity(64)
92		RS_parity(151)	RS_parity(150)		137		RS_parity(63)	RS_parity(62)
93		RS_parity(149)	RS_parity(148)		138		RS_parity(61)	RS_parity(60)
94		RS_parity(147)	RS_parity(146)		139		RS_parity(59)	RS_parity(58)
95		RS_parity(145)	RS_parity(144)		140		RS_parity(57)	RS_parity(56)
96		RS_parity(143)	RS_parity(142)		141		RS_parity(55)	RS_parity(54)
97		RS_parity(141)	RS_parity(140)		142		RS_parity(53)	RS_parity(52)
98		RS_parity(139)	RS_parity(138)		143		RS_parity(51)	RS_parity(50)
99		RS_parity(137)	RS_parity(136)		144		RS_parity(49)	RS_parity(48)
100		RS_parity(135)	RS_parity(134)		145		RS_parity(47)	RS_parity(46)
101		RS_parity(133)	RS_parity(132)		146		RS_parity(45)	RS_parity(44)
102		RS_parity(131)	RS_parity(130)		147		RS_parity(43)	RS_parity(42)
103		RS_parity(129)	RS_parity(128)		148		RS_parity(41)	RS_parity(40)
104		RS_parity(127)	RS_parity(126)		149		RS_parity(39)	RS_parity(38)
105		RS_parity(125)	RS_parity(124)		150		RS_parity(37)	RS_parity(36)
106		RS_parity(123)	RS_parity(122)		151		RS_parity(35)	RS_parity(34)
107		RS_parity(121)	RS_parity(120)		152		RS_parity(33)	RS_parity(32)
108		RS_parity(119)	RS_parity(118)		153		RS_parity(31)	RS_parity(30)
109		RS_parity(117)	RS_parity(116)		154		RS_parity(29)	RS_parity(28)
110		RS_parity(115)	RS_parity(114)		155		RS_parity(27)	RS_parity(26)
111		RS_parity(113)	RS_parity(112)		156		RS_parity(25)	RS_parity(24)
112		RS_parity(111)	RS_parity(110)		157		RS_parity(23)	RS_parity(22)
113		RS_parity(109)	RS_parity(108)		158		RS_parity(21)	RS_parity(20)
114		RS_parity(107)	RS_parity(106)		159		RS_parity(19)	RS_parity(18)
115		RS_parity(105)	RS_parity(104)		160		RS_parity(17)	RS_parity(16)
116		RS_parity(103)	RS_parity(102)		161		RS_parity(15)	RS_parity(14)
117		RS_parity(101)	RS_parity(100)		162		RS_parity(13)	RS_parity(12)
118		RS_parity(99)	RS_parity(98)		163		RS_parity(11)	RS_parity(10)
119		RS_parity(97)	RS_parity(96)		164		RS_parity(9)	RS_parity(8)
120		RS_parity(95)	RS_parity(94)		165		RS_parity(7)	RS_parity(6)
121		RS_parity(93)	RS_parity(92)		166		RS_parity(5)	RS_parity(4)
122		RS_parity(91)	RS_parity(90)		167		RS_parity(3)	RS_parity(2)
123		RS_parity(89)	RS_parity(88)		168		RS_parity(1)	RS_parity(0)
124		RS_parity(87)	RS_parity(86)		169	DUID 4	1	0
125		RS_parity(85)	RS_parity(84)		170	First Half of this burst's ISCH	ISCH(39)	ISCH(38)
126		RS_parity(83)	RS_parity(82)		171		ISCH(37)	ISCH(36)
127		RS_parity(81)	RS_parity(80)		172		ISCH(35)	ISCH(34)
128		RS_parity(79)	RS_parity(78)		173		ISCH(33)	ISCH(32)
129		RS_parity(77)	RS_parity(76)		174		ISCH(31)	ISCH(30)
130		RS_parity(75)	RS_parity(74)		175		ISCH(29)	ISCH(28)
131		RS_parity(73)	RS_parity(72)		176		ISCH(27)	ISCH(26)
132	DUID 3	1	1		177		ISCH(25)	ISCH(24)
133	ESS-A (2)	RS_parity(71)	RS_parity(70)		178		ISCH(23)	ISCH(22)
134		RS_parity(69)	RS_parity(68)		179		ISCH(21)	ISCH(20)

Table E- 8: Outbound Signaling with Sync Burst Bit Allocations

Symbol	Field	Bit 1	Bit 0		Symbol	Field	Bit 1	Bit 0
0	2nd Half of Previous burst's ISCH	ISCH(19)	ISCH(18)		45		S-OEMI(87)	S-OEMI(86)
1		ISCH(17)	ISCH(16)		46		S-OEMI(85)	S-OEMI(84)
2		ISCH(15)	ISCH(14)		47	DUID 1	DUID(1)	DUID(0)
3		ISCH(13)	ISCH(12)		48	S-OEMI (2)	S-OEMI(83)	S-OEMI(82)
4		ISCH(11)	ISCH(10)		49		S-OEMI(81)	S-OEMI(80)
5		ISCH(9)	ISCH(8)		50		S-OEMI(79)	S-OEMI(78)
6		ISCH(7)	ISCH(6)		51		S-OEMI(77)	S-OEMI(76)
7		ISCH(5)	ISCH(4)		52		S-OEMI(75)	S-OEMI(74)
8		ISCH(3)	ISCH(2)		53		S-OEMI(73)	S-OEMI(72)
9		ISCH(1)	ISCH(0)		54		S-OEMI(71)	S-OEMI(70)
10	DUID 0	DUID(3)	DUID(2)		55		S-OEMI(69)	S-OEMI(68)
11	S-OEMI (1)	S-OEMI(155)	S-OEMI(154)		56		S-OEMI(67)	S-OEMI(66)
12		S-OEMI(153)	S-OEMI(152)		57		S-OEMI(65)	S-OEMI(64)
13		S-OEMI(151)	S-OEMI(150)		58		S-OEMI(63)	S-OEMI(62)
14		S-OEMI(149)	S-OEMI(148)		59		S-OEMI(61)	S-OEMI(60)
15		S-OEMI(147)	S-OEMI(146)		60		S-OEMI(59)	S-OEMI(58)
16		S-OEMI(145)	S-OEMI(144)		61		S-OEMI(57)	S-OEMI(56)
17		S-OEMI(143)	S-OEMI(142)		62		S-OEMI(55)	S-OEMI(54)
18		S-OEMI(141)	S-OEMI(140)		63		S-OEMI(53)	S-OEMI(52)
19		S-OEMI(139)	S-OEMI(138)		64		S-OEMI(51)	S-OEMI(50)
20		S-OEMI(137)	S-OEMI(136)		65		S-OEMI(49)	S-OEMI(48)
21		S-OEMI(135)	S-OEMI(134)		66		S-OEMI(47)	S-OEMI(46)
22		S-OEMI(133)	S-OEMI(132)		67		S-OEMI(45)	S-OEMI(44)
23		S-OEMI(131)	S-OEMI(130)		68		S-OEMI(43)	S-OEMI(42)
24		S-OEMI(129)	S-OEMI(128)		69		S-OEMI(41)	S-OEMI(40)
25		S-OEMI(127)	S-OEMI(126)		70		S-OEMI(39)	S-OEMI(38)
26		S-OEMI(125)	S-OEMI(124)		71		S-OEMI(37)	S-OEMI(36)
27		S-OEMI(123)	S-OEMI(122)		72		S-OEMI(35)	S-OEMI(34)
28		S-OEMI(121)	S-OEMI(120)		73		S-OEMI(33)	S-OEMI(32)
29		S-OEMI(119)	S-OEMI(118)		74		S-OEMI(31)	S-OEMI(30)
30		S-OEMI(117)	S-OEMI(116)		75		S-OEMI(29)	S-OEMI(28)
31		S-OEMI(115)	S-OEMI(114)		76		S-OEMI(27)	S-OEMI(26)
32		S-OEMI(113)	S-OEMI(112)		77		S-OEMI(25)	S-OEMI(24)
33		S-OEMI(111)	S-OEMI(110)		78		S-OEMI(23)	S-OEMI(22)
34		S-OEMI(109)	S-OEMI(108)		79	Sync	0	1
35		S-OEMI(107)	S-OEMI(106)		80		0	1
36		S-OEMI(105)	S-OEMI(104)		81		0	1
37		S-OEMI(103)	S-OEMI(102)		82		1	1
38		S-OEMI(101)	S-OEMI(100)		83		0	1
39		S-OEMI(99)	S-OEMI(98)		84		0	1
40		S-OEMI(97)	S-OEMI(96)		85		0	1
41		S-OEMI(95)	S-OEMI(94)		86		1	1
42		S-OEMI(93)	S-OEMI(92)		87		0	1
43		S-OEMI(91)	S-OEMI(90)		88		1	1
44		S-OEMI(89)	S-OEMI(88)		89		1	1

Table E- 8: Outbound Signaling with Sync Burst Bit Allocations (concluded)

Symbol	Field	Bit 1	Bit 0	Symbol	Field	Bit 1	Bit 0
90		0	1	135		RS_parity(67)	RS_parity(66)
91		1	1	136		RS_parity(65)	RS_parity(64)
92		0	1	137		RS_parity(63)	RS_parity(62)
93		0	1	138		RS_parity(61)	RS_parity(60)
94		1	1	139		RS_parity(59)	RS_parity(58)
95		1	1	140		RS_parity(57)	RS_parity(56)
96		1	1	141		RS_parity(55)	RS_parity(54)
97		1	1	142		RS_parity(53)	RS_parity(52)
98		1	1	143		RS_parity(51)	RS_parity(50)
99		1	1	144		RS_parity(49)	RS_parity(48)
100		S-OEMI(21)	S-OEMI(20)	145		RS_parity(47)	RS_parity(46)
101		S-OEMI(19)	S-OEMI(18)	146		RS_parity(45)	RS_parity(44)
102		S-OEMI(17)	S-OEMI(16)	147		RS_parity(43)	RS_parity(42)
103		S-OEMI(15)	S-OEMI(14)	148		RS_parity(41)	RS_parity(40)
104		S-OEMI(13)	S-OEMI(12)	149		RS_parity(39)	RS_parity(38)
105		S-OEMI(11)	S-OEMI(10)	150		RS_parity(37)	RS_parity(36)
106		S-OEMI(9)	S-OEMI(8)	151		RS_parity(35)	RS_parity(34)
107		S-OEMI(7)	S-OEMI(6)	152		RS_parity(33)	RS_parity(32)
108		S-OEMI(5)	S-OEMI(4)	153		RS_parity(31)	RS_parity(30)
109		S-OEMI(3)	S-OEMI(2)	154		RS_parity(29)	RS_parity(28)
110		S-OEMI(1)	S-OEMI(0)	155		RS_parity(27)	RS_parity(26)
111		RS_parity(113)	RS_parity(112)	156		RS_parity(25)	RS_parity(24)
112		RS_parity(111)	RS_parity(110)	157		RS_parity(23)	RS_parity(22)
113		RS_parity(109)	RS_parity(108)	158		RS_parity(21)	RS_parity(20)
114		RS_parity(107)	RS_parity(106)	159		RS_parity(19)	RS_parity(18)
115	S-OEMI (3)	RS_parity(105)	RS_parity(104)	160		RS_parity(17)	RS_parity(16)
116		RS_parity(103)	RS_parity(102)	161		RS_parity(15)	RS_parity(14)
117		RS_parity(101)	RS_parity(100)	162		RS_parity(13)	RS_parity(12)
118		RS_parity(99)	RS_parity(98)	163		RS_parity(11)	RS_parity(10)
119		RS_parity(97)	RS_parity(96)	164		RS_parity(9)	RS_parity(8)
120		RS_parity(95)	RS_parity(94)	165		RS_parity(7)	RS_parity(6)
121		RS_parity(93)	RS_parity(92)	166		RS_parity(5)	RS_parity(4)
122		RS_parity(91)	RS_parity(90)	167		RS_parity(3)	RS_parity(2)
123		RS_parity(89)	RS_parity(88)	168		RS_parity(1)	RS_parity(0)
124		RS_parity(87)	RS_parity(86)	169	DUID 4	DUIDparity(1)	DUIDparity(0)
125		RS_parity(85)	RS_parity(84)	170		ISCH(39)	ISCH(38)
126		RS_parity(83)	RS_parity(82)	171		ISCH(37)	ISCH(36)
127		RS_parity(81)	RS_parity(80)	172		ISCH(35)	ISCH(34)
128		RS_parity(79)	RS_parity(78)	173		ISCH(33)	ISCH(32)
129		RS_parity(77)	RS_parity(76)	174	First Half of this burst's ISCH	ISCH(31)	ISCH(30)
130		RS_parity(75)	RS_parity(74)	175		ISCH(29)	ISCH(28)
131		RS_parity(73)	RS_parity(72)	176		ISCH(27)	ISCH(26)
132	DUID 3	DUIDparity(3)	DUIDparity(2)	177		ISCH(25)	ISCH(24)
133		RS_parity(71)	RS_parity(70)	178		ISCH(23)	ISCH(22)
134	S-OEMI (4)	RS_parity(69)	RS_parity(68)	179		ISCH(21)	ISCH(20)

Table E- 9: Outbound Signaling no Sync Burst Bit Allocations

Symbol	Field	Bit 1	Bit 0	Symbol	Field	Bit 1	Bit 0
0	2nd Half of Previous burst's ISCH	ISCH(19)	ISCH(18)	45	I-OEMI(1) con't	I-OEMI(111)	I-OEMI(110)
1		ISCH(17)	ISCH(16)	46		I-OEMI(109)	I-OEMI(108)
2		ISCH(15)	ISCH(14)	47	DUID 1	DUID(1)	DUID(0)
3		ISCH(13)	ISCH(12)	48	I-OEMI (2)	I-OEMI(107)	I-OEMI(106)
4		ISCH(11)	ISCH(10)	49		I-OEMI(105)	I-OEMI(104)
5		ISCH(9)	ISCH(8)	50		I-OEMI(103)	I-OEMI(102)
6		ISCH(7)	ISCH(6)	51		I-OEMI(101)	I-OEMI(100)
7		ISCH(5)	ISCH(4)	52		I-OEMI(99)	I-OEMI(98)
8		ISCH(3)	ISCH(2)	53		I-OEMI(97)	I-OEMI(96)
9		ISCH(1)	ISCH(0)	54		I-OEMI(95)	I-OEMI(94)
10	DUID 0	DUID(3)	DUID(2)	55		I-OEMI(93)	I-OEMI(92)
11	I-OEMI (1)	I-OEMI(179)	I-OEMI(178)	56		I-OEMI(91)	I-OEMI(90)
12		I-OEMI(177)	I-OEMI(176)	57		I-OEMI(89)	I-OEMI(88)
13		I-OEMI(175)	I-OEMI(174)	58		I-OEMI(87)	I-OEMI(86)
14		I-OEMI(173)	I-OEMI(172)	59		I-OEMI(85)	I-OEMI(84)
15		I-OEMI(171)	I-OEMI(170)	60		I-OEMI(83)	I-OEMI(82)
16		I-OEMI(169)	I-OEMI(168)	61		I-OEMI(81)	I-OEMI(80)
17		I-OEMI(167)	I-OEMI(166)	62		I-OEMI(79)	I-OEMI(78)
18		I-OEMI(165)	I-OEMI(164)	63		I-OEMI(77)	I-OEMI(76)
19		I-OEMI(163)	I-OEMI(162)	64		I-OEMI(75)	I-OEMI(74)
20		I-OEMI(161)	I-OEMI(160)	65		I-OEMI(73)	I-OEMI(72)
21		I-OEMI(159)	I-OEMI(158)	66		I-OEMI(71)	I-OEMI(70)
22		I-OEMI(157)	I-OEMI(156)	67		I-OEMI(69)	I-OEMI(68)
23		I-OEMI(155)	I-OEMI(154)	68		I-OEMI(67)	I-OEMI(66)
24		I-OEMI(153)	I-OEMI(152)	69		I-OEMI(65)	I-OEMI(64)
25		I-OEMI(151)	I-OEMI(150)	70		I-OEMI(63)	I-OEMI(62)
26		I-OEMI(149)	I-OEMI(148)	71		I-OEMI(61)	I-OEMI(60)
27		I-OEMI(147)	I-OEMI(146)	72		I-OEMI(59)	I-OEMI(58)
28		I-OEMI(145)	I-OEMI(144)	73		I-OEMI(57)	I-OEMI(56)
29		I-OEMI(143)	I-OEMI(142)	74		I-OEMI(55)	I-OEMI(54)
30		I-OEMI(141)	I-OEMI(140)	75		I-OEMI(53)	I-OEMI(52)
31		I-OEMI(139)	I-OEMI(138)	76		I-OEMI(51)	I-OEMI(50)
32		I-OEMI(137)	I-OEMI(136)	77		I-OEMI(49)	I-OEMI(48)
33		I-OEMI(135)	I-OEMI(134)	78		I-OEMI(47)	I-OEMI(46)
34		I-OEMI(133)	I-OEMI(132)	79		I-OEMI(45)	I-OEMI(44)
35		I-OEMI(131)	I-OEMI(130)	80		I-OEMI(43)	I-OEMI(42)
36		I-OEMI(129)	I-OEMI(128)	81		I-OEMI(41)	I-OEMI(40)
37		I-OEMI(127)	I-OEMI(126)	82		I-OEMI(39)	I-OEMI(38)
38		I-OEMI(125)	I-OEMI(124)	83		I-OEMI(37)	I-OEMI(36)
39		I-OEMI(123)	I-OEMI(122)	84		I-OEMI(35)	I-OEMI(34)
40		I-OEMI(121)	I-OEMI(120)	85		I-OEMI(33)	I-OEMI(32)
41		I-OEMI(119)	I-OEMI(118)	86		I-OEMI(31)	I-OEMI(30)
42		I-OEMI(117)	I-OEMI(116)	87		I-OEMI(29)	I-OEMI(28)
43		I-OEMI(115)	I-OEMI(114)	88		I-OEMI(27)	I-OEMI(26)
44		I-OEMI(113)	I-OEMI(112)	89		I-OEMI(25)	I-OEMI(24)

Table E- 9: Outbound Signaling no Sync Burst Bit Allocations (concluded)

Symbol	Field	Bit 1	Bit 0		Symbol	Field	Bit 1	Bit 0
90		I-OEMI(23)	I-OEMI(22)		135		RS_parity(67)	RS_parity(66)
91		I-OEMI(21)	I-OEMI(20)		136		RS_parity(65)	RS_parity(64)
92		I-OEMI(19)	I-OEMI(18)		137		RS_parity(63)	RS_parity(62)
93		I-OEMI(17)	I-OEMI(16)		138		RS_parity(61)	RS_parity(60)
94		I-OEMI(15)	I-OEMI(14)		139		RS_parity(59)	RS_parity(58)
95		I-OEMI(13)	I-OEMI(12)		140		RS_parity(57)	RS_parity(56)
96		I-OEMI(11)	I-OEMI(10)		141		RS_parity(55)	RS_parity(54)
97		I-OEMI(9)	I-OEMI(8)		142		RS_parity(53)	RS_parity(52)
98		I-OEMI(7)	I-OEMI(6)		143		RS_parity(51)	RS_parity(50)
99		I-OEMI(5)	I-OEMI(4)		144		RS_parity(49)	RS_parity(48)
100		I-OEMI(3)	I-OEMI(2)		145		RS_parity(47)	RS_parity(46)
101		I-OEMI(1)	I-OEMI(0)		146		RS_parity(45)	RS_parity(44)
102		RS_parity(131)	RS_parity(130)		147		RS_parity(43)	RS_parity(42)
103		RS_parity(129)	RS_parity(128)		148		RS_parity(41)	RS_parity(40)
104		RS_parity(127)	RS_parity(126)		149		RS_parity(39)	RS_parity(38)
105		RS_parity(125)	RS_parity(124)		150		RS_parity(37)	RS_parity(36)
106		RS_parity(123)	RS_parity(122)		151		RS_parity(35)	RS_parity(34)
107		RS_parity(121)	RS_parity(120)		152	I-OEMI(3) con't	RS_parity(33)	RS_parity(32)
108		RS_parity(119)	RS_parity(118)		153		RS_parity(31)	RS_parity(30)
109		RS_parity(117)	RS_parity(116)		154		RS_parity(29)	RS_parity(28)
110	I-OEMI(2) con't	RS_parity(115)	RS_parity(114)		155		RS_parity(27)	RS_parity(26)
111		RS_parity(113)	RS_parity(112)		156		RS_parity(25)	RS_parity(24)
112		RS_parity(111)	RS_parity(110)		157		RS_parity(23)	RS_parity(22)
113		RS_parity(109)	RS_parity(108)		158		RS_parity(21)	RS_parity(20)
114		RS_parity(107)	RS_parity(106)		159		RS_parity(19)	RS_parity(18)
115		RS_parity(105)	RS_parity(104)		160		RS_parity(17)	RS_parity(16)
116		RS_parity(103)	RS_parity(102)		161		RS_parity(15)	RS_parity(14)
117		RS_parity(101)	RS_parity(100)		162		RS_parity(13)	RS_parity(12)
118		RS_parity(99)	RS_parity(98)		163		RS_parity(11)	RS_parity(10)
119		RS_parity(97)	RS_parity(96)		164		RS_parity(9)	RS_parity(8)
120		RS_parity(95)	RS_parity(94)		165		RS_parity(7)	RS_parity(6)
121		RS_parity(93)	RS_parity(92)		166		RS_parity(5)	RS_parity(4)
122		RS_parity(91)	RS_parity(90)		167		RS_parity(3)	RS_parity(2)
123		RS_parity(89)	RS_parity(88)		168		RS_parity(1)	RS_parity(0)
124		RS_parity(87)	RS_parity(86)		169	DUID 4	DUIDparity(1)	DUIDparity(0)
125		RS_parity(85)	RS_parity(84)		170		ISCH(39)	ISCH(38)
126		RS_parity(83)	RS_parity(82)		171		ISCH(37)	ISCH(36)
127		RS_parity(81)	RS_parity(80)		172		ISCH(35)	ISCH(34)
128		RS_parity(79)	RS_parity(78)		173		ISCH(33)	ISCH(32)
129		RS_parity(77)	RS_parity(76)		174	First Half of this burst's ISCH	ISCH(31)	ISCH(30)
130		RS_parity(75)	RS_parity(74)		175		ISCH(29)	ISCH(28)
131		RS_parity(73)	RS_parity(72)		176		ISCH(27)	ISCH(26)
132	DUID 3	DUIDparity(3)	DUIDparity(2)		177		ISCH(25)	ISCH(24)
133		RS_parity(71)	RS_parity(70)		178		ISCH(23)	ISCH(22)
134	I-OEMI (3)	RS_parity(69)	RS_parity(68)		179		ISCH(21)	ISCH(20)

THE TELECOMMUNICATIONS INDUSTRY ASSOCIATION

TIA represents the global information and communications technology (ICT) industry through standards development, advocacy, tradeshows, business opportunities, market intelligence and world-wide environmental regulatory analysis. With roots dating back to 1924, TIA enhances the business environment for broadband, mobile wireless, information technology, networks, cable, satellite and unified communications.

TIA members' products and services empower communications in every industry and market, including healthcare, education, security, public safety, transportation, government, the military, the environment and entertainment. TIA co-owns the SUPERCOMM® tradeshow and is accredited by the American National Standards Institute (ANSI).

ADVANCING GLOBAL COMMUNICATIONS

ADVANCING GLOBAL COMMUNICATIONS

HEADQUARTERS
2500 Wilson Boulevard
Suite 300
Arlington, VA 22201-3834
+1.703.907.7700
+1.703.907.7727 (fax)

tiaonline.org