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## Mobile Station - Land Station Compatibility Specification

## EIA/TIA-553

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ELECTRONIC INDUSTRIES ASSOCIATION
ENGINEERING DEPARTMENT

TELECOMMUNICATIONS INDUSTRY ASSOCIATION

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# PREFACE

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

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

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

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

As commercial systems evolve there may be a need for additional capabilities primarily in the area of call-processing procedures and new system features. It is important that evolutionary changes be readily accommodated. To that end, these technical requirements have been organized into six general sections. Alterations to 2 and 3 can affect fundamental mobile station - land station compatibility. All other sections may be altered without affecting basic compatibility.

The following is a summary of each section:

1. Definitions. This section comprises a list of brief explanations of terms, processes, and functions used in these requirements. Since it is the intention of these requirements to permit great latitude of system configurations and the implementation of system features, only those items required for compatibility have strict definitions. Other items may be interpreted to fit the needs of manufacturers and system operators. For example, control channels may be implemented with either combined paging/access functions or as separate paging and access channels.

2. Mobile Station Compatibility Requirements. This section comprises the fundamental signaling compatibility requirements of mobile stations. If strictly adhered to, a mobile station technically will be able to signal a land station. This section assures communications only if service is not otherwise restricted by operational or RF signal level constraints. For example, service may be denied for reasons of subscriber credit or because the mobile station is out of the effective range of a land station. In general, changes or alterations to this section will affect fundamental mobile station - land station compatibility and the ability of mobile stations

to signal land stations irrespective of operational or RF signal level conditions.

3. Land Station Compatibility Requirements. This section comprises the fundamental signaling compatibility requirements of land stations and is organized in a manner similar to 2. (In fact, 2 and 3 should be read together for a clearer understanding of the bi-directional signaling protocol.) If strictly adhered to, a land station technically will be able to signal a mobile station. As in 2, communications are assured only if not otherwise restricted by factors such as RF signal levels or operational limitations. In general, changes or alterations to this section will affect fundamental mobile station - land station compatibility and the ability of mobile stations to signal land stations irrespective of operational or RF signal level conditions.

4. Requirements for Mobile Station Options. This section states requirements for use of optional functions and features by mobile stations. It is concerned with evolutionary changes which do not affect fundamental compatibility but which require strict definition to ensure uniform recognition and implementation of such factors as the order qualifier definitions, extended message protocols, feature coding recommendations, etc. Requirements in this section do not affect the operation of existing mobile stations. Also unaffected is the ability of mobile stations incorporating any of these options to communicate with existing land stations.

5. Requirements for Land Station Options. This section states requirements for use of optional functions and features by land stations. This section is in general organized to follow the sequence of items listed in 4. The reader may thus review the changes in both mobile stations and land stations by referring to corresponding paragraphs in 4 and 5. Similar to the requirements for mobile station options, this section defines changes that require strict definition to ensure uniform recognition and utilization of such factors as reserved bits, order qualifier definitions, extended message protocols, feature coding recommendations, etc. Requirements in this section do not affect the operation of existing mobile stations. Also unaffected is the ability of existing mobile stations to communicate with land stations incorporating any of these options.

6. Change History. This section traces all changes to these technical requirements beginning with the document in force when cellular systems began commercial service. The purpose and references to each affected section are given for each change.

## NOTES

1. Compatibility, as used in connection with these standards, is understood to mean: Any mobile station is able to place and receive calls in any cellular system. Conversely all systems are able to place and receive calls for any mobile station. In a subscriber's home system, all call placement must be automatic. It is preferable that call placement be automatic when a mobile station is in roam status.
2. The term "mobile station" is defined as one "... intended to be used while in motion or during halts at unspecified points." It is assumed that mobile stations include portable units (e.g., hand-held 'personal' units) as well as units installed in vehicles.
3. This compatibility specification is based upon the specific US spectrum allocation for cellular systems.
4. Technical details are included for the operation of two systems in a geographic area, System A and System B, each with a separate set of control channels.
5. EIA IS-19, Recommended Minimum Standards for 800 MHz Cellular Subscriber Units, and EIA IS-20, Recommended Minimum Standards for 800 MHz Cellular Land Stations provide specifications and measurement methods for cellular equipment.
6. Each cellular system is identified by a unique 15-bit digital code, the SID code (see **2.3.8**). The Federal Communications Commission assigns SID codes when cellular system construction permits are issued.
7. Each mobile station is assigned a unique 32-bit binary serial number (see **2.3.2**).
8. In the message formats used between the mobile stations and land stations, some bits are marked as reserved (RSVD). Some or all of these reserved bits may be used in the future for additional messages. Therefore, all mobile stations and land stations must set all bits that they are programmed to treat as reserved bits to "0" (zero) in all messages that they transmit. All mobile stations and land stations must ignore the state of all bits that they are programmed to treat as reserved bits in all messages that they receive.
9. All lines modified or added for this transition of IS-3-D to EIA-553 are indicated by a X in the right-hand margin.
10. Radiation Hazard. Despite extensive investigations by numerous government, industry, and academic groups, there is not widespread agreement as to safe levels of exposure to radiated radio frequency energy. Thus , while the EIA is unaware of any occurrences of damage or injury from RF power levels specified herein, we cannot represent them to be absolutely without hazard under all possible circumstances of operation.
11. For the optional extended protocol feature (see 4.2 and 5.2), the assignment of message type codes (MST words) will be made using procedures developed under authority of the L-M Section of the EIA. This will ensure that the feature will be implemented in an orderly manner.
12. Due to evolving network requirements, it is recommended that mobile stations be provided with the capability for enabling as well as disabling autonomous registration.
13. As of October 21, 1988, the allocation of SID numbers is under review by EIA TR45 for potential revision to accommodate international requirements. Utilization of SID numbers must be coordinated.
14. Due to evolving network requirements, the modification indicated in 2.6.3.4 is strongly recommended.

## 1. DEFINITIONS

**Access Channel.** A control channel used by a mobile station to access a system to obtain service.

**Analog Color Code.** An analog signal (see SAT) transmitted by a land station on a voice channel and used to detect capture of a mobile station by an interfering land station and/or the capture of a land station by an interfering mobile station.

**BCH Code.** Bose-Chaudhuri-Hocquenghem Code.

**Busy-Idle Bits.** The portion of the data stream transmitted by a land station on a forward control channel that is used to indicate the current busy-idle status of the corresponding reverse control channel.

**Continuous Transmission.** A mode of operation in which Discontinuous Transmission is not permitted.

**Control Channel.** A channel used for the transmission of digital control information from a land station to a mobile station or from a mobile station to a land station.

**Digital Color Code (DCC).** A digital signal transmitted by a land station on a forward control channel that is used to detect capture of a land station by an interfering mobile station.

**Discontinuous Transmission.** A mode of operation in which a mobile-station transmitter autonomously switches between two transmitter power levels while the mobile station is in the conversation state on a voice channel.

**Extended Protocol.** An optional expansion of the signaling messages between the land station and mobile station to allow for the addition of new system features and operational capabilities.

**Flash Request.** A message sent on a voice channel from a mobile station to a land station indicating that a user desires to invoke special processing.

**Forward control channel (FOCC).** A control channel used from a land station to a mobile station.

**Forward Voice Channel (FVC).** A voice channel used from a land station to a mobile station.

**Group Identification.** A subset of the most significant bits of the system identification (SID) that is used to identify a group of cellular systems.

**Handoff.** The act of transferring a mobile station from one voice channel to another.

**Home Mobile Station.** A mobile station that operates in the cellular system from which service is subscribed.

**Land Station.** A station in the Domestic Public Cellular Radio Telecommunications Service, other than a mobile station, used for radio communications with mobile stations.

**Mobile Identification Number (MIN).** The 34-bit number that is a digital representation of the 10-digit directory telephone number assigned to a mobile station.

**Mobile Station.** A station in the Domestic Public Cellular Radio Telecommunications Service intended to be used while in motion or during halts at unspecified points. It is assumed that mobile stations include portable units (e.g., hand-held 'personal' units) as well as units installed in vehicles.

**Mobile Station Class.** The following mobile station classes are defined for this section:

- Class I. High power station.
- Class II. Mid-range power station.

- Class III. Low power station:

**Numeric Information.** Numeric information is used to describe the operation of the mobile station. The following subscripts are used to clarify the use of the numeric information:

"s" to indicate a value stored in a mobile stations temporary memory,

"sv" to indicate a stored value that varies as a mobile station processes various tasks,

"sl" to indicate the stored limits on values that vary,

"r" to indicate a value received by a mobile station over a forward control channel,

"p" to indicate a value set in a mobile stations permanent security and identification memory, and

"s-p" to indicate a value stored in a mobile station's semi-permanent security and identification memory.

The numeric indicators are:

- $ACCOLC_p$. A four-bit number used to identify which overload class field controls access attempts.
- $BIS_s$. Identifies whether a mobile station must check for an idle-to-busy transition on a reverse control channel when accessing a system.
- $CCLIST_s$. The list of control channels to be scanned by a mobile station processing the Directed-Retry Task (see 2.6.3.14).
- $CMAX_s$. The maximum number of channels to be scanned by a mobile station when accessing a system.
- $CPA_s$. Identifies whether the access functions are combined with the paging functions on the same set of control channels.
- $DTX_s$. Identifies in what way the mobile station is permitted to use the discontinuous transmission mode on the voice channel.
- $E_s$. The stored value of the E field sent on the forward control channel. $E_s$ identifies whether a home mobile station must send only $MIN1_p$ or both $MIN1_p$ and $MIN2_p$ when accessing the system.
- $EX_p$. Identifies whether home mobile stations must send $MIN1_p$ or both $MIN1_p$ and $MIN2_p$ when accessing the system. $EX_p$ differs from $E_s$ in that the information is stored in the mobile station's security and identification memory.
- $FIRSTCHA_s$. The number of the first control channel used for accessing a system.
- $FIRSTCHP_s$. The number of the first control channel used for paging mobile stations.
- $LASTCHA_s$. The number of the last control channel used for accessing a system.
- $LASTCHP_s$. The number of the last control channel used for paging mobile stations.
- $LT_s$. Identifies whether the next access attempt is required to be the last try.
- $MIN1_p$. The 24-bit number that corresponds to the 7-digit directory telephone number assigned to a mobile station.
- $MIN2_p$. The 10-bit number that corresponds to the 3-digit area code assigned to a mobile station.
- $MAXBUSY_{sl}$. The maximum number of busy occurrences allowed on a reverse control channel.

- $MAXSZTR_{rl}$. The maximum number of seizure attempts allowed on a reverse control channel.
- $N_s$. The number of paging channels that a mobile station must scan.
- $NBUSY_{rv}$. The number of times a mobile station attempts to seize a reverse control channel and finds the reverse control channel busy.
- $NSZTR_{rv}$. The number of times a mobile station attempts to seize a reverse control channel and fails.
- $NXTREG_{s,p}$. Identifies when a mobile station must make its next registration to a system.
- $PL_s$. The mobile station RF power level.
- $R_s$. Indicates whether registration is enabled or not.
- $RCF_s$. Identifies whether the mobile station must read a control-filler message before accessing a system on a reverse control channel.
- $REGID_s$. The stored value of the last registration number ($REGID_f$) received on a forward control channel.
- $REGINCR_s$. Identifies increments between registrations by a mobile station.
- $S_s$. Identifies whether the mobile station must send its serial number when accessing a system.
- $SCC_s$. A digital number that is stored and used to identify which SAT frequency a mobile station should be receiving.
- $SID_p$. The home system identification stored in the mobile station's permanent security and identification memory.
- $SID_{s,p}$. Identifies the system of current (last successful) registration.
- $SID_f$. The system identification received on a forward control channel.
- $SID_s$. The stored system identification.
- $WFOM_s$. Identifies whether a mobile station must wait for an overhead message train before accessing a system on a reverse control channel.

**Orders.** The following orders can be sent to a mobile station from a land station:

- *Alert*. The alert order is used to inform the user that a call is being received.
- *Audit*. The audit order is used by a land station to determine whether the mobile station is active in the system.
- *Change Power*. The change power order is used by a land station to change the RF power level of a mobile station.
- *Intercept*. The intercept order is used to inform the user of a procedural error made in placing the call.
- *Maintenance*. The maintenance order is used by a land station to check the operation of a mobile station. All functions are similar to alert but the alerting device is not activated.
- *Release*. The release order is used to disconnect a call that is being established or is already established.
- *Reorder*. The reorder order is used to inform the user that all facilities are in use and the call should be placed again.
- *Send Called-Address*. The send called-address order is used to inform the mobile station that it must send a message to the land station with dialed-digit information.

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- *Stop Alert.* The stop alert order is used to inform a mobile station that it must discontinue alerting the user.

**Paging.** The act of seeking a mobile station when an incoming call has been placed to it.

**Paging Channel.** A forward control channel that is used to page mobile stations and send orders.

**Registration.** The steps by which a mobile station identifies itself to a land station as being active in the system at the time the message is sent to the land station.

**Release Request.** A message sent from a mobile station to a land station indicating that the user desires to disconnect the call.

**Reverse Control Channel (RECC).** The control channel used from a mobile station to a land station.

**Reverse Voice Channel (RVC).** The voice channel used from a mobile station to a land station.

**Roamer.** A mobile station that operates in a cellular system other than the one from which service is subscribed.

**Scan of Channels.** The procedure by which a mobile station examines the signal strength of each forward control channel.

**Seizure Precursor.** The initial digital sequence transmitted by a mobile station to a land station on a reverse control channel.

**Signaling Tone.** A 10-kilohertz tone transmitted by a mobile station on a voice channel to: 1) confirm orders, 2) signal flash requests, and 3) signal release requests.

**Status Information.** The following status information is used in this section to describe mobile station operation:

- *Serving System Status.* Indicates whether a mobile station is tuned to channels associated with System A or System B.
- *First Registration ID Status.* Indicates whether a mobile station has received a registration ID message since initialization.
- *Local Control Status.* Indicates whether a mobile station must respond to local control messages or not.
- *Roam Status.* Indicates whether a mobile station is in its home system or not.
- *Termination Status.* Indicates whether a mobile station must terminate the call when it is on a voice channel.

**Supervisory Audio Tone (SAT).** One of three tones in the 6-kilohertz region that are transmitted by a land station and transponded by a mobile station.

**System Identification (SID).** A digital identification associated with a cellular system; each system is assigned a unique number.

**Voice Channel.** A channel on which a voice conversation occurs and on which brief digital messages may be sent from a land station to a mobile station or from a mobile station to a land station.

## 1.1 TOLERANCES

Unless otherwise specified, all time and timing values indicated in **2, 3, 4,** and **5** have a tolerance of plus and minus 10 percent of the nominal value.

# 2. MOBILE STATION (See also 4. for Mobile Station Options)

## 2.1 TRANSMITTER

### 2.1.1 FREQUENCY PARAMETERS

#### 2.1.1.1 CHANNEL SPACING AND DESIGNATION

Channel spacing shall be 30 kHz and the mobile station transmit channel at 825.030 MHz (and the corresponding land station transmit channel at 870.030 MHz) shall be termed channel number 1. The 20-MHz range of channels 1 through 666 as shown in Table 2.1.1.1-1 for System A and System B is basic. The additional 5-MHz of channels 667 through 799 and (wrap-around) 991 through 1023 for extending System A (A', A'') and B (B') is optional. In either case, the station class mark (SCM, see **2.3.3**) shall be set appropriately.

Table 2.1.1.1-1 CHANNEL NUMBERS AND FREQUENCIES

| System | MHz | Number of Channels | Boundary Channel Number | Transmitter Center Frequency, MHz -Mobile- | -Land- |
|---|---|---|---|---|---|
| (Not used) | | 1 | (990) | (824.010) | (869.010) |
| A'' | 1 | 33 | 991 | 824.040 | 869.040 |
| | | | 1023 | 825.000 | 870.000 |
| A | 10 | 333 | 1 | 825.030 | 870.030 |
| | | | 333 | 834.990 | 879.990 |
| B | 10 | 333 | 334 | 835.020 | 880.020 |
| | | | 666 | 844.980 | 889.980 |
| A' | 1.5 | 50 | 667 | 845.010 | 890.010 |
| | | | 716 | 846.480 | 891.480 |
| B' | 2.5 | 83 | 717 | 846.510 | 891.510 |
| | | | 799 | 848.970 | 893.970 |

In the above, the center frequency in MHz corresponding to the channel number (expressed as N) is calculated as follows.

| Transmitter | Channel Number | Center Frequency MHz |
|---|---|---|
| Mobile | $1 \leq N \leq 799$ | 0.03 N + 825.000 |
| | $990 \leq N \leq 1023$ | 0.03 (N—1023) + 825.000 |
| Land | $1 \leq N \leq 799$ | 0.03 N + 870.000 |
| | $990 \leq N \leq 1023$ | 0.03 (N—1023) + 870.000 |

#### 2.1.1.2 FREQUENCY TOLERANCE

The mobile station carrier frequency must be maintained within ±2.5 parts per million (ppm) of any assigned channel frequency, except during channel switching (see **2.1.2.1**). This tolerance must be maintained over the ambient temperature range of —30 degrees Celsius to +60 degrees Celsius, and over the supply voltage range of ±15 percent from the nominal value, accumulative.

### 2.1.2 POWER OUTPUT CHARACTERISTICS

#### 2.1.2.1 CARRIER ON/OFF CONDITIONS

The carrier-off condition is defined as a power output at the transmitting antenna connector not exceeding —60 dBm. When commanded to the carrier-on condition on a reverse control channel, a mobile station transmitter must come to within 3 dB of the specified output power (see **2.1.2.2**) and to within the required stability (see **2.1.1.2**) within 2 ms. Conversely, when commanded to the carrier-off condition, the transmit power must fall to a level not exceeding —60 dBm within 2 ms. Whenever a transmitter is more than 1 kHz from its initial or final value during channel switching, the transmitter carrier must be inhibited to a power output level not greater than —60 dBm.

#### 2.1.2.2 POWER OUTPUT AND POWER CONTROL

The maximum effective radiated power with respect to a half-wave dipole (ERP) for any class mobile station transmitter is 8 dBW (6.3 Watts). An inoperative antenna assembly must not degrade the spurious emission levels as defined in **2.1.4.2**. The nominal ERP for each class of mobile station transmitter is:

| | |
|---|---|
| Class I | 6 dBW (4.0 Watts) |
| Class II | 2 dBW (1.6 Watts) |
| Class III | —2 dBW (0.6 Watts) |

A mobile station transmitter must be capable of reducing power in steps of 4 dB on command from a land station (see **2.6.3.3**, **2.6.3.5**, **3.7.1.1**, **3.7.1.2.4**, and **3.7.2**). The nominal levels are given in Table 2.1.2-1. Each power level must be maintained within the range of +2 dB and —4 dB of its nominal level over the ambient temperature range of —30 degrees Celsius to +60 degrees Celsius, and over the supply voltage range of ±10 percent from the nominal value, accumulative.

Table 2.1.2-1 MOBILE STATION NOMINAL POWER LEVELS

| Mobile Station Power Level (PL) | Mobile Attenuation Code (MAC) | Nominal ERP (dBW) for Mobile Station Power Class | | |
|---|---|---|---|---|
| | | I | II | III |
| 0 | 000 | 6 | 2 | —2 |
| 1 | 001 | 2 | 2 | —2 |
| 2 | 010 | —2 | —2 | —2 |
| 3 | 011 | —6 | —6 | —6 |
| 4 | 100 | —10 | —10 | —10 |
| 5 | 101 | —14 | —14 | —14 |
| 6 | 110 | —18 | —18 | —18 |
| 7 | 111 | —22 | —22 | —22 |

### 2.1.3 MODULATION CHARACTERISTICS

#### 2.1.3.1 VOICE SIGNALS

The (FM) modulator is preceded by the following four voice-processing stages (in the order listed):

- Compressor
- Pre-Emphasis
- Deviation Limiter
- Post Deviation-Limiter Filter

#### 2.1.3.1.1 COMPRESSOR

This stage must include the compressor portion of a 2:1 syllabic compandor. For every 2 dB change in input level to a 2:1 compressor within its operating range, the change in output level is a nominal 1 dB. The compressor must have a nominal attack time of 3 ms and a nominal recovery time of 13.5 ms as defined by the CCITT. (Reference: Recommendation G162, CCITT Plenary Assembly, Geneva, May-June 1964, Blue Book, Vol. 111, P. 52.) The nominal reference input level to the compressor is that corresponding to a 1000 Hz acoustic tone at the expected nominal speech volume level. This level must produce a nominal ±2.9 kHz peak frequency deviation of the transmitted carrier.

#### 2.1.3.1.2 PRE-EMPHASIS

The pre-emphasis characteristic must have a nominal +6 dB/octave response between 300 and 3000 Hz.

#### 2.1.3.1.3 DEVIATION LIMITER

For audio (voice) inputs applied to the transmitter voice-signal processing stages, a mobile station must limit the instantaneous frequency deviation to ±12 kHz. This requirement excludes supervision signals (see 2.4) and wideband data signals (see 2.1.3.2).

#### 2.1.3.1.4 POST DEVIATION-LIMITER FILTER

The deviation limiter must be followed by a low-pass filter whose attenuation characteristics must exceed:

| Frequency Band | Attenuation Relative to 1000 Hz |
|---|---|
| 3000 - 5900 Hz | 40 log (f/3000) dB |
| 5900 - 6100 Hz | 35 dB |
| 6100 - 15000 Hz | 40 log (f/3000) dB |
| above 15000 Hz | 28 dB |

### 2.1.3.2 WIDEBAND DATA SIGNALS

#### 2.1.3.2.1 ENCODING

The reverse control channel (RECC) and reverse voice channel (RVC) wideband data streams (see 2.7) must be further encoded such that each nonreturn-to-zero binary one is transformed to a zero-to-one transition, and each nonreturn-to-zero binary zero is transformed to a one-to-zero transition.

#### 2.1.3.2.2 MODULATION AND POLARITY

The filtered wideband data stream must then be used to modulate the transmitter carrier using direct binary frequency shift keying. A one (i.e., high state) into the modulator must correspond to a nominal peak frequency deviation 8 kHz above the carrier frequency, and a zero into the modulator must correspond to a nominal peak frequency deviation 8 kHz below the carrier frequency.

## 2.1.4 LIMITATIONS ON EMISSIONS

### 2.1.4.1 BANDWIDTH OCCUPIED

Modulation products outside the region ±20 kHz from the carrier shall not exceed a level of 26 dB below the unmodulated carrier. Modulation products outside the region of ±45 kHz from the carrier shall not exceed a level of 45 dB below the unmodulated carrier. Modulation products outside the region of ±90 kHz from the carrier shall not exceed a level of (a) 60 dB below the unmodulated carrier, or (b) 43 plus 10 $\log_{10}$(mean output power in Watts) dB below

the unmodulated carrier. Measurement techniques are defined in the current EIA edition of "Recommended Minimum Standards for 800-MHz Cellular Subscriber Units". X X

2.1.4.2 CONDUCTED SPURIOUS EMISSIONS

2.1.4.2.1 SUPPRESSION INSIDE CELLULAR BAND

When transmitting on any channel, the total emissions in each 30 kHz band located in the mobile station transmit band, centered 60 kHz or more from the transmitted carrier must be at least 45 dB below the level of the unmodulated carrier. In addition, the transmitter emissions in each 30 kHz band located anywhere in the mobile station receive band must not exceed —80 dBm at the transmit antenna connector.

2.1.4.2.2 SUPPRESSION OUTSIDE CELLULAR BAND

Current FCC rules shall apply.

2.1.4.3 RADIATED SPURIOUS EMISSIONS

Radiated spurious emissions (from sources other than via the antenna connector) must meet levels corresponding to the conducted spurious requirements listed in 2.1.4.2.

## 2.2 RECEIVER

### 2.2.1 FREQUENCY PARAMETERS

2.2.1.1 CHANNEL SPACING AND DESIGNATION

Channel spacing shall be 30 kHz and the mobile station receive channel at 870.030 MHz (and the corresponding land station receive channel at 825.030 MHz) shall be termed channel number 1. The 20-MHz range of channels 1 through 666 as shown in Table 2.1.1.1-1 for System A and System B is basic. The additional 5-MHz of channels 667 through 799 and (wrap-around) 991 through 1023 for extending Systems A and B is optional. In either case, the station class mark (SCM, see 2.3.3) shall be set appropriately.

### 2.2.2 DEMODULATION CHARACTERISTICS

2.2.2.1 VOICE SIGNALS

The demodulator is followed by the following two voice-signal processing stages:

- De-emphasis
- Expandor

2.2.2.1.1 DE-EMPHASIS

The de-emphasis characteristic must have a nominal —6 dB per octave response between 300 and 3000 Hz.

2.2.2.1.2 EXPANDOR

This stage must include the expandor portion of a 2:1 syllabic compandor. For every 1 dB change in input level to a 1:2 expandor, the change in output level is a nominal 2 dB. The signal expansion must follow all other demodulation signal processing (including the 6 dB/octave de-emphasis and filtering). The expandor must have a nominal attack time of 3 ms and a nominal recovery time of 13.5 ms as defined by the CCITT (Reference: Recommendation G162, CCITT Plenary Assembly, Geneva, May-June 1964, Blue Book, Vol. 111, P. 52). The nominal reference input level to the expandor is that corresponding to a 1000 Hz tone from a carrier with a ±2.9 kHz peak frequency deviation.

### 2.2.3 LIMITATIONS ON EMISSIONS

#### 2.2.3.1 CONDUCTED SPURIOUS EMISSIONS

##### 2.2.3.1.1 SUPPRESSION INSIDE CELLULAR BAND

Any RF signals emitted by the receiver and falling within the mobile station receive band must not exceed —80 dBm, as measured at the antenna connector. Additionally, signals falling within the mobile station transmit band must not exceed —60 dBm, as measured at the antenna connector.

##### 2.2.3.1.2 SUPPRESSION OUTSIDE CELLULAR BAND

Current FCC rules shall apply.

#### 2.2.3.2 RADIATED SPURIOUS EMISSIONS

Current FCC rules shall apply.

### 2.2.4 OTHER RECEIVER PARAMETERS

System performance is predicated upon receivers meeting EIA IS-19 (Recommended Minimum Standards for 800-MHz Cellular Subscriber Units).

## 2.3 SECURITY AND IDENTIFICATION

### 2.3.1 MOBILE IDENTIFICATION NUMBER

A 34-bit binary mobile identification number (MIN) is derived from the mobile station's 10-digit directory telephone number by the following procedure (see also 2.7.1).

(1) The first three digits are mapped into 10 bits (corresponding to $MIN2_p$) by the following coding algorithm:

(a) Represent the 3-digit field as $D_1 D_2 D_3$ with the digit 0 having the value 10.

(b) Compute $100D_1 + 10D_2 + D_3 - 111$.

(c) Convert the result in step (b) to binary by a standard decimal-to-binary conversion (see table below).

(2) The second three digits are mapped into the 10 most significant bits of $MIN1_p$ by the coding algorithm described in (1).

(3) The last four digits are mapped into the 14 least-significant bits of $MIN1_p$ as follows:

(a) The thousands digit should be mapped into four bits by a Binary-Coded-Decimal (BCD) conversion, as specified in the table below.

(b) The last three digits are mapped into 10 bits by the coding algorithm described in (1).

DECIMAL-TO-BINARY CONVERSION

| Decimal Number | Binary Number |
|---|---|
| 1 | 0000000001 |
| 2 | 0000000010 |
| 3 | 0000000011 |
| 4 | 0000000100 |
| . | . |
| . | . |
| . | . |
| 998 | 1111100110 |
| 999 | 1111100111 |

THOUSANDS-DIGIT BCD MAPPING PROCEDURE

| Thousands Digit | Binary Sequence |
|---|---|
| 1 | 0001 |
| 2 | 0010 |
| 3 | 0011 |
| 4 | 0100 |
| 5 | 0101 |
| 6 | 0110 |
| 7 | 0111 |
| 8 | 1000 |
| 9 | 1001 |
| 0 | 1010 |

In the following example the 10-digit directory telephone number 321-456-7890 is encoded into MIN2 and MIN1 using the procedure described above:

- MIN2. The 10-bit MIN2 is derived from the first three digits of the telephone number (i.e., 321):

  (a) $D_1 = 3$; $D_2 = 2$; $D_3 = 1$.

  (b) $100\ D_1 + 10\ D_2 + D_3 - 111 = 100(3) + 10(2) + (1) - 111 = 210$.

  (c) 210 in binary is '00 1101 0010'.

  Therefore MIN2 is '00 1101 0010'.

- MIN1. The 10 most significant bits of MIN1 are derived from the second three digits of the telephone number (i.e., 456):

  (a) $D_1 = 4$; $D_2 = 5$; $D_3 = 6$.

  (b) $100\ D_1 + 10\ D_2 + D_3 - 111 = 100(4) + 10(5) + (6) - 111 = 345$.

  (c) 345 in binary is '0101 0110 01'.

  The next four most significant bits of MIN1 are derived from the thousands digit of the telephone number (i.e., 7) by BCD conversion:

  7 in BCD is '01 11'.

  The 10 least significant bits of MIN1 are derived from the last three digits of the telephone number (i.e., 890):

  (a) $D_1 = 8$; $D_2 = 9$; $D_3 = 10$.

  (b) $100\ D_1 + 10\ D_2 + D_3 - 111 = 100(8) + 10(9) + (10) - 111 = 789$.

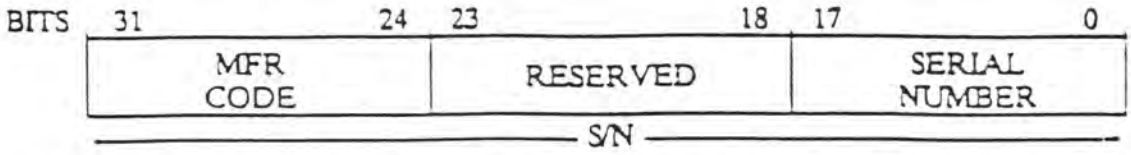
  (c) 789 in binary is '11 0001 0101'.

  Therefore MIN1 is '0101 0110 0101 1111 0001 0101'.

### 2.3.2 SERIAL NUMBER

The serial number is a 32-bit binary number that uniquely identifies a mobile station to any cellular system. It must be factory-set and not readily alterable in the field. The circuitry that provides the serial number must be isolated from fraudulent contact and tampering. Attempts to change the serial number circuitry should render the mobile station inoperative.

The bit allocation of the serial number (SN) shall be as follows:




At the time of issuance of initial type acceptance, the manufacturer shall be assigned a Manufacturer's (MFR) Code within the eight most-significant bits (bit 31 through bit 24) of the 32-bit serial number. Bits 23 through 18 shall be reserved (initially all zero), and bits 17 through 0 shall be uniquely assigned by each manufacturer. When a manufacturer has used substantially all possible combinations of serial numbers within bits 17 through 0, the manufacturer may submit notification to the FCC. The FCC will allocate the next sequential binary number within the reserve block (bits 23 through 18).

### 2.3.3 STATION CLASS MARK

Class-of-station information referred to as the station class mark ($SCM_p$) must be stored in a mobile station. The digital representation of this class mark is specified in the table below.

STATION CLASS MARK

| Power Class (see 2.1.2.2) | $SCM_p$ | Transmission (see 2.3.11) | $SCM_p$ | Bandwidth (see 2.1.1.1 and 2.2.1.1) | $SCM_p$ |
|---|---|---|---|---|---|
| Class I | XX00 | Continuous | X0XX | 20 MHz | 0XXX |
| Class II | XX01 | Discontinuous | X1XX | 25 MHz | 1XXX |
| Class III | XX10 | | | | |
| Reserved | XX11 | | | | |

### 2.3.4 REGISTRATION MEMORY

If the mobile station is equipped for autonomous registration (see note 12 in preface), then a single 21-bit (20 data bits plus an overflow bit) next registration ($NXTREG_{+p}$) and corresponding 15-bit system identification ($SID_{+p}$) pair must be retained when the mobile station power is turned off. The data retention time under power-off condition must be longer than 48 hours. If the integrity of the stored data can not be guaranteed after the mobile station is disconnected from the vehicle battery, then the memory must be set to zero when power is re-applied to the mobile station.

### 2.3.5 ACCESS OVERLOAD CLASS

A four-bit number ($ACCOLC_p$) must be stored in the mobile station and used to identify which overload class field controls access attempts by the mobile station (see 2.6.3.4).

### 2.3.6 ACCESS METHOD

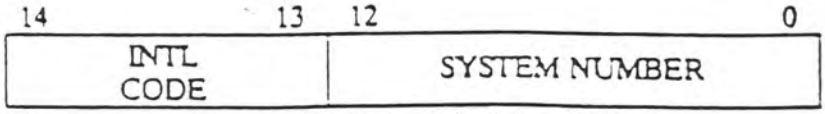
A one-bit access method ($EX_p$) must be stored in the mobile station and used to determine if the extended address word must be included in all access attempts (see 2.6.3.7).

### 2.3.7 FIRST PAGING CHANNEL

An eleven-bit first paging channel ($FIRSTCHP_p$) must be stored in the mobile station and used to identify the channel number of the first paging channel when the mobile station is "home" (see 2.6.1.1.2).

### 2.3.8 HOME SYSTEM IDENTIFICATION

A 15-bit system identification ($SID_p$) must be stored in the mobile station and used to identify the mobile station's home system (see 2.6.1.1.2). The bit allocation of the system identification (SID) shall be as follows:




The international (INTL) Codes (bits 14 and 13) shall be allocated as follows:

| BIT 14 | BIT13 | |
|---|---|---|
| 0 | 0 | United States |
| 0 | 1 | Other countries |
| 1 | 0 | Canada |
| 1 | 1 | Mexico |

Bits 12 through 0 will be assigned to each U.S. system by the FCC. (See note 13 in preface.) X

### 2.3.9 LOCAL CONTROL OPTION

A means must be equipped within the mobile station to enable or disable the local control option (see **2.6.2.1** and **2.6.2.5**).

### 2.3.10 PREFERRED-SYSTEM SELECTION

A means must be provided within the mobile station to identify the preferred system as either System A or System B.

## 2.3.11 DISCONTINUOUS TRANSMISSION

Discontinuous transmission refers to the ability of certain mobile stations to switch autonomously between two transmitter power-level states ("DTX-high" and "DTX-low") while the mobile station is in the conversation state on a voice channel. Discontinuous transmission is not permitted in any state other than the conversation state.

In the DTX-high state, the transmitter radiates at the power level indicated by the most recent power-controlling order (initial-voice-channel-designation, handoff, or power-change order) received by the mobile station. In this state the mobile station must transpond SAT at all times, except for the normal interruptions of SAT covered in **2.4.1.**

In the DTX-low state, the transmitter radiates at a power level determined by the DTX-high-state power level ("DTX-high level") and the $DTX_u$ indicator that is copied from the DTX field in Word 2 of the System Parameter Overhead Message (see **3.7.1.2.1**). If the $DTX_u$ indicator is set to '10', the DTX-low level must equal or exceed a level that is 8 dB below the DTX-high level.* If the $DTX_u$ indicator is set to '11', no minimum applies to the DTX-low level; that is, the transmitter may be turned off or it may be turned on at any level up to the DTX-high level. In the DTX-low state, the mobile station must not transpond SAT. If the $DTX_u$ indicator is set to '00', only the DTX-high state (that is "continuous transmission") is permitted. The $DTX_u$ indicator setting of '01' is reserved.

When a mobile station switches from the DTX-high state to the DTX-low state, it must pass through a transition state in which the transmitted power is at the DTX-high level but SAT is not transponded. The sequence must be as follows: starting in the DTX-high state, enter the transition state; remain in the transition state 300 ms; enter the DTX-low state. When a mobile station switches from the DTX-low state to the DTX-high state, it must begin transponding SAT immediately after changing the power level, except for the normal interruption of SAT covered in **2.4.1.** Each time that the mobile station enters the DTX-high state, it must remain in that state for at least 1.5 seconds, unless it enters the DTX-high state in response to an audit order in which case it must remain in that state for at least 5 seconds. (Note that any requirement for the mobile station to remain in the DTX-high state for a certain minimum time interval does not prohibit the mobile station from leaving the conversation state before the interval ends.)

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* Mobile stations manufactured prior to the formal addition of this option in IS-3-C may switch to any power between the DTX-high level and completely off when in the DTX-low state.

## 2.4 SUPERVISION

### 2.4.1 SUPERVISORY AUDIO TONE

The supervisory audio tone (SAT) will be one of three frequencies: 5970, 6000, or 6030 Hz. The SAT is added to the voice transmission by a land station (see 3.4.1). A mobile station must detect, filter, and modulate the transmitted voice channel carrier with this tone. Transmission of the SAT by a mobile station must be suspended during transmission of wideband data on the reverse voice channel (see 2.7.2), but must *not* be suspended when signaling tone is sent (see 2.4.2).

While a valid SAT is detected and the measured SAT determination does not agree with the SAT color code ($SCC_t$) received in the mobile station control message (see 3.7.1.1 and 3.7.2), the receiver audio must be muted.

#### 2.4.1.1 SAT DETECTION

A mobile station must make the following decisions to determine which SAT, or none, is present:

| Measured Frequency of Incoming Signal | Measured SAT Determination | where |
|---|---|---|
| $f < f_1$ | No valid SAT | |
| | | $f_1 = 5955 \pm 5$Hz |
| $f_1 \le f < f_2$ | SAT = 5970 | |
| | | $f_2 = 5985 \pm 5$Hz |
| $f_2 \le f < f_3$ | SAT = 6000 | |
| | | $f_3 = 6015 \pm 5$Hz |
| $f_3 \le f < f_4$ | SAT = 6030 | |
| | | $f_4 = 6045 \pm 5$Hz |
| $f_4 \le f$ | No valid SAT | |
| No SAT Received | No valid SAT | |

The determination of SAT is not required to be made continuously but should be performed at least every 250 ms.

#### 2.4.1.2 SAT TRANSMISSION

The transmission requirements for the SAT signal, including time delays in the transmitter, receiver, and any equalization circuits, are summarized as follows:

- Steady-state phase difference between received and transmitted SAT at 5970, 6000, and 6030 Hz — May have any average phase but must remain within a ±10 degree band
- Phase Step Response — Settle to within 10 degrees of final steady-state phase difference in ≤250 ms
- Tone Modulation Index — 1/3 radian ±10 percent ($\Delta f \sim \pm 2$ kHz)

#### 2.4.1.3 FADE TIMING STATUS

When an SAT determination is made a mobile station must perform the following:

- If no valid SAT is detected or the measured SAT determination does not agree with the SAT color code ($SCC_t$) received in the mobile station control message (see 3.7.1.1 and 3.7.2), the fade timing status must be enabled (see 2.6.4.1).
- Otherwise, the fade timing status must be disabled (see 2.6.4.1).

### 2.4.2 SIGNALING TONE

Signaling tone must be 10 kHz ± 1 Hz and produce a nominal frequency deviation of ± 8 kHz.

## 2.5 MALFUNCTION DETECTION

### 2.5.1 MALFUNCTION TIMER

A timer separate from and independent of all other functions must be running continuously whenever power is applied to the transmitter of a mobile station. If the mobile station is software-controlled, sufficient reset commands must be interspersed throughout the mobile station logic program to ensure that the timer never expires as long as the proper sequence of operations is taking place; similar means must be provided, as appropriate, in hardware-controlled designs. If the timer expires, a malfunction must be assumed and the mobile station must be inhibited from transmitting. The maximum time allowed for expiration of the timer is 60 seconds.

This supersedes the requirement for a transmitter carrier-on indicator.

### 2.5.2 FALSE TRANSMISSION

A protection circuit must be provided to minimize the possibility of false transmitter operation caused by component failure within the mobile station.

## 2.6 CALL PROCESSING

The following sections describe mobile station operation as controlled by a land station. Frequent references are made to the corresponding sections in the land station section and to the messages that flow between a land station and a mobile station. It is helpful to read **2.6** and 3.6 in parallel and examine the message formats in **2.7** and **3.7** at the same time.

When power is applied to a mobile station, it should enter the Retrieve System Parameters Task (see **2.6.1.1**). Each task from **2.6.1.1** to **2.6.4.5** contains information describing which tasks must be entered when a given task is completed.

### 2.6.1 INITIALIZATION

#### 2.6.1.1 RETRIEVE SYSTEM PARAMETERS

If the preferred system (see **2.3.10**) is System A, set the serving-system status to enabled; if the preferred system is System B, set the serving-system status to disabled.

The mobile station must then enter the Scan Dedicated Control Channels Task (see **2.6.1.1.1**).

##### 2.6.1.1.1 SCAN DEDICATED CONTROL CHANNELS

If the serving-system status is enabled, a mobile station must examine the signal strength on each of the dedicated control channels assigned nationwide to System A. If the serving-system status is disabled, a mobile station must examine the signal strength on each of the dedicated control channels assigned nationwide to System B.

The mobile station must then enter the Update Overhead Information Task (see **2.6.1.1.2**).

##### 2.6.1.1.2 UPDATE OVERHEAD INFORMATION

Overhead messages are sent in a group called an overhead message train (see **3.7.1.2**). The mobile station must use the value given in the NAWC (number of additional words coming) field of the system parameter overhead message in the train to determine that all messages of the train have been received. The END field must be used as a cross-check. For NAWC-counting purposes, inserted control-filler messages (see **3.7.1**) must not be counted as part of the overhead message train.

If the mobile station receives a BCH-code-correct but unrecognizable overhead message in the train, the mobile station must count that message as part of the train for NAWC-counting purposes, but must not attempt to execute the message.

The mobile station must tune to the strongest dedicated control channel and, within 3 seconds, receive a system parameter message (see 3.7.1.2) and update the following numeric information:

- *System identification* ($SID_s$). Set the 14 most significant bits of $SID_s$ to the value of the SID1 field. Set the least significant bit of $SID_s$ to '1' if the serving-system status is enabled; otherwise, set the bit to '0'.
- *Number of paging channels* ($N_s$). Set $N_s$ to 1 plus the value of the N—1 field.
- *First paging channel* ($FIRSTCHP_s$). Set $FIRSTCHP_s$ according to the following algorithm:
  - If $SID_s = SID_p$, $FIRSTCHP_s = FIRSTCHP_p$ (see 2.3.7).
  - If $SID_s \neq SID_p$ and the serving-system status is enabled, set $FIRSTCHP_s$ to the first dedicated control channel for System A (834.990 MHz mobile Tx, 879.990 MHz land Tx).
  - If $SID_s \neq SID_p$ and the serving-system status is disabled, set $FIRSTCHP_s$ to the first dedicated control channel for System B (835.020 MHz mobile Tx, 880.020 MHz land Tx).
- *Last paging channel* ($LASTCHP_s$). Set $LASTCHP_s$ according to the following algorithm:
  - If the serving-system status is enabled, $LASTCHP_s = FIRSTCHP_s - N_s + 1$.
  - If the serving-system status is disabled, $LASTCHP_s = FIRSTCHP_s + N_s - 1$.

If the mobile station is equipped for autonomous registration, the mobile station must:

- Set registration increment ($REGINCR_s$) to its default value of 450.
- Set the first registration ID status to enabled.

The mobile station must then enter the Paging Channel Selection Task (see 2.6.1.2).

If the mobile station cannot complete this task on the strongest dedicated control channel, it may tune to the second strongest dedicated control channel and attempt to complete this task within a second 3-second interval. If it cannot complete this task on either of the two strongest control channels, the mobile station may check the serving-system status: If the serving-system status is enabled, it may be disabled; if the serving-system status is disabled, it may be enabled. The mobile station must then enter the Scan Dedicated Control Channels Task (see 2.6.1.1.1).

### 2.6.1.2 PAGING CHANNEL SELECTION

#### 2.6.1.2.1 SCAN PAGING CHANNELS

The mobile station must examine the signal strength on each of channels $FIRSTCHP_s$ to $LASTCHP_s$ (see 2.6.1.1.2).

The mobile station must then enter the Verify Overhead Information Task (see 2.6.1.2.2).

#### 2.6.1.2.2 VERIFY OVERHEAD INFORMATION

The mobile station must set the Wait-for-Overhead-Message bit ($WFOM_s$) to '0'; the mobile station must then tune to the strongest paging channel and, within 3 seconds, receive an overhead message train (see 3.7.1.2) and update the following:

- *System identification:* Set the 14 most significant bits of $SID_r$ to the value of the SID1 field. Set the least significant bit of $SID_r$ to '1' if the serving-system status is enabled; otherwise, set the bit to '0'.

- *ROAM status:* The mobile station must compare the received system identification ($SID_r$) with the stored system identification ($SID_1$). If $SID_r = SID_1$, the mobile station must compare $SID_1$ with $SID_2$. If $SID_2 = SID_1$, the mobile station must set the ROAM status to disabled. If $SID_2 \neq SID_1$, the mobile station must set the ROAM status to enabled. If $SID_r \neq SID_1$, the mobile station must enter the Retrieve System Parameters Task (see 2.6.1.1).
- *Local control status:* If the local control option is enabled within the mobile station (see 2.3.9) and the bits of the home system identification ($SID_2$) that comprise the group identification match the corresponding bits of $SID_1$, then the local control status must be enabled. Otherwise, the local control status must be disabled.

The mobile station must then enter the Response to Overhead Information Task (see 2.6.2.1).

If the mobile station cannot complete this task on the strongest paging channel, it may tune to the second strongest paging channel and attempt to complete this task within a second 3-second interval. If it cannot complete this task on either of the two strongest paging channels, the mobile station may check the serving-system status: If the serving-system status is enabled, it may be disabled; if the serving-system status is disabled, it may be enabled. The mobile station must then enter the Scan Dedicated Control Channels Task (see 2.6.1.1.1).

### 2.6.2 IDLE

During the Idle Task, a mobile station must execute each of the following four (sub)tasks (see 2.6.2.1, 2.6.2.2, 2.6.2.3, and 2.6.2.4) at least every 46.3 ms, the periodicity of word blocks on the forward control channel. If the mobile station is not listening to a control channel of the preferred system, it may exit this task and enter the Retrieve System Parameters Task (see 2.6.1.1).

#### 2.6.2.1 RESPONSE TO OVERHEAD INFORMATION

Whenever a mobile station receives an overhead message train (see 3.7.1.2), the mobile station must compare $SID_3$ with $SID_r$. If $SID_3 \neq SID_r$, the mobile station must exit the Idle Task and enter the Initialization Task (see 2.6.1).

If $SID_3 = SID_r$, the mobile station must update the following numeric values using information contained in the system parameter overhead message:

- *Serial number bit* ($S_1$): Set $S_1$ to the value in the S field.
- *Registration bit* ($R_1$): If the roam status is disabled, set $R_1$ to the value of the REGH field; if the roam status is enabled, set $R_1$ to the value of the REGR field.
- *Extended address bit* ($E_1$): Set $E_1$ to the value in the E field.
- *Discontinuous transmission bit* ($DTX_1$): Set $DTX_1$ to the value of the DTX field.
- *Number of paging channels* ($N_1$): Set $N_1$ to 1 plus the value of the N—1 field.
- *Read-control-filler bit* ($RCF_1$): Set $RCF_1$ to the value of the RCF field.
- *Combined paging/access bit* ($CPA_1$): Set $CPA_1$ to the value of the CPA field.
- *Number of access channels* ($CMAX_1$): Set $CMAX_1$ to 1 plus the value of the CMAX—1 field.
- Determine control channel boundaries for accessing the system ($FIRSTCHA_1$ and $LASTCHA_1$) by using the following algorithm:
  - If the serving-system status is enabled,
    + If $CPA_1 = 1$, set $FIRSTCHA_1$ to the first dedicated control channel for System A (834.990 MHz mobile Tx, 879.990 MHz land Tx).

+ If $CPA_s = 0$, set $FIRSTCHA_s$ to the value of the first dedicated control channel for System A minus $N_s$.
+ $LASTCHA_s = FIRSTCHA_s - CMAX_s + 1$.

— If the serving-system status is disabled,

+ If $CPA_s = 1$, set $FIRSTCHA_s$ to the first dedicated control channel for System B (835.020 MHz mobile Tx, 880.020 MHz land Tx).
+ If $CPA_s = 0$, set $FIRSTCHA_s$ to the value of the first dedicated control channel for System B plus $N_s$.
+ $LASTCHA_s = FIRSTCHA_s + CMAX_s - 1$.

The mobile station must then respond as indicated to each of the following messages, if received in the overhead message train. The order in which the mobile station must respond to the messages, if two or more are received, is given by their order in the following list:

1. *Local Control Messages*: If the local control status is enabled (see **2.6.1.2.2**) the mobile station must respond to the local control messages.
2. *New Access Channel Set Message*:
   - The mobile station must set $FIRSTCHA_s$ to the value of the NEWACC field of the message.
   - The mobile station must set $LASTCHA_s$ according to the following algorithm:
     — If the serving-system status is enabled, $LASTCHA_s = NEWACC_s - CMAX_s + 1$.
     — If the serving-system status is disabled, $LASTCHA_s = NEWACC_s + CMAX_s - 1$.
3. *Registration Increment Message*: If the mobile station is equipped for autonomous registration, the mobile station must set $REGINCR_s$ to the value of the REGINCR field in the message.
4. *Registration ID Message*: If the mobile station is equipped for autonomous registration, the mobile station must perform the following:
   - The mobile station must set $REGID_s$ to the value of the REGID field of the received message and set the first-registration ID status to disabled (see **2.6.1.1.2**).
   - If $SID_s$ equals the $SID_{s,p}$ value stored in the registration memory, the mobile station must perform the following:
     — The mobile station must use the following (or an equivalent) algorithm to review the $NXTREG_{s,p}$ associated with the $SID_{s,p}$ to determine if $REGID_s$ has cycled through zero:
       + If $NXTREG_{s,p}$ is greater than or equal to $REGID_s + REGINCR_s + 5$, then $NXTREG_{s,p}$ must be replaced by the greater of 0 and the value $NXTREG_{s,p} - 2^{20}$.
       + Otherwise do not change $NXTREG_{s,p}$.
     — The mobile station must then compare $REGID_s$ with the $NXTREG_{s,p}$ associated with the $SID_{s,p}$.
       + If $REGID_s$ is greater than or equal to $NXTREG_{s,p}$ and autonomous registration is enabled, the mobile station must enter the System Access Task with a "registration" indication (see **2.6.3**).
       + If $REGID_s$ is greater than or equal to $NXTREG_{s,p}$ and autonomous registration is not enabled, then set $NXTREG_{s,p}$ equal to $REGID_s$.

— Otherwise, the mobile station must ignore the message and continue to process messages in the overhead message train.

- If $SID_s$ is not equal to the $SID_{s,p}$ value stored in the registration memory, the mobile station must perform the following:

  — If autonomous registration is enabled, the mobile station must exit this task and enter the System Access Task with a "registration" indication supplied (see 2.6.3).

  — Otherwise, the mobile station must ignore the message and continue to process messages in the overhead message train.

5. *Rescan Message*: The mobile station must immediately exit this task and enter the Initialization Task (see 2.6.1).

6. *Any Other Message*: Ignore message.

#### 2.6.2.2 PAGE MATCH

The mobile station must monitor mobile station control messages for page messages (see 3.7.1.1).

- If the ROAM status is disabled, the mobile station must attempt to match $MIN1_p$ to $MIN1_r$ for one-word messages and both $MIN1_p$ and $MIN2_p$ to $MIN1_r$ and $MIN2_r$, respectively, for two-word messages. All decoded MIN bits must match to cause the mobile station to respond to the message.
- If the ROAM Status is enabled, the mobile station must attempt to match both $MIN1_p$ and $MIN2_p$ to $MIN1_r$ and $MIN2_r$, respectively. All decoded MIN bits must match to cause the mobile station to respond to the order.

When a match occurs, the mobile station must enter the System Access Task with a "page response" indication (see 2.6.3).

#### 2.6.2.3 ORDER

The mobile station must monitor mobile station control messages for orders and must attempt to match both $MIN1_p$ and $MIN2_p$ to $MIN1_r$ and $MIN2_r$, respectively. All decoded MIN bits must match to cause the mobile station to respond to the order. The responses to the following orders are:

- *Audit order*: The mobile station must enter the System Access Task (see 2.6.3) with an "order" indication.
- *Local control order*: The action to be taken depends on the local control field.
- *Any other order*: Ignore order.

#### 2.6.2.4 CALL INITIATION

When the user desires to initiate a call, the System Access Task (see 2.6.3) must be entered with an "origination" indication.

#### 2.6.2.5 NON-AUTONOMOUS REGISTRATION INITIATION

If $R_s = 1$, the mobile station may initiate a non-autonomous registration by entering the System Access Task (see 2.6.3) with a "registration" indication.

### 2.6.3 SYSTEM ACCESS

#### 2.6.3.1 SET ACCESS PARAMETERS

When the System Access Task is started, a timer, called the access timer, must be set as follows:

- If this is an origination, to a maximum of 12 seconds.
- If this is a page response, to a maximum of 6 seconds.
- If this is an order response, to a maximum of 6 seconds.
- If this is a registration, to a maximum of 6 seconds.

The mobile station must set the last-try code ($LT_s$) to '0' and then enter the Scan Access Channels Task (see **2.6.3.2**).

#### 2.6.3.2 SCAN ACCESS CHANNELS

The mobile station must examine the signal strength on each of the channels $FIRSTCHA_s$ to $LASTCHA_s$ and choose up to two channels with the strongest signals. See **2.6.2.1** Response to Overhead Information Task for access channel set determination.

The mobile station must then tune to the strongest access channel and enter the Retrieve Access Attempts Parameters Task (see **2.6.3.3**).

#### 2.6.3.3 RETRIEVE ACCESS ATTEMPT PARAMETERS

The mobile station must set the maximum-number-of-seizure-attempts allowed ($MAXSZTR_d$) to a maximum of 10, and the maximum-number-of-busy-occurrences ($MAXBUSY_d$) to a maximum of 10.

The mobile station must then initialize the following to zero:

- Number of busy occurrences ($NBUSY_{av}$)
- Number of unsuccessful seizure attempts ($NSZTR_{av}$)

The mobile station must then examine the read control-filler bit ($RCF_s$).

- If $RCF_s = 0$, the mobile station must then within 400 ms (+100 ms, —0 ms) set $DCC_s$ to the value in the DCC field of a received message and set the power level ($PL_s$) to 0.
- If $RCF_s = 1$, the mobile station must then within 1000 ms (+100 ms, —0 ms) read a control-filler message, set $DCC_s$ and $WFOM_s$ to the values in the DCC and WFOM fields of the message, respectively, and set $PL_s$ to the power level given by Table 2.1.2-1 for the value of the CMAC field of the message and the mobile station power class (see **2.1.2.2**, **2.3.3**, and **3.7.1.2.4**).

If the DCC field or the control-filler message is not received within the time allowed, then the mobile station must examine the access timer. If the access timer has expired, the mobile station must enter the Serving-System Determination Task (see **2.6.3.12**). If the access timer has not expired, the mobile station must enter the Alternate Access Channel Task (see **2.6.3.13**).

The mobile station must then set $BIS_s$ to '1' and examine the $WFOM_s$ bit.

- If $WFOM_s = 1$, the mobile station must enter the Update Overhead Information Task (see **2.6.3.4**).
- If $WFOM_s = 0$, the mobile station must wait a random delay. Each time it waits a random delay, a different random delay must be generated with the time uniformly distributed in the interval 0 to 92 ± 1 ms and, if quantized, with granularity no more than 1 ms. The mobile station must then enter the Seize Reverse Control Channel Task (see **2.6.3.5**).

#### 2.6.3.4 UPDATE OVERHEAD INFORMATION

If this task is not completed within 1.5 seconds, the mobile station must exit this task and enter the Serving-System Determination Task (see **2.6.3.12**). If the Update Overhead Information Task is completed, the mobile station must enter the Seize Reverse Control Channel Task (see **2.6.3.5**)

The mobile station must receive an overhead message train (see 3.7.1.2) and act as indicated below in response to the following global action messages, if received in the overhead message train:

- *Overload Control Message*.
  - — If this access is an origination, the mobile station must examine the value of the overload class field (OLC) identified by $ACCOLC_p$. If the identified OLC field is set to '0', the mobile station must exit this task and enter the Serving-System Determination Task (see 2.6.3.12); if the identified OLC field is set to '1', the mobile station must continue to respond to messages in the overhead message train.
  - — Otherwise, the mobile station must continue to respond to messages in the overhead message train.
- *Access Type Parameters Message*: The busy-idle status bit ($BIS_s$) must be set to the value of the BIS field of the received message.
- *Access Attempt Parameters Message*: The mobile station must update the following parameters:
  - — If this access is a page response,
    - + Maximum number of seizure tries allowed ($MAXSZTR_u$) must be set to the value of the MAXSZTR-PGR field of the received message.
    - + Maximum number of busy occurrences allowed ($MAXBUSY_u$) must be set to the value of the MAXBUSY-PGR field of the received message.
  - — Otherwise,
    - + Maximum number of seizure tries allowed ($MAXSZTR_u$) must be set to the value of the MAXSZTR-OTHER field of the received message.
    - + Maximum number of busy occurrences allowed ($MAXBUSY_u$) must be set to the value of the MAXBUSY-OTHER field of the received message.

  After the overhead message train is received and processed as required above, the mobile station must wait a random time. Each time this task is executed, a different random delay must be generated, distributed uniformly in the interval 0 to 750 ms, and if quantized, with granularity no greater than 1 ms. At the end of the delay, the mobile station must enter the Seize Reverse Control Channel Task (see 2.6.3.5).

**Due to evolving network requirements, the subsequent modification to the rescan procedure represents a strongly recommended enhancement.** X X X

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### 2.6.3.4 UPDATE OVERHEAD INFORMATION X

If this task is not completed within 1.5 seconds, the mobile station must exit this task and enter the Serving-System Determination Task (see 2.6.3.12). If the Update Overhead Information Task is completed, the mobile station must enter the Seize Reverse Control Channel Task (see 2.6.3.5) X X X X

The mobile station must receive an overhead message train (see 3.7.1.2). X

If the access is a registration access, the mobile station shall perform the following: X

- Update System identification (SIDr). Set the 14 most significant bits of SIDr to the value of the SID1 field. Set the least significant bit of SIDr to "1" if the serving-system status is enabled; otherwise, set the bit to "0". X X X
- The mobile station must then compare SIDr with SIDs. If SIDr ≠ SIDs, the mobile station must exit the Update Overhead Information task and enter the Se[illegible] X X

Determination Task (see 2.6.3.12). Otherwise, the mobile station shall continue to process this task.

The mobile station must act as indicated below in response to the following global action messages, if received in the overhead message train:

- *Overload Control Message*.
  - — If this access is an origination, the mobile station must examine the value of the overload class field (OLC) identified by $ACCOLC_p$. If the identified OLC field is set to '0', the mobile station must exit this task and enter the Serving-System Determination Task (see 2.6.3.12); if the identified OLC field is set to '1', the mobile station must continue to respond to messages in the overhead message train.
  - — Otherwise, the mobile station must continue to respond to messages in the overhead message train.
- *Access Type Parameters Message*: The busy-idle status bit ($BIS_s$) must be set to the value of the BIS field of the received message.
- *Access Attempt Parameters Message*: The mobile station must update the following parameters:
  - — If this access is a page response,
    - + Maximum number of seizure tries allowed ($MAXSZTR_{sl}$) must be set to the value of the MAXSZTR-PGR field of the received message.
    - + Maximum number of busy occurrences allowed ($MAXBUSY_{sl}$) must be set to the value of the MAXBUSY-PGR field of the received message.
  - — Otherwise,
    - + Maximum number of seizure tries allowed ($MAXSZTR_{sl}$) must be set to the value of the MAXSZTR-OTHER field of the received message.
    - + Maximum number of busy occurrences allowed ($MAXBUSY_{sl}$) must be set to the value of the MAXBUSY-OTHER field of the received message.

If the access is a registration access, the mobile station must respond as indicated to the registration identification message, if received in the overhead message train:

- The mobile station must set REGIDs to the value of the REGID field in the message.

After the overhead message train is received and processed as required above, the mobile station must wait a random time. Each time this task is executed, a different random delay must be generated, distributed uniformly in the interval 0 to 750 ms, and if quantized, with granularity no greater than 1 ms. At the end of the delay, the mobile station must enter the Seize Reverse Control Channel Task (see 2.6.3.5).

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### 2.6.3.5 SEIZE REVERSE CONTROL CHANNEL

The mobile station must read the busy-idle status of the channel.

- If the channel is busy, the mobile station must increment $NBUSY_{sv}$ by 1.
  - — If $NBUSY_{sv}$ exceeds $MAXBUSY_{sl}$, then the mobile station must exit this task and enter the Serving-System Determination Task (see 2.6.3.12).
  - — If $NBUSY_{sv}$ does not exceed $MAXBUSY_{sl}$, then the mobile station must exit this task and the Delay After Failure Task must be executed (see 2.6.3.6).
- If the channel is idle, then the mobile station must set $NBUSY_{sv}$ to zero, turn on the transmitter at the power level indicated by $PL_s$ (see 2.6.3.3 and 2.1.2.2), wait the proper

delay (see 2.1.2.1) until the transmitter is within 3 dB of the required power level, and then start to send the message to the land station (see 2.7.1).

If $BIS_t$ = 0, then the mobile station must enter the Service Request Task (see 2.6.3.7); if $BIS_t$ = 1, then upon starting to send the message, the mobile station must continuously monitor the busy-idle status of the channel.

- If the channel becomes busy before the first 56 bits of the message are sent, the mobile station must immediately stop sending the message and turn off the transmitter.
- If the channel fails to change to busy by the time the mobile station has sent 104 bits, then the mobile station must immediately stop sending the message and turn off the transmitter.

  In either of these cases, the mobile station must then increment the count of seizure failures ($NSZTR_{rv}$) by 1 and compare the result with the maximum number of seizure attempts allowed ($MAXSZTR_{sl}$).

  — If $NSZTR_{rv}$ exceeds $MAXSZTR_{sl}$, the mobile station must exit this task and enter the Serving-System Determination Task (see 2.6.3.12).

  — If $NSZTR_{rv}$ does not exceed $MAXSZTR_{sl}$, the mobile station must exit this task and enter the Delay After Failure Task (see 2.6.3.6).
- If the busy-idle status changes to busy after 56 bits and before 104 bits are sent, then the mobile station must enter the Service Request Task (see 2.6.3.7).

### 2.6.3.6 DELAY AFTER FAILURE

The mobile station must examine the access timer. If the access timer has expired, the mobile station must enter the Serving-System Determination Task (see 2.6.3.12). If the access timer has not expired, the mobile station must wait a random time. Each time it enters this task, it must generate a different time, uniformly distributed in the interval 0 to 200 ms, and if quantized, with granularity no greater than 1 ms. The mobile station must then enter the Seize Reverse Control Channel Task (see 2.6.3.5).

### 2.6.3.7 SERVICE REQUEST

X

The mobile station must continue to send its message to the land station. The information that must be sent is as follows (with the formats given in 2.7.1):

- Word A must always be sent.
- If:
  — $E_t$ = 1, or
  — $LT_t$ = 1, or
  — the ROAM status is enabled, or
  — the ROAM status is disabled and $EX_p$ = 1, or
  — the access is an "order confirmation", or
  — the access is a "registration", or
  — the mobile station was paged with a two-word mobile station control message,
  word B must be sent.
- If $S_t$ = 1,
  word C must be sent.
- If the access is an "origination",
  word D must be sent.
- If the access is an "origination" and 9 to 16 digits were dialed,
  word E must be sent.

delay (see 2.1.2.1) until the transmitter is within 3 dB of the required power level, and then start to send the message to the land station (see 2.7.1).

If $BIS_s$ = 0, then the mobile station must enter the Service Request Task (see 2.6.3.7); if $BIS_s$ = 1, then upon starting to send the message, the mobile station must continuously monitor the busy-idle status of the channel.

- If the channel becomes busy before the first 56 bits of the message are sent, the mobile station must immediately stop sending the message and turn off the transmitter.
- If the channel fails to change to busy by the time the mobile station has sent 104 bits, then the mobile station must immediately stop sending the message and turn off the transmitter.

  In either of these cases, the mobile station must then increment the count of seizure failures ($NSZTR_{rv}$) by 1 and compare the result with the maximum number of seizure attempts allowed ($MAXSZTR_d$).

  — If $NSZTR_{rv}$ exceeds $MAXSZTR_d$, the mobile station must exit this task and enter the Serving-System Determination Task (see 2.6.3.12).

  — If $NSZTR_{rv}$ does not exceed $MAXSZTR_d$, the mobile station must exit this task and enter the Delay After Failure Task (see 2.6.3.6).
- If the busy-idle status changes to busy after 56 bits and before 104 bits are sent, then the mobile station must enter the Service Request Task (see 2.6.3.7).

2.6.3.6 DELAY AFTER FAILURE

The mobile station must examine the access timer. If the access timer has expired, the mobile station must enter the Serving-System Determination Task (see 2.6.3.12). If the access timer has not expired, the mobile station must wait a random time. Each time it enters this task, it must generate a different time, uniformly distributed in the interval 0 to 200 ms, and if quantized, with granularity no greater than 1 ms. The mobile station must then enter the Seize Reverse Control Channel Task (see 2.6.3.5).

2.6.3.7 SERVICE REQUEST X

The mobile station must continue to send its message to the land station. The information that must be sent is as follows (with the formats given in 2.7.1):

- Word A must always be sent.
- If:
  — $E_s$ = 1, or
  — $LT_s$ = 1, or
  — the ROAM status is enabled, or
  — the ROAM status is disabled and $EX_p$ = 1, or
  — the access is an "order confirmation", or
  — the access is a "registration", or
  — the mobile station was paged with a two-word mobile station control message,
  word B must be sent.
- If $S_s$ = 1,
  word C must be sent.
- If the access is an "origination",
  word D must be sent.
- If the access is an "origination" and 9 to 16 digits were dialed,
  word E must be sent.

When the mobile station has sent its complete message, it must continue to send unmodulated carrier for a nominal duration of 25 ms and then turn off the transmitter.

The next task to be entered depends on the type of access by the mobile station:

- If the access is an order confirmation, the mobile station must enter the Serving-System Determination Task (see 2.6.3.12).
- If the access is an origination, the mobile station must enter the Await Message Task (see 2.6.3.8).
- If the access is a page response, the mobile station must enter the Await Message Task (see 2.6.3.8).
- If the access is a registration request, the mobile station must enter the Await Registration Confirmation Task (see 2.6.3.9).

2.6.3.8 AWAIT MESSAGE

If this task is not completed within 5 seconds, the mobile station must enter the Serving-System Determination Task (see 2.6.3.12).

The mobile station must monitor mobile station control messages (see 3.7.1.1). If the mobile station sent Word B as part of the Service Request (see 2.6.3.7), then the mobile station must attempt to match $MIN1_p$ and $MIN2_p$ to $MIN1_r$ and $MIN2_r$, respectively; otherwise, the mobile station must attempt to match only $MIN1_p$ to $MIN1_r$.

The mobile station must respond as indicated to any of the following messages if all decoded MIN bits match.

If the access is an origination or page response:

- *Initial voice channel designation message* (see 3.7.1.1): The mobile station must update the parameters as set in the message. If $R_1 = 1$ and the mobile station is equipped for autonomous registration, the mobile station must enter the Autonomous Registration Update Task (see 2.6.3.11), supplying a "success" indication and then enter the Initial Voice Channel Confirmation Task (see 2.6.4.2). Otherwise, the mobile station must enter the Initial Voice Channel Confirmation Task.
- *Directed-retry message* (see 3.7.1.1): If the mobile station is equipped for directed retry, it must respond to the directed-retry message as follows:

  If the mobile station encounters the start of a new message before it receives all four words of the directed-retry message, it must exit this task and enter the Serving-System Determination Task (see 2.6.3.12).

  The mobile station must set the last-try code ($LT_1$) according to the ORDQ field of the message:

  — If ORDQ = '000', set $LT_1$ to '0'.

  — If ORDQ = '001', set $LT_1$ to '1'.

  The mobile station must then clear CCLIST, and examine each CHANPOS field in Words 3 and 4 of the message. For each nonzero CHANPOS field, the mobile station must calculate a corresponding channel number according to the following algorithm:

  — If the serving-system status is enabled, subtract CHANPOS from $FIRSTCHA_1 + 1$.

  — If the serving-system status is disabled, add CHANPOS to $FIRSTCHA_1 - 1$.

  The mobile station must then determine whether each channel number is within the set allocated to cellular systems, and if so, list the channel number in $CCLIST_1$.

After completing its response to the directed-retry message, the mobile station must examine the access timer. If the access timer has expired, the mobile station must enter the Serving-System Determination Task (see 2.6.3.12). If the access timer has not expired, the mobile station must enter the Directed-Retry Task (see 2.6.3.14).

If the access is an origination:

- *Intercept:* The mobile station must enter the Serving-System Determination Task (see 2.6.3.12).
- *Reorder:* The mobile station must enter the Serving-System Determination Task (see 2.6.3.12).

If the access is a page response:

- *Release:* The mobile station must enter the Serving-System Determination Task (see 2.6.3.12).

If the access is an origination and the user terminates a call during this task, the termination status must be enabled so that the call can be released on a voice channel (see 2.6.4.4) instead of on a control channel.

### 2.6.3.9 AWAIT REGISTRATION CONFIRMATION

If this task is not completed within 5 seconds, the mobile station must exit this task and enter the Action on Registration Failure Task (see 2.6.3.10).

The mobile station must monitor mobile station control messages (see 3.7.1.1). If the mobile station sent Word B as part of the Service Request (see 2.6.3.7), then the mobile station must attempt to match $MIN1_p$ and $MIN2_p$ to $MIN1_s$ and $MIN2_s$, respectively; otherwise, the mobile station must attempt to match only $MIN1_p$ to $MIN1_s$.

The mobile station must respond as indicated to any of the following messages if all decoded MIN bits match:

- *Release order* (see 3.7.1.1): The mobile station must exit this task and enter the Action on Registration Failure Task (see 2.6.3.10).
- *Order confirmation* (see 3.7.1.1): If the mobile station is equipped for autonomous registration and autonomous registration is enabled, the mobile station must enter the Autonomous Registration Update Task (see 2.6.3.11), supplying a "success" indication; the mobile station must then enter the Serving-System Determination Task (see 2.6.3.12). Otherwise, the mobile station must enter the Serving-System Determination Task (see 2.6.3.12).

### 2.6.3.10 ACTION ON REGISTRATION FAILURE

If the mobile station is equipped for autonomous registration and autonomous registration is enabled, the mobile station must enter the Autonomous Registration Update Task (see 2.6.3.11), supplying a "failure" indication; the mobile station must then enter the Serving-System Determination Task (see 2.6.3.12). Otherwise, the mobile station must enter the Serving-System Determination Task (see 2.6.3.12).

### 2.6.3.11 AUTONOMOUS REGISTRATION UPDATE

If the first-registration ID status is enabled, return to the invoking task. Otherwise the mobile station must set the $SID_{s,p}$ equal to $SID_s$ and update the $NXTREG_{s,p}$ according to the following:

- If a "success" indication was supplied to the Registration Update Task, the mobile station must set the next registration ID to: $NXTREG_{s,p} = REGID_s + REGINCR_s$.

- If a "failure" indication was supplied to the Registration Update Task, the mobile station must generate a random number($NRANDOM_{nn}$). Each time this step is executed, a different random number must be generated, uniformly distributed in the interval 0 to 10, and with granularity no more than 1.

  The mobile station must then update the next registration ID to: $NXTREG_{s\text{-}p} = REGID_s + NRANDOM_{nn}$.

The mobile station must then return to the invoking task.

#### 2.6.3.12 SERVING-SYSTEM DETERMINATION

If the serving-system status does not correspond to the preferred system, the mobile station may enter the Retrieve System Parameters Task (see 2.6.1.1); otherwise, it must enter the Paging Channel Selection Task (see 2.6.1.2).

#### 2.6.3.13 ALTERNATE ACCESS CHANNEL

If the mobile station is tuned to the strongest access channel, it *may* tune to the second strongest channel and then enter the Retrieve Access Attempt Parameters Task (see 2.6.3.3). Otherwise, it must enter the Serving-System Determination Task (see 2.6.3.12).

#### 2.6.3.14 DIRECTED RETRY

The mobile station must examine the signal strength on each of the channels listed in $CCLIST_s$ and choose up to two channels with the strongest signals. The mobile station must then tune to the strongest access channel and enter the Retrieve Access Attempts Parameters Task (see 2.6.3.3).

## 2.6.4 MOBILE STATION CONTROL ON THE VOICE CHANNEL

### 2.6.4.1 LOSS OF RADIO-LINK CONTINUITY

While the mobile station is tuned to a voice channel, it must monitor the fade timing status (see 2.4.1.3). If the fade timing status is enabled, a fade timer must be started; each time the fade timing status is disabled, the timer must be reset. If the timer counts to 5 seconds, the mobile station must turn off its transmitter; and enter the Serving-System Determination Task (see 2.6.3.12).

### 2.6.4.2 CONFIRM INITIAL VOICE CHANNEL

Within 100 ms of the receipt of the initial voice channel designation (see 3.7.1.1), the mobile station must determine whether the channel number is within the set allocated to cellular systems, and

- If it is within the allocated set, the mobile station must tune to the designated voice channel, turn on the transmitter at the power level indicated by the VMAC field of the initial voice channel message (see 2.1.2.2 and 3.7.1.1), turn on the SAT transponder (see 2.4.1), and set the stored SAT Color Code ($SCC_s$) to the value of the SCC field of the initial voice channel message (see 3.7.1.1). Discontinuous transmission (see 2.3.11) is prohibited while the mobile station is in this task. That is, a mobile station capable of discontinuous-transmission operation must remain in the DTX-high state.
  - — If this is an origination access, the mobile station then must enter the Conversation Task (see 2.6.4.4).
  - — If this is a page response access, the mobile station then must enter the Waiting for Order Task (see 2.6.4.3.1).
- Otherwise, the mobile station must enter the Serving-System Determination Task (see 2.6.3.12).

### 2.6.4.3 ALERTING

#### 2.6.4.3.1 WAITING FOR ORDER

Discontinuous transmission (see 2.3.11) is prohibited while the mobile station is in this task. That is, a mobile station capable of discontinuous-transmission operation must remain in the DTX-high state. When this task is entered, an order timer must be set to 5 seconds. The following may occur:

- If the order timer expires the mobile station must turn off the transmitter; then the mobile station must enter the Serving-System Determination Task (see 2.6.3.12).
- Within 100 ms of the receipt of any of the orders listed below (see 3.7.2), the mobile station must compare $SCC_s$ to the present SAT color code (PSCC) field in the received message. If $SCC_s \neq PSCC$, the order must be ignored. If $SCC_s = PSCC$, the action to be taken for each order is as follows:
  - — *Handoff*: Turn on signaling tone for 50 ms, turn off signaling tone, turn off transmitter, adjust power level, tune to new channel, adjust to new SAT, set $SCC_s$ to the value of the SCC field of the message (see 2.4.1), turn on transmitter, reset fade timer, remain in the Waiting for Order Task, and reset the order timer to 5 seconds.
  - — *Alert*: Turn on signaling tone, wait 500 ms, and enter the Waiting for Answer Task (see 2.6.4.3.2).
  - — *Release*: Enter Release Task (see 2.6.4.5).
  - — *Audit*: Send order confirmation message to land station (see 2.7.2), remain in the Waiting for Order Task, and reset the order timer to 5 seconds.

— *Maintenance*: Turn on signaling tone, wait 500 ms, and enter the Waiting for Answer Task (see 2.6.4.3.2).

— *Change power*: Adjust the transmitter to the power level indicated by the order qualification code (see 3.7.1.1 and 2.1.2.2) and send order confirmation message to land station (see 2.7.2). Remain in the Waiting for Order Task, and reset the order timer to 5 seconds.

— *Local Control*: If the local control status is enabled (see 2.6.1.2.2) and a local control order is received, the local control field must be examined to determine the action and confirmation to take.

— *Any other order*: Ignore order.

2.6.4.3.2 WAITING FOR ANSWER

Discontinuous transmission (see 2.3.11) is prohibited while the mobile station is in this task. That is, a mobile station capable of discontinuous-transmission operation must remain in the DTX-high state. When this task is entered, an alert timer must be set to 65 seconds (-0, +20%). The following may occur:

- If the alert timer expires the mobile station must turn off the transmitter; then the mobile station must enter the Serving-System Determination Task (see 2.6.3.12).
- If the user answers, signaling tone must be turned off and the Conversation Task (see 2.6.4.4) must be entered.
- Within 100 ms of the receipt of any of the orders listed below, the mobile station must compare $SCC_s$ to the PSCC field in the received message. If $SCC_s \neq$ PSCC, the order must be ignored. If $SCC_s$ = PSCC, the action to be taken for each order is as follows:

  — *Handoff*: Turn off signaling tone for 500 ms, turn on signaling tone for 50 ms, turn off signaling tone, turn off transmitter, adjust power level, tune to new channel, adjust to new SAT, set $SCC_s$ to the value of the SCC field of the message (see 2.4.1), turn on transmitter, reset fade timer, and turn on signaling tone. Then remain in the Waiting for Answer Task.

  — *Alert*: Remain in the Waiting for Answer Task, and reset the alert timer to 65 seconds.

  — *Stop Alert*: Turn off signaling tone, and enter the Waiting for Order Task (see 2.6.4.3.1).

  — *Release*: Turn off signaling tone, wait 500 ms, and then enter the Release Task (see 2.6.4.5).

  — *Audit*: Send order confirmation message to land station (see 2.7.2) and remain in the Waiting for Answer Task.

  — *Maintenance*: Remain in the Waiting for Answer Task, and reset the alert timer to 65 seconds.

  — *Change power*: Adjust the transmitter to the power level indicated by the order qualification code (see 3.7.1.1 and 2.1.2.2) and send order confirmation message to land station (see 2.7.2). Remain in the Waiting for Answer Task.

  — *Local Control*: If the local control status is enabled (see 2.6.1.2.2) and a local control order is received, the local control field must be examined to determine the action and confirmation to take.

  — *Any other order*: Ignore order.

2.6.4.4 CONVERSATION

When this task is entered, a release-delay timer must be set to 500 ms. If the termination status is enabled (see 2.6.3.8), the mobile station must set the termination status to disabled, wait 500 ms and then enter the Release Task (see 2.6.4.5).

Discontinuous transmission (see 2.3.11) must be inhibited for 1.5 seconds after the mobile station enters this task. That is, for at least 1.5 seconds after entering this task, a mobile station capable of discontinuous-transmission operation must remain in the DTX-high state.

In the conversation state; the following may occur:

- If the user terminates the call, the release-delay timer must be examined. If the timer has expired, the Release Task must be entered (see 2.6.4.5). If the timer has not expired, the mobile station must wait until the timer expires and then enter the Release Task.
- If the user requests a flash, the mobile station must take the following steps. Mobile stations capable of discontinuous-transmission operation (see 2.3.11) must inhibit discontinuous transmission for 1.5 seconds; that is, for at least 1.5 seconds the mobile station must remain in the DTX-high state. Immediately following the flash, a mobile station not capable of discontinuous transmission or a mobile station capable of discontinuous transmission but in the DTX-high state must turn on signaling tone for 400 ms.

  If the mobile station is capable of discontinuous transmission and is in the DTX-low state or the transition state when the flash occurs, the mobile station must enter the DTX-high state and wait 200 ms. Then it must turn on signaling tone for 400 ms. If a valid order (one that is not ignored) is received while processing a flash, the flash must be terminated immediately and the order must be processed. Flashes so terminated are not considered valid.
- Within 100 ms of the receipt of any of the orders listed below, the mobile station must compare $SCC_s$ to the PSCC field in the received message. If $SCC_s \neq$ PSCC, the order must be ignored. If $SCC_s$ = PSCC, the mobile station must take the following steps. Except for the audit order, mobile stations capable of discontinuous-transmission operation (see 2.3.11) must inhibit discontinuous transmission for 1.5 seconds; that is, for at least 1.5 seconds the mobile station must remain in the DTX-high state. Upon receipt of the audit order, mobile stations capable of discontinuous transmission must inhibit discontinuous transmission for at least 5 seconds. Immediately after determining that $SCC_s$ = PSCC a mobile station not capable of discontinuous transmission or a mobile station capable of discontinuous transmission but in the DTX-high state must take the actions specified below for each order.

  If the mobile station is capable of discontinuous transmission and is in the DTX-low state or the transition state when the order arrives, the mobile station must enter the DTX-high state and wait 200 ms. Then it must take the actions specified below for each order.

  — *Handoff*: Turn on signaling tone for 50 ms, turn off signaling tone, turn off transmitter, adjust power level, tune to new channel, adjust to new SAT, set $SCC_s$ to the value of the SCC field of the message (see 2.4.1), turn on transmitter, reset fade timer, and remain in the Conversation Task.

  — *Send Called-Address*:

    + If received within 10 seconds of the completion of the last valid flash, send the called-address to the land station (see 2.7.2) and remain in the Conversation Task.

    + Otherwise, ignore the order and remain in the Conversation Task.

  — *Alert*: Turn on signaling tone, wait 500 ms, and then enter the Waiting for Answer Task (see 2.6.4.3.2).

— *Release*: Examine the release-delay timer. If the timer has expired, the mobile station must enter the Release Task (see 2.6.4.5). If the timer has not expired, the mobile station must wait until the timer expires and then enter the Release Task.

— *Audit*: Send order confirmation message to land station (see 2.7.2) and remain in the Conversation Task.

— *Maintenance*: Turn on signaling tone, wait 500 ms, and then enter the Waiting for Answer Task (see 2.6.4.3.2).

— *Change power*: Adjust the transmitter to the power level indicated by the order qualification code (see 3.7.1.1 and 2.1.2.2) and send order confirmation message to land station (see 2.7.2). Remain in the Conversation Task. If the mobile station is capable of discontinuous transmission and is in the DTX-low state or the transition state when this order arrives, the mobile station must immediately enter the DTX-high state at the power level indicated in the order.

— *Local Control*: If the local control status is enabled (see 2.6.1.2.2) and a local control order is received, the local control field must be examined to determine the action and confirmation to take.

— *Any other order*: Ignore order.

#### 2.6.4.5 RELEASE

Discontinuous transmission (see 2.3.11) is prohibited while the mobile station is in this task. That is, a mobile station capable of discontinuous-transmission operation must remain in the DTX-high state. Any mobile station in the DTX-low state must immediately enter the DTX-high state, wait 200 ms, and take the following action:

- Send signaling tone for 1.8 seconds. If a flash (see 2.6.4.4) was being sent when this task was entered, signaling tone must continue to be sent and the timing bridged so that no more than 1.8 seconds of signaling tone is sent.
- Stop sending signaling tone.
- Turn off the transmitter.

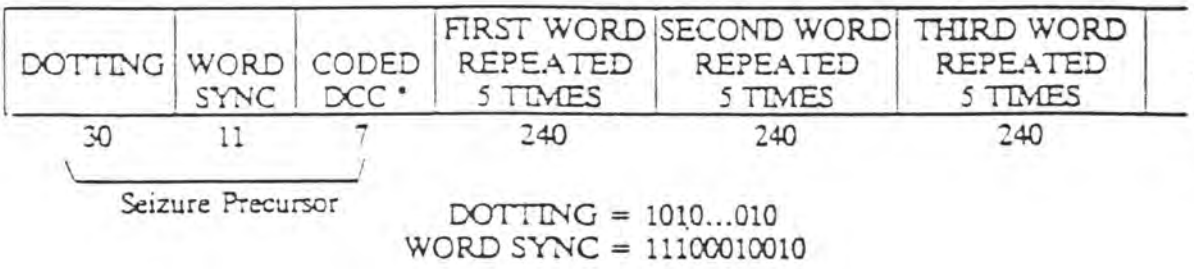
The mobile station must then enter the Serving-System Determination Task (see 2.6.3.12).

## 2.7 SIGNALING FORMATS

In the message formats used between the mobile stations and land stations, some bits are marked as reserved (RSVD). Some or all of these reserved bits may be used in the future for additional messages. Therefore, all mobile stations and land stations must set all bits that they are programmed to treat as reserved bits to "0" (zero) in all messages that they transmit. All mobile stations and land stations must ignore the state of all bits that they are programmed to treat as reserved bits in all messages that they receive.

### 2.7.1 REVERSE CONTROL CHANNEL

The reverse control channel (RECC) is a wideband data stream sent from the mobile station to the land station. This data stream must be generated at a 10 kilobit/second ±1 bit/second rate. Figure 2.7.1-1 depicts the format of the RECC data stream.




* DIGITAL COLOR CODE - Coded per Table 2.7.1-1.

Figure 2.7.1-1. REVERSE CONTROL CHANNEL MESSAGE STREAM (Mobile-to-Land)

All messages begin with the RECC seizure precursor that is composed of a 30-bit dotting sequence (1010...010), an 11-bit word sync sequence (11100010010), and the coded digital color code (DCC). The 7-bit coded DCC is obtained by translating the received DCC according to Table 2.7.1-1.

Table 2.7.1-1. CODED DIGITAL COLOR CODE

| Received DCC | 7-Bit Coded DCC |
|---|---|
| 00 | 0000000 |
| 01 | 0011111 |
| 10 | 1100011 |
| 11 | 1111100 |

Each word contains 48 bits, including parity, and is repeated five times; it is then referred to as a word block. A word is formed by encoding 36 content bits into a (48, 36) BCH code that has a distance of 5, (48, 36; 5). The left-most bit (i.e., earliest in time) shall be designated the most-significant bit. The 36 most-significant bits of the 48-bit field shall be the content bits. The generator polynomial for the code is the same as for the (40, 28; 5) code used on the forward control channel (see 3.7.1).

#### 2.7.1.1 RECC MESSAGES

Each RECC message can consist of one to five words. The types of messages to be transmitted over the reverse control channel are:

- Page Response Message
- Origination Message
- Order Confirmation Message
- Order Message

(See Table 3.7.1-1).

LOCAL — Local control field. This field is specific to each system. The ORDER field must be set to local control (see Table 3.7.1-1) for this field to be interpreted.

LT — Last-try code field (see **2.6.3.8**).

MIN1 — First part of the mobile identification number field (see **2.3.1**).

MIN2 — Second part of the mobile identification number field (see **2.3.1**).

SERIAL — Serial number field. Identifies the serial number of the mobile station (see **2.3.2**).

DIGIT — Digit field (see Table 2.7.1-2).

RSVD — Reserved for future use; all bits must be set as indicated.

P — Parity field.

Examples of encoding called-address information into the called-address words are given below:

I. If the number 2# is entered, the word is:

| NOTE | 0010 | 1100 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | P |
|---|---|---|---|---|---|---|---|---|---|
| 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 12 |

II. If the number 13792640 is entered, the word is:

| NOTE | 0001 | 0011 | 0111 | 1001 | 0010 | 0110 | 0100 | 1010 | P |
|---|---|---|---|---|---|---|---|---|---|
| 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 12 |

III. If the number *24273258 is entered, the words are:

Word D - First Word of the Called-Address

| NOTE | 1011 | 0010 | 0100 | 0010 | 0111 | 0011 | 0010 | 0101 | P |
|---|---|---|---|---|---|---|---|---|---|
| 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 12 |

Word E - Second Word of the Called-Address

| NOTE | 1000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | P |
|---|---|---|---|---|---|---|---|---|---|
| 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 12 |

NOTE: These four bits depend on the type of message.

**Table 2.7.1-2. DIGIT CODE**

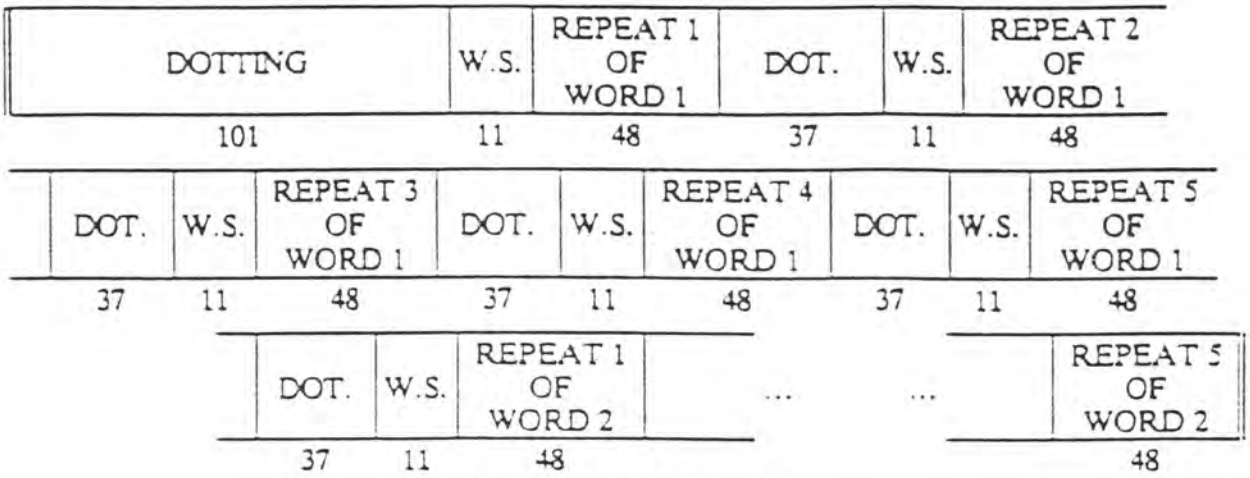
| Digit | Code | Digit | Code |
|---|---|---|---|
| 1 | 0001 | 7 | 0111 |
| 2 | 0010 | 8 | 1000 |
| 3 | 0011 | 9 | 1001 |
| 4 | 0100 | 0 | 1010 |
| 5 | 0101 | * | 1011 |
| 6 | 0110 | # | 1100 |
| | | Null | 0000 |

NOTES:

1) The digit 0 is encoded as binary "ten"; not binary "zero."
2) The code 0000 is the null code, indicating no digit present.
3) All other four-bit sequences are reserved, and must not be transmitted.

### 2.7.2 REVERSE VOICE CHANNEL

The reverse voice channel (RVC) is a wideband data stream sent from the mobile station to the land station. This data stream must be generated at a 10 kilobit/second ± 1 bit/second rate. Figure 2.7.2-1 depicts the format of the RVC data stream.




DOTTING = 1010....101
W.S. (WORD SYNC) = 11100010010

**Figure 2.7.2-1. REVERSE VOICE CHANNEL MESSAGE STREAM (Mobile-to-Land)**

A 37-bit dotting sequence (1010....101) and an 11-bit word sync sequence (11100010010) are sent to permit land stations to achieve synchronization with the incoming data, except at the first repeat of word 1 of the message where a 101-bit dotting sequence is used. Each word contains 48 bits, including parity, and is repeated five times together with the 37-bit dotting and 11-bit word sync sequences; it is then referred to as a word block. For a multi-word message, the second word block is formed the same as the first word block including the 37-bit dotting and 11-bit word sync sequences. A word is formed by encoding the 36 content bits into a (48, 36) BCH code that has a distance of 5, (48, 36; 5). The left-most bit (i.e., earliest in time) shall be designated the most-significant bit. The 36 most-significant bits of the 48-bit field shall be the content bits. The generator polynomial for the code is the same as for the (40, 28; 5) code used on the forward control channel (see 3.7.1).

#### 2.7.2.1 RVC MESSAGES

Each RVC message can consist of one or two words. The types of messages to be transmitted over the reverse voice channel are:

- Order Confirmation Message
- Called-Address Message.

The message formats are as follows:

**Order Confirmation Message**

| F = 1 | NAWC = 00 | T = 1 | LOCAL | ORDQ | ORDER | RSVD = 000...0 | P |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 1 | 5 | 3 | 5 | 19 | 12 |

**Called-Address Message:**

**Word 1 - First Word of the Called-Address**

| F = 1 | NAWC = 01 | T = 0 | 1st DIGIT | 2nd DIGIT | ... | ... | ... | ... | 7th DIGIT | 8th DIGIT | P |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 1 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 12 |

**Word 2 - Second Word of the Called-Address**

| F = 0 | NAWC = 00 | T = 0 | 9th DIGIT | 10th DIGIT | ... | ... | ... | ... | 15th DIGIT | 16th DIGIT | P |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 1 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 12 |

The interpretation of the data fields is as follows:

F — First word indication field. Set to '1' in first word and '0' in second word.

NAWC — Number of additional words coming field.

T — T field. Set to '1' to identify the message as an order confirmation. Set to '0' to identify the message as a called-address.

DIGIT — Digit field (see Table 2.7.1-2).

ORDER — Order field. Identifies the order type (see Table 3.7.1-1).

ORDQ — Order qualifier field. Qualifies the order confirmation to a specific action (See Table 3.7.1-1).

LOCAL — Local Control field. This field is specific to each system. The ORDER field must be set to local control (see Table 3.7.1-1) for this field to be interpreted.

RSVD — Reserved for future use; all bits must be set as indicated.

P — Parity field.

# 3. LAND STATION (See also 5. for Land Station Options)

## 3.1 TRANSMITTER

### 3.1.1 FREQUENCY PARAMETERS

#### 3.1.1.1 CHANNEL SPACING AND DESIGNATION

Channel spacing shall be 30 kHz and the land station transmit channel at 870.030 MHz (and the corresponding mobile station transmit channel at 825.030 MHz) shall be termed channel number 1. The 20-MHz range of channels 1 through 666 as shown in Table 2.1.1.1-1 for System A and System B is basic. The additional 5-MHz of channels 667 through 799 and (wrap-around) 991 through 1023 for extending Systems A and B is optional. The station class mark (SCM, see 2.3.3) of a mobile station must be taken into account in the consideration of assignment of a channel in this extended band.

#### 3.1.1.2 FREQUENCY TOLERANCE

The land station carrier frequency must be maintained within ±1.5 parts per million (ppm) of any assigned channel frequency.

### 3.1.2 POWER OUTPUT CHARACTERISTICS

Maximum effective radiated power (ERP) and antenna height above average terrain (HAAT) must be coordinated locally on an ongoing basis.

### 3.1.3 MODULATION CHARACTERISTICS

#### 3.1.3.1 VOICE SIGNALS

The (FM) modulator is preceded by the following four voice-processing stages (in the order listed):

- Compressor
- Pre-Emphasis
- Deviation Limiter
- Post Deviation-Limiter Filter

##### 3.1.3.1.1 COMPRESSOR

This stage must include the compressor portion of a 2:1 syllabic compandor. For every 2 dB change in input level to a 2:1 compressor within its operating range, the change in output level is a nominal 1 dB. The compressor must have a nominal attack time of 3 ms and a nominal recovery time of 13.5 ms as defined by the CCITT. (Reference: Recommendation G162, CCITT Plenary Assembly, Geneva, May-June 1964, Blue Book, Vol. 111, P. 52.) The nominal reference input level to the compressor is that corresponding to a 1000 Hz acoustic tone at the expected nominal speech volume level. This level must produce a nominal ±2.9 kHz peak frequency deviation of the transmitted carrier.

##### 3.1.3.1.2 PRE-EMPHASIS

The pre-emphasis characteristic must have a nominal +6 dB/octave response between 300 and 3000 Hz.

##### 3.1.3.1.3 DEVIATION LIMITER

For audio (voice) inputs applied to the transmitter voice-signal processing stages, a land station must limit the instantaneous frequency deviation to ±12 kHz. This requirement excludes supervision signals (see 3.4) and wideband data signals (see 3.1.3.2).

##### 3.1.3.1.4 POST DEVIATION-LIMITER FILTER

The deviation limiter must be followed by a low-pass filter whose attenuation characteristics must exceed:

| Frequency Band | Attenuation Relative to 1000 Hz |
|---|---|
| 3000 - 15000 Hz | 40 log (f/3000) dB |
| above 15000 Hz | 28 dB |

#### 3.1.3.2 WIDEBAND DATA SIGNALS

##### 3.1.3.2.1 ENCODING

The forward control channel (FOCC) and forward voice channel (FVC) wideband data streams (see 3.7) must be further encoded such that each nonreturn-to-zero binary one is transformed to a zero-to-one transition, and each nonreturn-to-zero binary zero is transformed to a one-to-zero transition.

##### 3.1.3.2.2 MODULATION AND POLARITY

The filtered wideband data stream must then be used to modulate the transmitter carrier using direct binary frequency shift keying. A one (i.e., high state) into the modulator must correspond to a nominal peak frequency deviation 8 kHz above the carrier frequency, and a zero into the modulator must correspond to a nominal peak frequency deviation 8 kHz below the carrier frequency.

### 3.1.4 LIMITATIONS ON EMISSIONS

#### 3.1.4.1 BANDWIDTH OCCUPIED

Modulation products outside the region ±20 kHz from the carrier shall not exceed a level of 26 dB below the unmodulated carrier. Modulation products outside the region of ±45 kHz from the carrier shall not exceed a level of 45 dB below the unmodulated carrier. Modulation products outside the region of ±90 kHz from the carrier shall not exceed a level of (a) 60 dB below the unmodulated carrier, or (b) 43 plus $10\log_{10}$(mean output power in Watts) dB below the unmodulated carrier. Measurement techniques are defined in the current EIA edition of "Recommended Minimum Standards for 800-MHz Cellular Land Stations". X

#### 3.1.4.2 CONDUCTED SPURIOUS EMISSIONS

Current FCC rules shall apply.

#### 3.1.4.3 RADIATED SPURIOUS EMISSIONS

Current FCC rules shall apply.

#### 3.1.4.4 INTERMODULATION

Radiated products from co-located transmitters shall not exceed FCC spurious and harmonic level requirements that would apply to any of the transmitters operated singly.

## 3.2 RECEIVER

### 3.2.1 FREQUENCY PARAMETERS

#### 3.2.1.1 CHANNEL SPACING AND DESIGNATION

Channel spacing shall be 30 kHz and the land station receive channel at 825.030 MHz (and the corresponding mobile station receive channel at 870.030 MHz) shall be termed channel number 1. The 20-MHz range of channels 1 through 666 as shown in Table 2.1.1.1-1 for System A and System B is basic. The additional 5-MHz of channels 667 through 799 and (wrap-around) 991 through 1023 for extending Systems A and B is optional. The station class mark (SCM, see 2.3.3) of a mobile station must be taken into account in the consideration of assignment of a channel in this extended band.

### 3.2.2 DEMODULATION CHARACTERISTICS

#### 3.2.2.1 VOICE SIGNALS

The demodulator is followed by the following two voice-signal processing stages:

- De-Emphasis
- Expandor

##### 3.2.2.1.1 DE-EMPHASIS

The de-emphasis characteristic must have a nominal —6 dB per octave response between 300 and 3000 Hz.

##### 3.2.2.1.2 EXPANDOR

This stage must include the expandor portion of a 2:1 syllabic compandor. For every 1 dB change in input level to a 1:2 expandor, the change in output level is a nominal 2 dB. The signal expansion must follow all other demodulation signal processing (including the 6 dB/octave de-emphasis and filtering). The expandor must have a nominal attack time of 3 ms and a nominal recovery time of 13.5 ms as defined by the CCITT. (Reference: Recommendation G162, CCITT Plenary Assembly, Geneva, May-June 1964, Blue Book, Vol. 111, P. 52.)

The nominal reference input level to the expandor is that corresponding to a 1000 Hz tone from a carrier with a ±2.9 kHz peak frequency deviation.

### 3.2.3 LIMITATIONS ON EMISSIONS

Current FCC rules shall apply.

### 3.2.4 OTHER RECEIVER PARAMETERS

System performance is predicated upon receivers meeting EIA IS-20 (Recommended Minimum Standards for 800-MHz Cellular Land Stations).

## 3.3 SECURITY AND IDENTIFICATION (reserved)

## 3.4 SUPERVISION

### 3.4.1 SUPERVISORY AUDIO TONE

#### 3.4.1.1 SAT DETECTION (reserved)

#### 3.4.1.2 SAT TRANSMISSION

Whenever a land station transmitter is active on a voice channel, one of the following tones must be modulated on the carrier with a frequency deviation of ±2 kHz ±10 percent:

- 5970 Hz.
- 6000 Hz.
- 6030 Hz.

The frequency tolerance of the tone must be ±1 Hz.

#### 3.4.1.3 FADE TIMING STATUS (reserved)

### 3.4.2 SIGNALING TONE DETECTION (reserved)

## 3.5 MALFUNCTION DETECTION (reserved)

## 3.6 CALL PROCESSING

The following sections describe the land station operation to control the mobile station. Frequent references are made to the corresponding sections in the mobile section and to the messages that flow between the land station and the mobile station. It is helpful to read 2.6

and 3.6 in parallel and examine the message formats in 2.7 and 3.7 at the same time.

### 3.6.1 OVERHEAD FUNCTIONS FOR MOBILE STATION INITIATION

To control mobile stations executing the Initialization Task (see 2.6.1), the following information must be sent in the overhead message train (see 3.7.1.2 for the formats of the messages):

- First part of the system identification (SID1).
- Number of paging channels (N).

### 3.6.2 MOBILE STATION CONTROL ON THE CONTROL CHANNEL

#### 3.6.2.1 OVERHEAD INFORMATION

To control mobile stations monitoring a control channel, the following overhead information must be sent in the system parameter overhead message (see 3.7.1.2 for the message formats):

- *First part of the system identification (SID1).*
- *Serial number (S).* To require that all mobile stations send their serial numbers during a system access, the S field must be set to '1'; otherwise it must be set to '0'.
- *Registration (REGH, REGR).* To enable registration for home mobile stations, the REGH field must be set to '1'; otherwise it must be set to '0'. To enable registration for roaming mobile stations, The REGR field must be set to '1'; otherwise it must be set to '0'. If registration is enabled, the land station must support both autonomous and non-autonomous registration by mobile stations.
- *Extended Address (E).* To require that all mobile stations send both MIN1 and MIN2 during a system access, the E field must be set to '1'; otherwise it must be set to '0'.
- *Discontinuous transmission (DTX).* To permit mobile stations to use the discontinuous transmission mode on the voice channel, the DTX field must be set to '10' or '11'; otherwise it must be set to '00'. A setting of '10' indicates that the DTX-low level must equal or exceed a level 8 dB below the DTX-high level. A setting of '11' indicates that no minimum applies to the DTX-low level. (See 2.3.11.)
- *Number of paging channels (N).*
- *Read control-filler message (RCF).* To require that all mobile stations read a control-filler message before accessing a system on a reverse control channel, the RCF field must be set to '1'; otherwise it must be set to '0'.
- *Combined paging/access (CPA).* If the access functions are combined with the paging functions on the same set of control channels, the CPA field must be set to '1'. If the access functions are not on the same set of channels as the paging functions, the CPA field must be set to '0'.
- *Number of access channels (CMAX).*

The following overhead information is sent as required in messages appended to a system parameter overhead message (see 3.7.1.2 for messages formats):

- *Local control.* A system may customize operation for home mobile stations and for those roaming mobile stations whose home systems are members of a group by sending local control global action messages.
- *New Access channels.* If the access channel set is not the default set (see 2.6.2.1), the new access channel global action message must be sent with the NEWACC field set to the first access channel.

- *Registration increment.* Each time a mobile station with autonomous registration enabled registers, it increments its next registration ID by a fixed value ($REGINCR_r$; see 2.6.3.11). To change this value, the registration increment global action message must be sent with the REGINCR field appropriately set.
- *Registration ID.* The registration ID message must be sent in order to require that all mobile stations with autonomous registration enabled and with a given or lower next registration ID ($NXTREG_{r,p}$) register.
- *Rescan.* To require that all mobile stations enter the Initialization Task and scan the dedicated control channels, the rescan global action message must be sent.

#### 3.6.2.2 PAGE

To page a mobile station, a mobile station control message must be sent (see 3.7.1.1). Home mobile stations may be paged with a one-word or a two-word message. Roaming mobile stations must be paged with a two-word message.

#### 3.6.2.3 ORDER

Orders must be sent to mobile stations with a two-word mobile station control message (See 3.7.1.2). The following orders may be transmitted:

- Audit.
- Local control.

#### 3.6.2.4 LOCAL CONTROL

A cellular system may customize operation for home mobile stations, and for those roaming mobile stations whose home systems are members of a group, by sending local orders with the order field set to local control (which informs the mobile station to examine the local control field), and by sending one or both of two local control global action overhead messages (see 3.7.1.1, 3.7.1.2.2, and 3.7.2).

A group of systems could be formed by participating systems agreeing to a common set of local control protocols and whose system identifications (SID) are recognized by mobile stations as a common group.

### 3.6.3 LAND STATION SUPPORT OF SYSTEM ACCESS BY MOBILE STATIONS

#### 3.6.3.1 OVERHEAD INFORMATION

The following information must be sent on a forward control channel to support system access by mobile stations (see 3.7.1.2 for message formats):

- *Digital color code (DCC).* The DCC is transmitted from the land station to the mobile station. The mobile station then uses the DCC to identify to the land station which land station transmitter the mobile station is receiving.
- *Control mobile attenuation code (CMAC).* The CMAC must be transmitted from the land station to the mobile station in the control-filler message if the mobile station must adjust its transmitter power level before accessing a system on a reverse control channel. The translation of the CMAC field to transmitter power level depends on the mobile station's power class as indicated by its station class mark ($SCM_p$) (see 2.1.2.2 and 2.3.3). When not required, the CMAC field must be set to '000'. To require that mobile stations read a control-filler message prior to system access, the RCF field must be set to '1' in the system parameter overhead message.
- *Wait-for-overhead-message (WFOM).* If the mobile station must wait for an overhead message train before accessing a system on a reverse control channel, then the WFOM field must be set to '1' in the control-filler message; otherwise it must be set to '0'.

- *Overload control (OLC).* If the mobile stations assigned to one or more of the 16 overload classes must not access the system for originations on the reverse control channel, the overload control global action message must be appended to a system parameter overhead message. When this message is appended, the overload class fields corresponding to the restricted overload classes must be set to '0', and the remaining overload class fields must be set to '1'.

- *Access type parameters.* If a mobile station must not check for an idle-to-busy status transition on the reverse control channel when accessing a system, then the access type parameters global action message with the BIS field set to '0' must be appended to a system parameter overhead message; otherwise the BIS field must be set to '1' whenever the message is appended.

- *Access attempt parameters.* If the default values for the number of seizure attempts and/or the limit on the number of busy occurrences for mobile stations accessing the reverse control channel must not be used, then the access attempt parameters global action message must be appended to a system parameter overhead message.

#### 3.6.3.2 REVERSE CONTROL CHANNEL SEIZURE BY MOBILE STATIONS

If mobile stations are required to check for an idle-to-busy transition of the busy-idle bits in the corresponding FOCC when accessing a system (i.e., the BIS field is set to '1'), then whenever the land station receives a seizure precursor (see 2.7.1) that matches its encoded form of the DCC with 1 or no bit errors, it must begin transmitting busy-idle bits as busy on the FOCC between 0.8 ms and 2.9 ms, inclusive, after the reception of the last bit of the mobile station's precursor (i.e., bit times 56 through 77 of the mobile station's message). The busy-idle bits must remain busy until the 30 ms after the last bit of the last word of the mobile station's message has been received, if this can be determined; otherwise, until the time equal to (24N + 55) ms after transmitting the first busy-idle bit as busy, where N is the maximum number of words the land station has been designed to receive.

#### 3.6.3.3 RESPONSE TO MOBILE STATION MESSAGES

Whenever the mobile station sends a message to the land station, it is not required that the land station respond to the message. During periods of overload and/or high usage, it may be desirable to permit mobile stations to "time-out" rather than sending release or other orders that use system capacity.

The following responses to mobile station messages may be sent:

- *Origination message.* Send one of the following orders:
  - — Initial voice channel designation,
  - — Directed retry,
  - — Intercept,
  - — Reorder.

- *Page response message.* Send one of the following orders:
  - — Initial voice channel designation,
  - — Directed retry,
  - — Release.

- *Order message.* Send one of the following orders:
  - — Order confirmation,
  - — Release.

- *Order confirmation message.* No message is sent.

### 3.6.4 MOBILE STATION CONTROL ON VOICE CHANNEL

Whenever the mobile station is transmitting on a voice channel, changes in the status of the supervisory audio tone (SAT) and signaling tone (ST) are used to signal the occurrence of certain events during the progress of a call. These events include confirming orders, sending a release request, sending a flash request, and loss of radio-link continuity. The mobile station will signal these events by changing in a prescribed manner (see 2.6.4) the status of the SAT and ST, abbreviated in the following sections (SAT,ST) where SAT and ST have the value '0' when not present and '1' when present. These status changes must be detected by the land station and interpreted within the context of the task the land station is in as a message that identifies the event signaled by the mobile station. Requirements concerning these land station actions are described below. In the following sections, the (0,1) status shall always be treated as the (0,0) status.

In addition to the analog signaling to and from the mobile station, digital messages can be sent to the mobile station and received from the mobile station. The response to a digital message sent to the mobile station will be either be a digital message or a status change of SAT and ST.

#### 3.6.4.1 LOSS OF RADIO-LINK CONTINUITY (reserved)

#### 3.6.4.2 INITIAL VOICE CHANNEL CONFIRMATION

Confirmation that a mobile station has successfully tuned to its initial designated voice channel will be received by the land station as a change in the SAT, ST status from (0,0) to (1,0).

If the confirmation is not received, the land station must either resend the message or turn off the voice channel transmitter.

Following confirmation, if the mobile station was paged, the land station must enter the Waiting for Order Task (see 3.6.4.3.1); otherwise, the land station must enter the Conversation Task (see 3.6.4.4).

#### 3.6.4.3 ALERTING

##### 3.6.4.3.1 WAITING FOR ORDER

When the mobile station confirms the initial voice channel designation after having been paged, it enters this task. The following orders can be sent to the mobile station, with the resultant confirmation and action to be taken as follows:

- *Handoff*. The mobile station confirms the order by a change in the SAT, ST status from (1,0) to (1,1) with the (1,1) status held for 50 ms. The land station must remain in the Waiting for Order Task.
- *Alert*. The mobile station confirms the order by a change in the SAT, ST status from (1,0) to (1,1). The land station must then enter the Waiting for Answer Task (see 3.6.4.3.2).
- *Release*. The mobile station confirms the order by a change of the SAT, ST status from (1,0) to (1,1) with the (1,1) status held for 1.8 seconds. The land station must then turn off the transmitter.
- *Audit*. The mobile station confirms the order by a digital message (see 2.7.2). The land station must remain in the Waiting for Order Task.
- *Maintenance*. The mobile station confirms the order by a change in the SAT, ST status from (1,0) to (1,1). The land station must then enter the Waiting for Answer Task (see 3.6.4.3.2).
- *Change power*. The mobile station confirms the order by a digital message (see 2.7.2). The land station must remain in the Waiting for Order Task.
- *Local control*. The confirmation and action depend on the message.

#### 3.6.4.3.2 WAITING FOR ANSWER

When this task is entered, an alert timer may be set. The following orders can be sent with the confirmation and action to be taken as follows:

- *Handoff*. The mobile station confirms the order by changing the SAT, ST status from (1,1) to (1,0) for 500 ms followed by a change in the status from (1,0) to (1,1), with the (1,1) status held for 50 ms on the old channel. Then a (1,1) status is sent on the new channel. The land station must remain in the Waiting for Answer Task.
- *Alert*. No confirmation is received. The land station may reset the alert timer and remain in the Waiting for Answer Task.
- *Stop alert*. The mobile station confirms the order by a change in the SAT, ST status from (1,1) to (1,0). The land station must then enter the Waiting for Order Task.
- *Release*. The mobile station confirms the order by a change in the SAT, ST status from (1,1) to (1,0) for 500 ms followed by a change in the status from (1,0) to (1,1), with the (1,1) status held for 1.8 seconds. The land station must then turn off the transmitter.
- *Audit*. The mobile station confirms the order by a digital message (see 2.7.2). The land station must remain in the Waiting for Answer Task.
- *Maintenance*. No confirmation is received. The land station may reset the alert timer and remain in the Waiting for Answer Task.
- *Change power*. The mobile station confirms the order by a digital message (see 2.7.2). The land station must remain in the Waiting for Answer Task.
- *Local control*. The confirmation and action depend on the message.

The mobile station signals an answer by a change in the SAT, ST status from (1,1) to (1,0). The land station must then enter the Conversation Task (see 3.6.4.4).

#### 3.6.4.4 CONVERSATION

While the land station is in the Conversation Task, the following orders can be sent to the mobile station, with confirmation and action to be taken as follows:

- *Handoff*. The mobile station confirms the order by a change in the SAT, ST status from (1,0) to (1,1), with the (1,1) status held for 50 ms. The land station must remain in the Conversation Task.
- *Send called address*. The mobile station confirms the order by a digital message with the called-address information (see 2.7.2). The action to be taken will depend on the called-address information.
- *Alert*. The mobile station confirms the order by a change in the SAT, ST status from (1,0) to (1,1). The land station must then enter the Waiting for Answer Task (see 3.6.4.3.2).
- *Release*. The mobile station confirms the order by a change in the SAT, ST status from (1,0) to (1,1), with the (1,1) status held for 1.8 seconds. The land station must turn off the transmitter.
- *Audit*. The mobile station confirms the order by a digital message (see 2.7.2). The land station must remain in the Conversation Task.
- *Maintenance*. The mobile station confirms the order by a change in the SAT, ST status from (1,0) to (1,1). The land station must then enter the Waiting for Answer Task (see 3.6.4.3.2).
- *Change power*. The mobile station confirms the order by a digital message (see 2.7.2). The land station must remain in the Conversation Task.

- *Local control*. The confirmation and action depend on the message.

In addition, the following messages can be received autonomously from the mobile station:

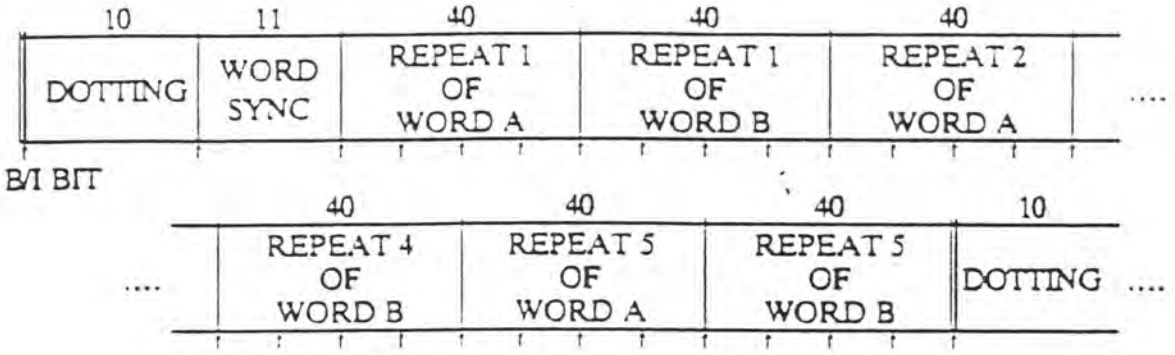
- *Flash request*. The mobile station signals a flash by a change in the SAT, ST status from (1,0) to (1,1) with the (1,1) status held for 400 ms followed by a transition to the (1,0) status.
- *Release*. The mobile station signals a release by a change in the SAT, ST status from (1,0) to (1,1) with the (1,1) status held for 1.8 seconds. The land station must turn off the transmitter.

## 3.7 SIGNALING FORMATS

In the message formats used between the mobile stations and land stations, some bits are marked as reserved (RSVD). Some or all of these reserved bits may be used in the future for additional messages. Therefore, all mobile stations and land stations must set all bits that they are programmed to treat as reserved bits to '0' (zero) in all messages that they transmit. All mobile stations and land stations must ignore the state of all bits that they are programmed to treat as reserved bits in all messages that they receive.

### 3.7.1 FORWARD CONTROL CHANNEL

The forward control channel (FOCC) is a continuous wideband data stream sent from the land station to the mobile station. This data stream must be generated at a 10 kilobit/second ±0.1 bit/second rate. Figure 3.7.1-1 depicts the format of the FOCC data stream.




DOTTING = 1010101010
WORD SYNC = 11100010010

NOTES:
1. A given mobile reads only one of the two interleaved messages (A or B).
2. Busy-Idle bits are inserted at each arrow.

Figure 3.7.1-1. FORWARD CONTROL CHANNEL MESSAGE STREAM (Land-to-Mobile)

Each forward control channel consists of three discrete information streams, called stream A, stream B, and busy-idle stream, that are time-multiplexed together. Messages to mobile stations with the least significant bit of their mobile identification number (see 2.3.1) equal to '0' are sent on stream A, and those with the least-significant bit of their mobile identification number equal to '1' are sent on stream B.

The busy-idle stream contains busy-idle bits, which are used to indicate the current status of the reverse control channel. The reverse control channel is busy if the busy-idle bit is equal to '0' and idle if the busy-idle bit is equal to '1'. A busy-idle bit is located at the beginning of each dotting sequence, at the beginning of each word sync sequence, at the beginning of the first repeat of word A, and after every 10 message bits thereafter.

A 10-bit dotting sequence (1010101010) and an 11-bit word sync sequence (11100010010) are sent to permit mobile stations to achieve synchronization with the incoming data. Each word contains 40 bits, including parity, and is repeated five times; it is then referred to as a word block. For a multi-word message, the second word block and subsequent word blocks are formed the same as the first word block including the 10-bit dotting and 11-bit word sync sequences. A word is formed by encoding 28 content bits into a (40, 28) BCH code that has a distance of 5, (40, 28; 5). The left-most bit (i.e., earliest in time) shall be designated the most-significant bit. The 28 most-significant bits of the 40-bit field shall be the content bits.

The generator polynomial for the (40, 28; 5) BCH code is:

$$g_B(x) = X^{12} + X^{10} + X^8 + X^5 + X^4 + X^3 + X^0.$$

The code, a shortened version of the primitive (63, 51; 5) BCH code, is a systematic linear block code with the leading bit as the most significant information bit and the least-significant bit as the last parity-check bit.

Each FOCC message can consist of one or more words. The types of messages to be transmitted over the forward control channel are:

- Mobile station control message
- Overhead message
- Control-Filler message

Control-filler messages may be inserted between messages and between word blocks of a multi-word message.

The following sections contain descriptions of the message formats that the land station transmits over either stream A or B. For purposes of format presentation and explanation, the busy-idle bits have been deleted in the discussion of the message formats.

### 3.7.1.1 MOBILE STATION CONTROL MESSAGE

The mobile station control message can consist of one, two, or four words.

**Word 1 - Abbreviated Address Word**

| $T_1T_2$ | DCC | $MIN1_{23-0}$ | P |
|---|---|---|---|
| 2 | 2 | 24 | 12 |

**Word 2 - Extended Address Word**

| 2 | 2 | 10 | 1 | 5 | 3 | 5 | 12 |
|---|---|---|---|---|---|---|---|
| $T_1T_2$ = 10 | SCC = 11 | $MIN2_{33-24}$ | RSVD = 0 | LOCAL | ORDQ | ORDER | P |
| | SCC ≠ 11 | | VMAC | CHAN | | | |
| 2 | 2 | 10 | 3 | 11 | | | 12 |

**Word 3 - First Directed-Retry Word**

| $T_1T_2$ = 10 | SCC = 11 | CHANPOS | CHANPOS | CHANPOS | RSVD = 000 | P |
|---|---|---|---|---|---|---|
| 2 | 2 | 7 | 7 | 7 | 3 | 12 |

**Word 4 - Second Directed-Retry Word**

| $T_1T_2$ = 10 | SCC = 11 | CHANPOS | CHANPOS | CHANPOS | RSVD = 000 | P |
|---|---|---|---|---|---|---|
| 2 | 2 | 7 | 7 | 7 | 3 | 12 |

The interpretation of the data fields is as follows:

$T_1T_2$ — Type field. If only Word 1 is sent, set to '00' in Word 1. If a multiple-word

message is sent, set to '01' in Word 1 and set to '10' in each additional word.

DCC — Digital color code field.

MIN1 — First part of the mobile identification number field (see 2.3.1).

MIN2 — Second part of the mobile identification number field (see 2.3.1).

SCC — SAT color code (see Table 3.7.1-2).

ORDER — Order field. Identifies the order type (see Table 3.7.1-1).

ORDQ — Order qualifier field. Qualifies the order to a specific action (See Table 3.7.1-1).

LOCAL — Local control field. This field is specific to each system. The ORDER field must be set to local control (see Table 3.7.1-1) for this field to be interpreted.

VMAC — Voice mobile attenuation code field. Indicates the mobile station power level associated with the designated voice channel (see Table 2.1.2-1).

CHAN — Channel number field. Indicates the designated voice channel (see 2.3.3).

CHANPOS — Channel position field. Indicates the position of a control channel relative to the first access channel (FIRSTCHA).

RSVD — Reserved for future use, all bits must be set as indicated.

P — Parity field.

Table 3.7.1-1. ORDER AND ORDER QUALIFICATION CODES

| Order Code | Order Qualification Code | Function |
|---|---|---|
| 00000 | 000 | Page (or Origination) |
| 00001 | 000 | Alert |
| 00011 | 000 | Release |
| 00100 | 000 | Reorder |
| 00110 | 000 | Stop Alert |
| 00111 | 000 | Audit |
| 01000 | 000 | Send Called-address |
| 01001 | 000 | Intercept |
| 01010 | 000 | Maintenance |
| 01011 | 000 | Change Power to Power Level 0 (see 2.1.2.2) |
| 01011 | 001 | Change Power to Power Level 1 |
| 01011 | 010 | Change Power to Power Level 2 |
| 01011 | 011 | Change Power to Power Level 3 |
| 01011 | 100 | Change Power to Power Level 4 |
| 01011 | 101 | Change Power to Power Level 5 |
| 01011 | 110 | Change Power to Power Level 6 |
| 01011 | 111 | Change Power to Power Level 7 |
| 01100 | 000 | Directed Retry - not last try |
| 01100 | 001 | Directed Retry - last try |
| 01101 | 000 | Non-autonomous Registration - Do not make whereabouts known |
| 01101 | 001 | Non-autonomous Registration - Make whereabouts known |
| 01101 | 010 | Autonomous Registration - Do not make whereabouts known |
| 01101 | 011 | Autonomous Registration - Make whereabouts known |
| 11110 | 000 | local control |

(All other codes are reserved)

Table 3.7.1-2. SAT COLOR CODE (SCC)

| Bit Pattern | SAT Frequency |
|---|---|
| 00 | 5970 Hz |
| 01 | 6000 Hz |
| 10 | 6030 Hz |
| 11 | (Not a channel designation) |

### 3.7.1.2 OVERHEAD MESSAGE

A three-bit OHD field is used to identify the overhead message types. Overhead message type codes are listed in Table 3.7.1-3, and are grouped into the following functional classes:

- System parameter overhead message,
- Global action overhead message,
- Registration identification message,
- Control-filler message.

Overhead messages are sent in a group called an overhead message train. The first message of the train must be the system parameter overhead message. The desired global action messages and/or a registration ID message must be appended to the end of the system parameter overhead message. The total number of words in an overhead message train is one more than the value of the NAWC field contained in the first word of the system parameter overhead message. The last word in the overhead message train is identified by a '1' in the END field of that word; the END field of all other words in the train must be set to '0'. For NAWC-counting purposes, inserted control-filler messages (see 3.7.1) must not be counted as part of the overhead message train.

The system parameter overhead message must be sent every 0.8 ±0.3 seconds on each of the following control channels:

- All dedicated control channels (see 2.6.1.1.1).
- Combined paging-access forward control channel (i.e., CPA = 1, see 3.7.1.2.1).
- Separate paging forward control channel (i.e., CPA = 0).
- Separate access forward control channel (i.e., CPA = 0) when the control-filler message is sent with the WFOM bit set to '1' (see 3.7.1.2.4).

The global action messages and the registration identification message are sent on an as needed basis.

Table 3.7.1-3. OVERHEAD MESSAGE TYPES

| Code | Order |
|---|---|
| 000 | Registration ID |
| 001 | Control-filler |
| 010 | Reserved |
| 011 | Reserved |
| 100 | Global action |
| 101 | Reserved |
| 110 | Word 1 of system parameter message |
| 111 | Word 2 of system parameter message |

3.7.1.2.1 SYSTEM PARAMETER OVERHEAD MESSAGE

The system parameter overhead message consists of two words.

Word 1

| $T_1T_2$ = 11 | DCC | SID1 | RSVD = 000 | NAWC | OHD = 110 | P |
|---|---|---|---|---|---|---|
| 2 | 2 | 14 | 3 | 4 | 3 | 12 |

**Word 2**

| $T_1T_2$ = 11 | DCC | S | E | REGH | REGR | DTX |
|---|---|---|---|---|---|---|
| 2 | 2 | 1 | 1 | 1 | 1 | 2 |

| | N-1 | RCF | CPA | CMAX-1 | END | OHD = 111 | P |
|---|---|---|---|---|---|---|---|
| | 5 | 1 | 1 | 7 | 1 | 3 | 12 |

The interpretation of the data fields is as follows:

$T_1T_2$ — Type field. Set to '11' indicating an overhead word.

OHD — Overhead message type field. The OHD field of word 1 is set to '110' indicating the first word of the system parameter overhead message. The OHD field of word 2 is set to '111' indicating the second word of the system parameter overhead message.

DCC — Digital color code field.

SID1 — First part of the system identification field.

NAWC — Number of additional words coming field. In word 1 this field is set to one fewer than the total number of words in the overhead message train.

S — Serial number field.

E — Extended address field.

REGH — Registration field for home stations.

REGR — Registration field for roaming stations.

DTX — Discontinuous transmission field.

N-1 — N is the number of paging channels in the system.

RCF — Read-control-filler field.

CPA — Combined paging/access field.

CMAX-1 — CMAX is the number of access channels in the system.

END — End indication field. Set to '1' to indicate the last word of the overhead message train; set to '0' if not last word.

RSVD — Reserved for future use, all bits must be set as indicated.

P — Parity field.

#### 3.7.1.2.2 GLOBAL ACTION OVERHEAD MESSAGE

Each global action overhead message consists of one word. The global action message types are listed in Table 3.7.1-4. Any number of global action messages can be appended to a system parameter overhead message.

The formats for the global action commands are as follows:

**Rescan Global Action Message**

| $T_1T_2$ = 11 | DCC | ACT = 0001 | RSVD= 000...00 | END | OHD = 100 | P |
|---|---|---|---|---|---|---|
| 2 | 2 | 4 | 16 | 1 | 3 | 12 |

Registration Increment Global Action Message

| $T_1T_2$ = 11 | DCC | ACT = 0010 | REGINCR | RSVD = 0000 | END | OHD = 100 | P |
|---|---|---|---|---|---|---|---|
| 2 | 2 | 4 | 12 | 4 | 1 | 3 | 12 |

New Access Channel Set Global Action Message

| $T_1T_2$ = 11 | DCC | ACT = 0110 | NEWACC | RSVD = 00000 | END | OHD = 100 | P |
|---|---|---|---|---|---|---|---|
| 2 | 2 | 4 | 11 | 5 | 1 | 3 | 12 |

Overload Control Global Action Message

| $T_1T_2$ = 11 | DCC | ACT = 1000 | OLC 0 | OLC 1 | OLC 2 | OLC 3 | OLC 4 | OLC 5 | OLC 6 | OLC 7 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 2 | 4 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| OLC 8 | OLC 9 | OLC 10 | OLC 11 | OLC 12 | OLC 13 | OLC 14 | OLC 15 | END | OHD = 100 | P |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 12 |

Access Type Parameters Global Action Message

| $T_1T_2$ = 11 | DCC | ACT = 1001 | BIS | RSVD= 000...0 | END | OHD = 100 | P |
|---|---|---|---|---|---|---|---|
| 2 | 2 | 4 | 1 | 15 | 1 | 3 | 12 |

Access Attempt Parameters Global Action Message

| $T_1T_2$ = 11 | DCC | ACT = 1010 | MAXBUSY -PGR | MAXSZTR -PGR |
|---|---|---|---|---|
| 2 | 2 | 4 | 4 | 4 |

| MAXBUSY -OTHER | MAXSZTR -OTHER | END | OHD = 100 | P |
|---|---|---|---|---|
| 4 | 4 | 1 | 3 | 12 |

Local Control 1 Message

| $T_1T_2$ = 11 | DCC | ACT = 1110 | LOCAL CONTROL | END | OHD = 100 | P |
|---|---|---|---|---|---|---|
| 2 | 2 | 4 | 16 | 1 | 3 | 12 |

Local Control 2 Message

| $T_1T_2$ = 11 | DCC | ACT = 1111 | LOCAL CONTROL | END | OHD = 100 | P |
|---|---|---|---|---|---|---|
| 2 | 2 | 4 | 16 | 1 | 3 | 12 |

The interpretation of the data fields is as follows:

$T_1T_2$ — Type field. Set to '11' indicating overhead word.

ACT — Global action field. See Table 3.7.1-4.

BIS — Busy-idle status field.

DCC — Digital color code field.

OHD — Overhead message type field. Set to '100' indicating the global action message.

REGINCR — Registration increment field.

NEWACC — New access channel starting point field.

MAXBUSY-PGR — Maximum busy occurrences field (page response).

MAXBUSY-OTHER — Maximum busy occurrences field (other accesses).

MAXSZTR-PGR — Maximum seizure tries field (page response).

MAXSZTR-OTHER — Maximum seizure tries field (other accesses).

OLC N — Overload class field (N = 0 to 15). (See NOTE for recommended overload control bit assignments.)

END — End indication field. Set to '1' to indicate the last word of the overhead message train; set to '0' if not last word.

RSVD — Reserved for future use, all bits must be set as indicated.

LOCAL CONTROL — May be set to any bit pattern.

P — Parity field.

NOTE: The recommended overload control bit assignments are:

| OLC 0 | OLC 1 | OLC 2 | OLC 3 | ..... | OLC 9 | OLC 10 | OLC 11 | OLC 12 | ..... | OLC 15 |
|---|---|---|---|---|---|---|---|---|---|---|

Uniform distribution assigned to normal subscribers = OLC 0 through OLC 9

Test mobiles = OLC 10

Emergency mobiles = OLC 11

Reserved = OLC 12 through OLC 15

For more information, refer to EIA Telecommunications Systems Bulletin No. 16 (March 1985), "Assignment of Access Overload Classes in the Cellular Telecommunications Services".

#### 3.7.1.2.3 REGISTRATION ID MESSAGE

The registration ID message consists of one word. When sent, the message must be appended to a system parameter overhead message in addition to any global action messages.

| $T_1T_2$ = 11 | DCC | REGID | END | OHD = 000 | P |
|---|---|---|---|---|---|
| 2 | 2 | 20 | 1 | 3 | 12 |

The interpretation of the data fields is as follows:

$T_1T_2$ — Type field. Set to '11' indicating overhead word.

DCC — Digital color code field.

OHD — Overhead message type field. Set to '000' indicating the registration ID message.

REGID — Registration ID field.

END — End indication field. Set to '1' to indicate last word of the overhead message train; set to '0' if not last word.

P — Parity field.

Table 3.7.1-4. GLOBAL ACTION MESSAGE TYPES

| Action Code | Type |
|---|---|
| 0000 | Reserved |
| 0001 | Rescan paging channels |
| 0010 | Registration increment |
| 0011 | Reserved |
| 0100 | Reserved |
| 0101 | Reserved |
| 0110 | New access channel set |
| 0111 | Reserved |
| 1000 | Overload control |
| 1001 | Access type parameters |
| 1010 | Access attempt parameters |
| 1011 | Reserved |
| 1100 | Reserved |
| 1101 | Reserved |
| 1110 | Local control 1 |
| 1111 | Local control 2 |

#### 3.7.1.2.4 CONTROL-FILLER MESSAGE

The control-filler message consists of one word. It is sent whenever there is no other message to be sent on the forward control channel. It may be inserted between messages as well as between word blocks of a multi-word message. The control-filler message is chosen so that when it is sent, the 11-bit word sync sequence (11100010010) will not appear in the message stream, independent of the busy-idle bit status.

The control-filler message is also used to specify a control mobile attenuation code (CMAC) for use by mobile stations accessing the system on the reverse control channel, and a wait-for-overhead-message bit (WFOM) indicating whether or not mobile stations must read an overhead message train before accessing the system.

| $T_1T_2$ = 11 | DCC | 010111 | CMAC | RSVD = 00 | 11 | RSVD = 00 | 1 | WFOM | 1111 | OHD = 001 | P |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 2 | 6 | 3 | 2 | 2 | 2 | 1 | 1 | 4 | 3 | 12 |

The interpretation of the data fields is as follows:

$T_1T_2$ — Type field. Set to '11' indicating overhead word.

DCC — Digital color code field.

CMAC — Control mobile attenuation field. Indicates the mobile station power level associated with the reverse control channel (see Table 2.1.2-1).

RSVD — Reserved for future use; all bits must be set as indicated.

WFOM — Wait-for-overhead-message field.

OHD — Overhead message type field. Set to '001' indicating the control-filler word.

P — Parity field.

### 3.7.1.3 DATA RESTRICTIONS

The 11-bit word-sync sequence (11100010010) is shorter than the length of a word, and therefore can be embedded in a word. Normally, embedded word-sync will not cause a problem because the next word to be sent will not have the word-sync sequence embedded in it. There are, however, three cases in which the word-sync sequence may appear periodically in the FOCC stream. They are:

- The overhead message,
- The control-filler message,
- Mobile station control messages with pages to mobile stations with certain central office codes.

These three cases are handled by 1) restricting the overhead message transmission rate to about once per second, 2) designing the control-filler message to exclude the word-sync sequence, taking into account the various busy-idle bits, and 3) restricting the use of certain central office codes.

If the mobile station control message (see 3.7.1.1) is examined with the MIN1 separated into NXX-X-XXX as described in 2.3.1 (where NXX is the central office code, N represents a number from 2-9, and X represents a number from 0-9), Table 3.7.1-5 identifies the central office codes that are troublesome when used in the 1-word page mode. Use of the 2-word page mode alleviates the possibility of improper word-sync when using troublesome central office codes. For completeness, all 3-digit combinations that may be troublesome are shown even though they may be unrealistic, e.g., beginning with 0 or 1.

Table 3.7.1-5. TROUBLESOME CENTRAL OFFICE CODES

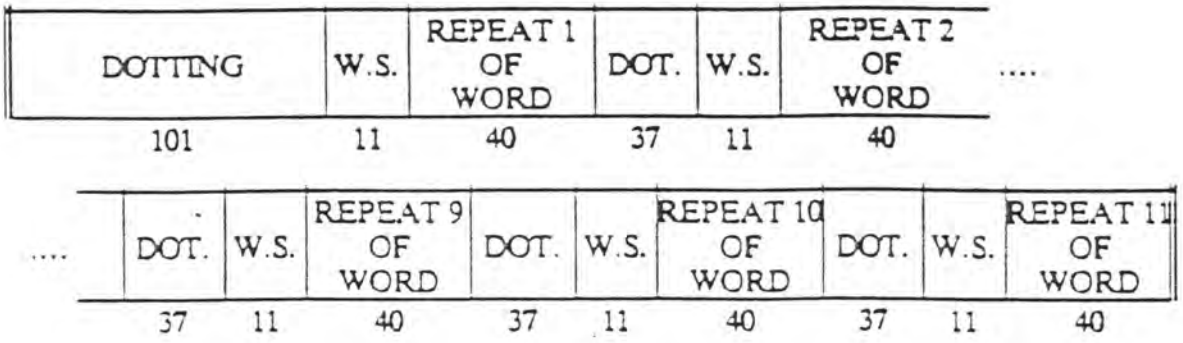
| Bit Pattern | | | | | Central Office Code | Thousands Digit |
|---|---|---|---|---|---|---|
| $T_1$ $T_2$ | DCC | NXX | X | XXX | | |
| 00 | ZZ | 111110(0)0100 | 10YY | ... | 007 | 0,8,9 |
| 00 | ZZ | 111011(1)0001 | 0010 | ... | 056 | 2 |
| 00 | ZZ | 111100(0)1001 | 0ZZZ | ... | 070 | 1-7 |
| 00 | ZZ | 000011(1)0001 | 0010 | ... | 150 | 2 |
| 00 | ZZ | 000111(1)0001 | 0010 | ... | 224 | 2 |
| 00 | ZZ | 000111(0)0010 | 010Z | ... | 225 | 4,5 |
| 00 | ZZ | 001011(1)0001 | 0010 | ... | 288 | 2 |
| 00 | ZZ | 001110(0)0100 | 10YY | ... | 339 | 0,8,9 |
| 00 | ZZ | 001111(1)0001 | 0010 | ... | 352 | 2 |
| 00 | ZZ | 001111(0)0010 | 010Z | ... | 353 | 4,5 |
| 00 | ZZ | 010011(1)0001 | 0010 | ... | 416 | 2 |
| 00 | ZZ | 010111(1)0001 | 0010 | ... | 470 | 2 |
| 00 | ZZ | 010111(0)0010 | 010Z | ... | 481 | 4,5 |
| 00 | ZZ | 011111(1)0001 | 0010 | ... | 508 | 2 |
| 00 | ZZ | 011111(0)0010 | 010Z | ... | 509 | 4,5 |
| 00 | ZZ | 011011(1)0001 | 0010 | ... | 544 | 2 |
| 00 | ZZ | 011100(0)1001 | 0ZZZ | ... | 568 | 1-7 |
| 00 | ZZ | 011110(0)0100 | 10YY | ... | 595 | 0,8,9 |
| 00 | 11 | 100010(0)1000 | .... | ... | 663 | 0-9 |
| 00 | 11 | 100010(0)1001 | .... | ... | 664 | 0-9 |
| 00 | 11 | 100010(0)1010 | .... | ... | 665 | 0-9 |
| 00 | 11 | 100010(0)1011 | .... | ... | 666 | 0-9 |
| 00 | ZZ | 100011(1)0001 | 0010 | ... | 672 | 2 |
| 00 | ZZ | 100111(1)0001 | 0010 | ... | 736 | 2 |
| 00 | ZZ | 100111(0)0010 | 010Z | ... | 737 | 4,5 |
| 00 | ZZ | 101011(1)0001 | 0010 | ... | 790 | 2 |
| 00 | ZZ | 101110(0)0100 | 10YY | ... | 851 | 0,8,9 |
| 00 | ZZ | 101111(1)0001 | 0010 | ... | 864 | 2 |
| 00 | ZZ | 101111(0)0010 | 010Z | ... | 865 | 4,5 |
| 00 | Z1 | 110001(0)0101 | .... | ... | 890 | 0-9 |
| 00 | Z1 | 110001(0)0100 | .... | ... | 899 | 0-9 |
| 00 | ZZ | 111000(1)0010 | .... | ... | 909 | 0-9 |
| 00 | ZZ | 110011(1)0001 | 0010 | ... | 928 | 2 |
| 00 | ZZ | 110111(1)0001 | 0010 | ... | 992 | 2 |
| 00 | ZZ | 110111(0)0010 | 010Z | ... | 993 | 4,5 |
| 00 | ZZ | 111111(0)0010 | 010Z | ... | --- | 4,5* |
| 00 | ZZ | 111111(1)0001 | 0010 | ... | --- | 2* |

Notes:

1) YY-bits can be '0', but both cannot be '1' at the same time.
2) Z represents a bit that may be '1' or '0'.
3) The bit in parentheses is the busy-idle bit.
4) * - Central Office Code above 999.
5) Central Office Codes beginning with '1' and '0' have been included for completeness.

### 3.7.2 FORWARD VOICE CHANNEL

The forward voice channel (FVC) is a wideband data stream sent by the land station to the mobile station. This data stream must be generated at a 10 kilobit/second ±0.1 bit/second rate. Figure 3.7.2-1 depicts the format of the FVC data stream.




DOTTING = 1010....101
W.S. (WORD SYNC) = 11100010010

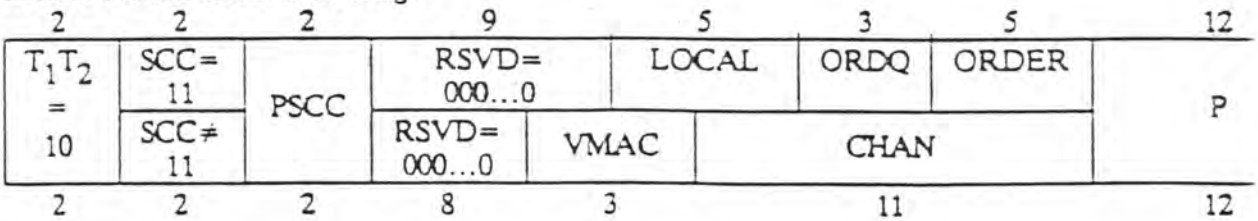
Figure 3.7.2-1. FORWARD VOICE CHANNEL MESSAGE STREAM (Land-to-Mobile)

A 37-bit dotting sequence (1010....101) and an 11-bit word sync sequence (11100010010) are sent to permit mobile stations to achieve synchronization with the incoming data, except at the first repeat of the word, where the 101-bit dotting sequence is used. Each word contains 40 bits, including parity, and is repeated eleven times together with the 37-bit dotting and 11-bit word sync sequences; it is then referred to as a word block. A word is formed by encoding the 28 content bits into a (40, 28) BCH code that has a distance of 5, (40, 28; 5). The left-most bit (i.e., earliest in time) shall be designated the most-significant bit. The 28 most-significant bits of the 40-bit field shall be the content bits. The generator polynomial is the same as that used for the forward control channel (see 3.7.1).

#### 3.7.2.1 MOBILE STATION CONTROL MESSAGE

The mobile station control message is the only message transmitted over the forward voice channel. The mobile station control message consists of one word.

**Mobile Station Control Message**




The interpretation of the data fields is as follows:

$T_1T_2$ — Type field. Set to '10'.

SCC — SAT color code for new channel (see Table 3.7.1-2).

PSCC — Present SAT color code. Indicates the SAT color code associated with the present channel.

ORDER — Order field. Identifies the order type (see Table 3.7.1-1).

ORDQ — Order Qualifier field. Qualifies the order to a specific action (See Table 3.7.1-1).

LOCAL — Local Control field. This field is specific to each system. The ORDER field must be set to local control (see Table 3.7.1-1) for this field to be interpreted.

VMAC — Voice mobile attenuation code field. Indicates the mobile station power level associated with the designated voice channel (see Table 2.1.2-1).

CHAN — Channel number field. Indicates the designated voice channel (see 2.3.3).

RSVD — Reserved for future use; all bits must be set as indicated.

P — Parity field.

## 4. REQUIREMENTS FOR MOBILE STATION OPTIONS

Mobile stations may be equipped with the following optional capabilities:

### 4.1 32-DIGIT DIALING

The following optional changes to **2.6.3.7** and **2.7** permit mobile stations to send up to 32 dialed digits to a land station on the reverse control channel in an origination message, and on the reverse voice channel in a called-address message. (Sections excerpted here have lines of asterisks above and at the bottom of the page.)

**********

### 2.6.3.7 SERVICE REQUEST - REQUIREMENT FOR 32-DIGIT DIALING OPTION

The mobile station must continue to send its message to the land station. The information that must be sent is as follows (with the formats given in **2.7.1**):

- Word A must always be sent.
- If:
  - — $E_s$ = 1, or
  - — $LT_s$ = 1, or
  - — the ROAM status is enabled, or
  - — the ROAM status is disabled and $EX_p$ = 1, or
  - — the access is an "order confirmation", or
  - — the access is a "registration", or
  - — the mobile station was paged with a two-word mobile station control message,

  Word B must be sent.
- If $S_s$ = 1,
  Word C must be sent.
- If the access is an "origination",
  Word D must be sent.
- If the access is an "origination" and 9 to 16 digits were dialed,
  Word E must be sent.
- If the access is an "origination" and 17 to 24 digits were dialed,
  Word F must be sent.
- If the access is an "origination" and 25 to 32 digits were dialed,
  Word G must be sent.

When the mobile station has sent its complete message, it must continue to send unmodulated carrier for a nominal duration of 25 ms and then turn off the transmitter.

The next task to be entered depends on the type of access by the mobile station:

- If the access is an order confirmation, the mobile station must enter the Serving-System Determination Task (see **2.6.3.12**).
- If the access is an origination, the mobile station must enter the Await Message Task (see **2.6.3.8**).
- If the access is a page response, the mobile station must enter the Await Message Task (see **2.6.3.8**).
- If the access is a registration request, the mobile station must enter the Await Registration Confirmation Task (see **2.6.3.9**).

**********

4.1 DIGIT DIALING - Continued

## 2.7 SIGNALING FORMATS - REQUIREMENT FOR 32-DIGIT DIALING OPTION

In the message formats used between the mobile stations and land stations, some bits are marked as reserved (RSVD). Some or all of these reserved bits may be used in the future for additional messages. Therefore, all mobile stations and land stations must set all bits that they are programmed to treat as reserved bits to "0" (zero) in all messages that they transmit. All mobile stations and land stations must ignore the state of all bits that they are programmed to treat as reserved bits in all messages that they receive.

### 2.7.1 REVERSE CONTROL CHANNEL - REQUIREMENT FOR 32-DIGIT DIALING OPTION

The reverse control channel (RECC) is a wideband data stream sent from the mobile station to the land station. This data stream must be generated at a 10 kilobit/second ± 1 bit/second rate. Figure 2.7.1-1 depicts the format of the RECC data stream.

| DOTTING | WORD SYNC | CODED DCC * | FIRST WORD REPEATED 5 TIMES | SECOND WORD REPEATED 5 TIMES | THIRD WORD REPEATED 5 TIMES | ... |
|---|---|---|---|---|---|---|
| 30 | 11 | 7 | 240 | 240 | 240 | |

Seizure Precursor

DOTTING = 1010...010
WORD SYNC = 11100010010

* DIGITAL COLOR CODE - Coded per Table 2.7.1-1.

Figure 2.7.1-1. REVERSE CONTROL CHANNEL MESSAGE STREAM (Mobile-to-Land)

All messages begin with the RECC seizure precursor that is composed of a 30-bit dotting sequence (1010...010), an 11-bit word sync sequence (11100010010), and the coded digital color code (DCC). The 7-bit coded DCC is obtained by translating the received DCC according to Table 2.7.1-1.

Table 2.7.1-1. CODED DIGITAL COLOR CODE

| Received DCC | 7-Bit Coded DCC |
|---|---|
| 00 | 0000000 |
| 01 | 0011111 |
| 10 | 1100011 |
| 11 | 1111100 |

Each word contains 48 bits, including parity, and is repeated five times; it is then referred to as a word block. A word is formed by encoding 36 content bits into a (48, 36) BCH code that has a distance of 5, (48, 36; 5). The left-most bit (i.e., earliest in time) shall be designated the most-significant bit. The 36 most-significant bits of the 48-bit field shall be the content bits. The generator polynomial for the code is the same as for the (40, 28; 5) code used on the forward control channel (see 3.7.1).

4.1 DIGIT DIALING - Continued

2.7.1.1 RECC MESSAGES

Each RECC message can consist of one to seven words. The types of messages to be transmitted over the reverse control channel are:

- Page Response Message
- Origination Message
- Order Confirmation Message
- Order Message

These messages are made up of combinations of the following seven words:

Word A - Abbreviated Address Word

| F = 1 | NAWC | T | S | E | RSVD = 0 | SCM | $MIN1_{23-0}$ | P |
|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 1 | 1 | 1 | 1 | 4 | 24 | 12 |

Word B - Extended Address Word

| F = 0 | NAWC | LOCAL | ORDQ | ORDER | LT | RSVD = 000...0 | $MIN2_{33-24}$ | P |
|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 5 | 3 | 5 | 1 | 8 | 10 | 12 |

Word C - Serial Number Word

| F = 0 | NAWC | SERIAL | P |
|---|---|---|---|
| 1 | 3 | 32 | 12 |

Word D - First Word of the Called-Address

| F = 0 | NAWC | 1st DIGIT | 2nd DIGIT | ... | .... | ... | ... | 7th DIGIT | 8th DIGIT | P |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 12 |

Word E - Second Word of the Called-Address

| F = 0 | NAWC | 9th DIGIT | 10th DIGIT | ... | ... | ... | ... | 15th DIGIT | 16th DIGIT | P |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 12 |

Word F - Third Word of the Called-Address

| F = 0 | NAWC | 17th DIGIT | 18th DIGIT | ... | ... | ... | ... | 23rd DIGIT | 24th DIGIT | P |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 12 |

4.1 DIGIT DIALING - Continued

**********

Word G - Fourth Word of the Called-Address

| F = 0 | NAWC = 000 | 25th DIGIT | 26th DIGIT | ... | ... | ... | ... | 31st DIGIT | 32nd DIGIT | P |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 12 |

*[The rest of 2.7.1.1 up to 2.7.2 contained no changes for the 32-digit dialing option, so it was redundant here and has been deleted.]*

## 2.7.2 REVERSE VOICE CHANNEL - REQUIREMENT FOR 32-DIGIT DIALING OPTION

The reverse voice channel (RVC) is a wideband data stream sent from the mobile station to the land station. This data stream must be generated at a 10 kilobit/second ± 1 bit/second rate. Figure 2.7.2-1 depicts the format of the RVC data stream.

| DOTTING | W.S. | REPEAT 1 OF WORD 1 | DOT. | W.S. | REPEAT 2 OF WORD 1 |
|---|---|---|---|---|---|
| 101 | 11 | 48 | 37 | 11 | 48 |

| DOT. | W.S. | REPEAT 3 OF WORD 1 | DOT. | W.S. | REPEAT 4 OF WORD 1 | DOT. | W.S. | REPEAT 5 OF WORD 1 |
|---|---|---|---|---|---|---|---|---|
| 37 | 11 | 48 | 37 | 11 | 48 | 37 | 11 | 48 |

| DOT. | W.S. | REPEAT 1 OF WORD 2 | ... |
|---|---|---|---|
| 37 | 11 | 48 | |

DOTTING = 1010...01
W.S. (WORD SYNC) = 11100010010

**Figure 2.7.2-1. REVERSE VOICE CHANNEL MESSAGE STREAM (Mobile-to-Land)**

A 37-bit dotting sequence (1010...01) and an 11-bit word sync sequence (11100010010) are sent to permit land stations to achieve synchronization with the incoming data, except at the first repeat of word 1 of the message where a 101-bit dotting sequence is used. Each word contains 48 bits, including parity, and is repeated five times together with the 37-bit dotting and 11-bit word sync sequences; it is then referred to as a word block. For a multi-word message, each additional word block is formed the same as the first word block including the 37-bit dotting and 11-bit word sync sequences. A word is formed by encoding the 36 content bits into a (48, 36) BCH code that has a distance of 5, (48, 36; 5). The left-most bit (i.e., earliest in time) shall be designated the most-significant bit. The 36 most-significant bits of the 48-bit field shall be the content bits. The generator polynomial for the code is the same as for the (40, 28; 5) code used on the forward control channel (see 3.7.1).

**********

4.1 DIGIT DIALING - Continued

2.7.2.1 RVC MESSAGES

Each RVC message can consist of one to four words. The types of messages to be transmitted over the reverse voice channel are:

- Order Confirmation Message
- Called-Address Message

The message formats are as follows:

Order Confirmation Message

| F = 1 | NAWC = 00 | T = 1 | LOCAL | ORDQ | ORDER | RSVD = 000...0 | P |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 1 | 5 | 3 | 5 | 19 | 12 |

Called-Address Message:

Word 1 - First Word of the Called-Address

| F = 1 | NAWC | T = 0 | 1st DIGIT | 2nd DIGIT | ... | ... | ... | ... | 7th DIGIT | 8th DIGIT | P |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 1 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 12 |

Word 2 - Second Word of the Called-Address

| F = 0 | NAWC | T = 0 | 9th DIGIT | 10th DIGIT | ... | ... | .... | ... | 15th DIGIT | 16th DIGIT | P |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 1 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 12 |

Word 3 - Third Word of the Called-Address

| F = 0 | NAWC | T = 0 | 17th DIGIT | 18th DIGIT | ... | ... | ... | ... | 23rd DIGIT | 24th DIGIT | P |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 1 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 12 |

Word 4 - Fourth Word of the Called-Address

| F = 0 | NAWC = 00 | T = 0 | 25th DIGIT | 26th DIGIT | ... | ... | ... | ... | 31st DIGIT | 32nd DIGIT | P |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 1 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 12 |

## 4.1 DIGIT DIALING - Continued

**********

The interpretation of the data fields is as follows:

F — First word indication field. Set to '1' in first word and '0' in second word.

NAWC — Number of additional words coming field.

T — T field. Set to '1' to identify the message as an order confirmation. Set to '0' to identify the message as a called-address.

DIGIT — Digit field (see Table 2.7.1-2).

ORDER — Order field. Identifies the order type (see Table 3.7.1-1).

ORDQ — Order qualifier field. Qualifies the order confirmation to a specific action (See Table 3.7.1-1).

LOCAL — Local Control field. This field is specific to each system. The ORDER field must be set to local control (see Table 3.7.1-1) for this field to be interpreted.

RSVD — Reserved for future use; all bits must be set as indicated.

P — Parity field.

**********

## 4.2 MOBILE STATION EXTENDED PROTOCOL (See also 5.2)

### 4.2.1 PURPOSE

The following optional additions to Section 2 provide the structure and signaling procedures to allow new messages and data to be sent to or transmitted by mobile stations. The term "mobile stations" is used in the generic sense as indicated in Note 2 and includes transportable, handheld and fixed station units as well as mobiles mounted in vehicles.

The purpose of this option is to extend the signaling capabilities of the Land Station/Mobile Station interface to allow new features and operational capabilities to be added to existing and future cellular systems.

The Extended Protocol structure and signaling have been designed to allow all four of the following combinations of systems and mobile stations to be simultaneously operational:

1. Old systems operating with old mobile stations;
2. Old systems operating with new mobile stations;
3. New systems operating with old mobile stations;
4. New systems operating with new mobile stations;

where "old" means a version that does not include this optional capability, and "new" means a version that does.

### 4.2.2 SECTION 2 NEW PARAGRAPHS

**********

### 2.7.1.2 RECC EXTENDED PROTOCOL MESSAGES

Each Extended Protocol message starts with a message header. In all cases, the message headers contain among other information:

- Message Length (MSL) indicator;
- Message Type (MST) indicator; and
- Extended Protocol (ER) indicator.

In the RECC, each message header always consists of two words.

**Header Word A**

| F1 | RSVD | T | S | E | ER | SCM | MIN 1 | P | – field designer |
|---|---|---|---|---|---|---|---|---|---|
| 11 | 00 | 1 | 0 | 1 | X | X..X | X..X | X..X | – Bit assignment |
| 2 | 2 | 1 | 1 | 1 | 1 | 4 | 24 | 12 | – number of bits/field |

**Header Word B**

| F2 | RSVD | MSL | MST | LT | EP | RSVD | MIN 2 | P |
|---|---|---|---|---|---|---|---|---|
| 10 | 00 | X..X | X..X | X | 1 | 0..0 | X..X | X..X |
| 2 | 2 | 5 | 8 | 1 | 1 | 7 | 10 | 12 |

The interpretation of the data fields is as follows:

**********

## 4.2 MOBILE STATION EXTENDED PROTOCOL - Continued

F1 = Start of Header, first word (new);
RSVD = Reserved (new bit assignments);
T = message class, i.e., order or response (unchanged);
S = serial number (not used);
E = extended address (Word B to be sent) (unchanged);
ER = Extended Protocol (Reverse Channel) (new);
SCM = Station Class Mark (unchanged);
MIN1 = subscriber coded director number (7 digits) (unchanged);
P = cyclic redundancy code (unchanged);
F2 = Second word of header (new);
MSL = Message Length (former LOCAL field) (new);
MST = Message Type (former ORDQ and ORDER fields) (new);
MIN2 = 3 most significant digits of subscriber directory number (unchanged);
LT = Last Try (unchanged);
EP = Extended Protocol Capability indicator (new); and
X..X = variable bit field depending on the message.

The following are expanded definitions of the new fields.

MSL - The Message Length (MSL) field makes use of the former 5 bit LOCAL field to allow up to 31 Message Data Words to be appended to a message header to form a complete message. An all zero MSL field (MSL = 00000) means that there are no Message Data Words appended. The header words are not included in the message length count.

MST - The Message Type (MST) field defines the type of message and, by implication, the form and format of any appended Message Data Words. (See Note 11)

EP - The Extended Protocol (EP) bit is used to indicate to the system that the mobile station is capable of using the Extended Protocol.

ER - The Extended Protocol Reverse Channel (ER) bit is used to indicate that the current message is in the Extended Protocol. If the ER bit is a "zero" (0), the message format of 2.7.1.1 above, is being used. If the ER bit is a "one" (1), the Extended Protocol message format is being used.

The generic formats of Message Data Words used are as follows:

**Message Data Word 1 to N-1**

| F3 | Message Data | P |
|---|---|---|
| 01 | X..X | X..X |
| 2 | 34 | 12 |

## 4.2 MOBILE STATION EXTENDED PROTOCOL - Continued

**********

Message Data Word N

| F4 | Message Data | P |
|---|---|---|
| 00 | X..X | X..X |
| 2 | 34 | 12 |

The F1, F2, F3 and F4 fields are used as follows:

F1 = 11 = the first header word, Header Word A
F2 = 10 = the second header word, Header Word B
F3 = 01 = the 1st to N-1 Message Data Word
F4 = 00 = the last (Nth) Message Data Word

### 2.7.2.2 RVC EXTENDED PROTOCOL MESSAGES

In the RVC, each message header consists of one word whose format is shown below.

RVC Header Word

| F1 | RSVD | T | MSL | MST | ER | EP | RSVD | P |
|---|---|---|---|---|---|---|---|---|
| 11 | 0 | X | X..X | X..X | X | 1 | 0..0 | X..X |
| 2 | 1 | 1 | 5 | 8 | 1 | 1 | 17 | 12 |

The interpretation of the fields is as follows:

F1 = Start of header (Header Word) (new);
T = message class, i.e., order or response (unchanged);
MSL = Message Length indicator (new);
MST = Message Type indicator (new);
ER = Extended Protocol Reverse Channel indicator (new);
EP = Extended Protocol Capability indicator (new);
P = cyclic redundancy code (unchanged); and
RSVD = reserved field (unchanged).

When ER is set to "zero" (0), the message format and field definitions are as defined in 2.7.2.1 above. When ER is set to a "one" (1), the message format and field definitions are as shown for the Extended Protocol RVC Header Word.

Message Data Words that are appended to RVC Header Word are formatted in accordance with the generic formats shown in 2.7.1.1, above.

**********

# 5. REQUIREMENTS FOR LAND STATION OPTIONS

Land stations may be equipped with the following optional capabilities:

## 5.1 32-DIGIT DIALING

No changes to 3 are required to permit mobile stations to send up to 32 dialed digits to a land station on the reverse control channel in an origination message, and on the reverse voice channel in a called-address message.

Note: Land stations that do not have 32-digit dialing capability must not malfunction if a mobile station sends a called-address message that includes three or four called-address words. X

## 5.2 LAND STATION EXTENDED PROTOCOL (See also 4.2) X

### 5.2.1 PURPOSE X

Refer to 4.2.1. X

### 5.2.2 SECTION 3 NEW PARAGRAPHS X

********** X

**3.7.1.1.1 Extended Protocol Mobile Station Control Message** X

Each message header always consists of two words as follows: X

**Word 1** X

X

| T1 T2 | DCC | MIN 1 | P | |
|---|---|---|---|---|
| 01 | XX | X..X | X..X | – Bit assignment |
| 2 | 2 | 24 | 12 | – number of bits/field |

– field designer X
X
X
X

**Word 2** X

X

| T1 T2 | SCC | MIN 2 | EF | MSL | MST | P |
|---|---|---|---|---|---|---|
| 10 | 11 | X..X | X | X..X | X..X | X..X |
| 2 | 2 | 10 | 1 | 5 | 8 | 12 |

X
X
X
X

The interpretation of the fields is as follows: X

T1T2 = Type field (bit assignment unchanged); X
DCC = Digital Color Code (unchanged); X
MIN1 = subscriber coded directory number (7 digits) (unchanged); X
P = cyclic redundancy code (unchanged); X
SCC = SAT Color Code = 11 = not a channel designation message (unchanged); X
MIN2 = 3 most significant digits of subscriber directory number (unchanged); X
EF = Extended Protocol (Forward Channel) indicator (new); X
MSL = Message Length (former LOCAL) (new); X
MST = Message Type (former ORDQ and ORDER (new); and X
X..X = variable bit field depending on message. X

**********

## 5.2 LAND STATION EXTENDED PROTOCOL - Continued

The generic format of Message Data Words on the FOCC are as follows:

**Message Data Word 1 to N-1**

| T1 T2 | DCC | Message Data | P |
|---|---|---|---|
| 01 | XX | X..X | X..X |
| 2 | 2 | 24 | 12 |

**Message Data Word N**

| T1 T2 | DCC | Message Data | P |
|---|---|---|---|
| 00 | XX | X..X | X..X |
| 2 | 2 | 24 | 12 |

### 3.7.1.2.5 EXTENDED PROTOCOL OVERHEAD MESSAGE

One of the formerly reserved (RSVD) bits in Word 1 of the SYSTEM PARAMETER overhead message is used to indicate to mobile stations that the cellular system is equipped to use the Extended Protocol.

**Word 1**

| T1 T2 | DCC | SID 1 | EP | RSVD | NAWC | OHD | P |
|---|---|---|---|---|---|---|---|
| 11 | XX | X..X | 1 | 00 | X..X | 110 | X..X |
| 2 | 2 | 14 | 1 | 2 | 4 | 3 | 12 |

All other words of the System Overhead Parameter Message are as defined in 3.7.1.2.1 through 3.7.1.2.4, above.

### 3.7.2.2 FVC EXTENDED PROTOCOL MESSAGE

In the FVC each message header consists of one word whose format is shown below.

**Word 1 (Control Message)**

| T1 T2 | SCC | PSCC | EF | RSVD | MSL | MST | P |
|---|---|---|---|---|---|---|---|
| 10 | 11 | XX | X | 0..0 | X..X | X..X | X..X |
| 2 | 2 | 2 | 1 | 8 | 5 | 8 | 12 |

## 5.2 LAND STATION EXTENDED PROTOCOL - Continued

The interpretation of the data fields is as follows:

T1T2 = Type field (bit assignment unchanged);
SCC = Digital Color Code = 11 = not a channel designation message (unchanged);
PSCC = Present SAT Color Code (unchanged);
EF = Extended Protocol Forward Channel indicator (new);
MSL = Message Length indicator (new);
MST = Message Type indicator (new); and
P = cyclic redundance code (unchanged).

The generic format of Message Data Words used in the FVC are as follows:

**Message Data Word 1 to N-1**

| T1 T2 | Message Data | P |
|---|---|---|
| 01 | X..X | X..X |
| 2 | 26 | 12 |

**Message Data Word N**

| T1 T2 | Message Data | P |
|---|---|---|
| 00 | X..X | X..X |
| 2 | 26 | 12 |

# 6. CHANGE HISTORY

## 6.1 CHRONOLOGY OF REVISIONS FOR IS-3-B

| ADOPTED | SECTION | CHANGE |
|---|---|---|
| 3/7/84 | 4, 5, 6 | Added option and history sections. |
| 3/7/84 | 4.1, 5.1 | Added requirement for 32-digit dialing option. |
| 5/16/84 | PREFACE | Added description of each section. |
| 5/16/84 | NOTES | Added Notes 7 and 8. |
| 5/16/84 | 2.7, 3.7 | Added text of Note 8 to these sections. |
| 5/16/84 | 3.7.1.2 | Added clarifying statement that the system parameter overhead message must be sent on all dedicated control channels. |

## 6.2 CHRONOLOGY OF REVISIONS FOR IS-3-C

| ADOPTED | SECTION | CHANGE |
|---|---|---|
| 8/28/85 | 1.1 | Added general statement of tolerances on time and timing. |
| 8/28/85 | 1, 2.3.3, 2.3.11, 2.6.4.2, 2.6.4.3.1, 2.6.4.3.2, 2.6.4.4, 2.6.4.5, 3.6.2.1, 3.7.1.2.1 | Made changes and additions to define DTX operation and DTX operational requirements. |
| 8/28/85 | 2.3.2 | Added Serial Number (SN) bit assignment requirements. |
| 8/28/85 | 2.3.8 | Added System Identification (SID) bit assignment requirements. |
| 8/28/85 | 2.4.1.2 | Changed to relax SAT phase requirements. |
| 8/28/85 | 2.6.3.7, 2.7 | Added references to section headings for options. |
| 8/28/85 | 2.7.1.1, 2.7.2.1, 3.7.2.1 | Added section headings for clarification. |
| 8/28/85 | 3.6.2.4 | Updated second paragraph. |
| 8/28/85 | 3.6.3.2 | Changed to correct the Busy/Idle bit operation and allow mobile station to land station messages of more than five words. |
| 8/28/85 | 3.6.4.3.2 | Changed to make an Alert Timer optional. |
| 8/28/85 | 3.7.1.2.2 | Added recommended use of the Overload Class field bits. |
| 8/28/85 | 3.7.1.3 | Changed to clarify the troublesome office code problem and to correct office code table. |
| 8/28/85 | 4.1 | Added text of Note 8 and deleted redundant material from excerpted 2.7.1.1. |
| 8/28/85 | 4.2, 5.2 | Added sections for Extended Protocol. |
| 8/28/85 | 6.2 | Listed revisions for IS-3-C. |

## 6.3 CHRONOLOGY OF REVISIONS FOR IS-3-D

| ADOPTED | SECTION | CHANGE |
|---|---|---|
| 10/30/86 | 1 | Changed $SID_{REG}$ to $SIDREG_{REG}$ under Numeric Information. |
| 10/30/86 | 2.3.4 | Reduced memory requirement to a single registration. |
| 10/30/86 | 2.3.8 | Deleted reserved notations and assigned '01' to "Other countries". |
| 10/30/86 | 2.6.1.2.2 | Corrected "equal" sign to "not equal". |
| 10/30/86 | 2.6.2.1 | Reduced memory requirement to a single registration. |
| 10/30/86 | 2.6.3.11 | Reduced memory requirement to a single registration. |
| 10/30/86 | 3.7.1.2.2 | Corrected section number. |
| 1/28/87 | NOTES | Deleted all of Note 7 except first sentence. Updated Note 9 for IS-3-D. |
| 1/28/87 | 2.1.1.1 | Added extended spectrum requirements and Table 2.1.1.1-1. |
| 1/28/87 | 2.2.1.1 | Added extended spectrum requirements. |
| 1/28/87 | 2.3.2 | Deleted FCC serial number notice. |
| 1/28/87 | 2.3.3 | Revised SCM requirements for extended spectrum. |
| 1/28/87 | 3.1.1.1 | Added extended spectrum requirements. |
| 1/28/87 | 3.2.1.1 | Added extended spectrum requirements. |
| 1/28/87 | 3.7.1.1 | Added reference to 2.3.3 for CHAN. |
| 1/28/87 | 3.7.2.1 | Added reference to 2.3.3 for CHAN. |
| 1/28/87 | 6.3 | Listed revisions for IS-3-D. |

## 6.4 CHRONOLOGY OF REVISIONS FROM IS-3-D TO EIA-553

| ADOPTED | SECTION | CHANGE |
|---|---|---|
| 2/2/88 | PREFACE | Changed to clarify experiences with commercial systems. |
| 2/2/88 | NOTES | Updated Note 9 for EIA-553. Added Note 11. |
| 2/2/88 | 1 | Added Extended Protocol definition. Changed $SIDREG_{s-p}$ to $SID_{s-p}$ under Numeric Information. |
| 2/2/88 | 2 | Added reference to 4. |
| 2/2/88 | 2.1.4.1 | Added reference to measurement technique. |
| 2/2/88 | 2.6.2.1 | Corrected $NXTREG_{s-r}$ to $NXTREG_{s-p}$ under Registration ID Message. |
| 2/2/88 | 2.6.3.7 | Deleted reference to 4.1. |
| 2/2/88 | 2.6.3.11 | Revised first paragraph and first bullet item. |
| 2/2/88 | 2.7 | Deleted reference to 4.1. |
| 2/2/88 | 2.7.11 | Deleted reference to 4.1. |
| 2/2/88 | 3 | Added reference to 5. |
| 2/2/88 | 3.1.4.1 | Added reference to measurement technique. |
| 2/2/88 | 3.7.1.3 | Corrected office code 609 to be 509. |
| 2/2/88 | 4.2 | Added requirements for Extended Protocol signaling and message structure option. |
| 2/2/88 | 5.2 | Added requirements for Extended Protocol signaling and message structure option. |
| 2/2/88 | 6.4 | Listed revisions for EIA-553. |
| 10/21/88 | NOTES | Added Notes 12 and 13. |
| 3/28/89 | NOTES | Added Note 14. |
| 3/28/89 | 2.6.3.4 | Improved rescan procedure. |