*3GPP2 C.S0017-003-A*

*Version 1.0*

*Date: November 2009*

3RD GENERATION PARTNERSHIP PROJECT 2 "3GPP2"

# *Data Service Options for Spread Spectrum Systems: AT Command Processing and the $R_m$ Interface*

**CONTENTS**

**CONTENTS**

**CONTENTS**

**CONTENTS**



**FIGURES**

**TABLES**

This page left intentionally blank.

# 1 INTRODUCTION AND OVERVIEW

## 1.1 General Description

This chapter of IS-707 provides requirements for the $R_m$ Interface, Service Selection methods, and AT Command processing required and optional for mobile stations and BS/MSCs.

## 1.2 Terms

**AT Command Set.** Command set interface between data terminal equipment (DTE) and data circuit terminating equipment (DCE).

**Base Station.** A station in the Domestic Public Cellular Radio Telecommunications Service, other than a mobile station, used for communicating with mobile stations. Depending upon the context, the term base station may refer to a cell, a sector within a cell, an MSC, an IWF, or other part of the cellular system.

**BS.** See base station.

**Data Circuit-Terminating Equipment (DCE).** A DCE connects a TE2 to the PSTN. A typical DCE would be a V-series modem. For Group-3 Fax Service, the DCE and its associated TE2 are often combined into a single Group-3 fax machine.

**Digital Facsimile.** That form of facsimile in which densities of the original are sampled and quantified as a digital signal for processing, transmission, or storage.

**Error Correction Mode (ECM).** A mode of operation for T.30 fax service providing end-to-end reliable data transport.

**Facsimile.** The process by which a document is scanned, converted into the electrical signals, transmitted, and recorded or displayed as a copy of the original.

**Fax.** An abbreviation for facsimile.

**Group-3.** Digital Facsimile equipment per CCITT Recommendation T.4.

**Interworking Function (IWF).** An IWF provides the functions needed for terminal equipment connected to a mobile termination to inter-work with terminal equipment connected to the PSTN. A physical implementation may include a pool of modems.

**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. Mobile stations include portable units (e.g., hand-held personal units) and units installed in vehicles.

**Mobile Termination 2 (MT2).** An MT2 provides a non-ISDN ($R_m$) user interface, e.g., CCITT V series or CCITT X series.

**Terminal Equipment 2 (TE2).** A TE2 is a data terminal device that has a non-ISDN user-network interface, e.g., CCITT V series or CCITT X series.

## 1.3 References

| | |
|---|---|
| **ANSI X3.4-1986** | Coded Character Set – 7-Bit American National Standard Code for Information Interchange, 1992. |
| **EIA/TIA-232-F** | *Interface Between DTE and DCE Employing Serial Binary Data Interchange.* |
| **EIA/TIA-592** | *Asynchronous Facsimile DCE control Standard - Service Class 2.0.* |
| **EIA/TIA-602** | *Serial Asynchronous Automatic Dialing and Control.* |
| **EIA/TIA-605** | *Facsimile DCE-DTE Packet Protocol Standard.* |
| **EIA/TIA-615** | *Extensions to Serial Asynchronous Automatic Dialing and Control.* |
| **T.4** | Compression/decompression standard for facsimile applications. |
| **T.30** | Facsimile protocol standard. |
| **ANSI/TIA/EIA-617** | *Inband DCE Control for Asynchronous DTE–DCE Interfaces.* |
| **TIA/EIA/IS-131** | *Data Transmission Systems and Equipment – Extensions to Serial Asynchronous Dialing and Control.* |
| **TIA/EIA/IS-134** | Amendments to TIA-592 to Support T.30-1993. |

# 2 REQUIREMENTS FOR THE $R_m$ INTERFACE

## 2.1 Physical Layer

The MT2 shall support the circuits of EIA/TIA-232-F over the $R_m$ reference point as described herein. The MT2 may also support other physical layer interfaces over the $R_m$ reference point. The MT2 should provide functionality equivalent to that defined by 2.1.1 for alternative physical layer interfaces.

### 2.1.1 Electrical

The MT2 shall support the EIA/TIA-232-F circuits for each service as listed in Table 2.1.1-1. For the async data or fax service, the MT2 should support EIA/TIA-232-F circuit 125 (Calling Indicator).

Note: for the purpose of these circuits, TE2 is equivalent to Data Terminal Equipment (DTE) as defined in EIA/TIA-232-E; similarly, MT2 is equivalent to Data Circuit-Terminating Equipment (DCE).

**Table 2.1.1-1. EIA/TIA-232-F Circuits**

| Ckt | Name | Description | Async & Fax | Packet Data | STU III |
|---|---|---|---|---|---|
| 102 | AB | Signal Common<br>Common ground reference for all circuits. | R | R | R |
| 103 | BA | Transmitted Data<br>Used to transfer data from the TE2 to the MT2. | R | R | R |
| 104 | BB | Received Data<br>Used to transfer data from the MT2 to the TE2. | R | R | R |
| 106 | CB | Clear to Send<br>Used by the MT2 to signal that the TE2 may transmit data. | R | O | R |
| 107 | CC | DCE Ready<br>Used by the MT2 to signal that it is ready to send or receive data. | O | O | R |
| 108/2 | CD | DTE Ready<br>Used by the TE2 to signal that it is ready to send or receive data. | R | O | R |
| 109 | CF | Received Line Signal Detector<br>Used by the MT2 to indicate capability to transmit and receive data. | R | O | O |

| | | | | | |
|---|---|---|---|---|---|
| 125 | CE | Ring Indicator<br>Used by the MT2 to signal alerting. | O | O | R |
| 133 | CJ | Ready for Receiving<br>Used by the TE2 to signal that it is ready to receive data from the MT2. | R | O | O |
| 135 | CK | Received Energy Present Indicator<br>Indicates presence of energy on the line. This information should be refreshed 5 times per second. | O | O | O |
| Note: Required signals are marked “R” while optional signals are marked “O” for each data service. | | | | | |

### 2.1.2 Mechanical

The MT2 may support interface connectors other than those specified in Section 3 of EIA/TIA-232-E.

An MT2 shall support the AT command set defined in EIA/TIA-602, with the modifications specified in this document. The mobile station may support extensions to EIA/TIA-602 directly or by means of the AT+CXT and AT+CFG commands.

## 2.2 Data Service Selection

The AT+CRM parameter is used for all CDMA data services to select the service to be supported on the $R_m$ interface. All CDMA mobile stations supporting AT command processing on the $R_m$ interface shall support appropriate values of the +CRM command in accordance with Table 7.4.1-1.

### 2.2.1 Service Selection for Async Data and Fax Services

The MT2 shall use the +CRM command to select async data or fax services, in accordance with Table 7.4.1-1.

To select facsimile service, the MT2 shall use the +FCLASS command with a value consistent with facsimile service, in accordance with Table 7.3.1-1.

### 2.2.2 Service Selection for Packet Data Services

#### 2.2.2.1 Control Functions

The MT2 should provide a means for the user to control the features of the packet data service, including selecting the packet data service option. The control method may be provided either through a user interface on the MT2 or by means of a control protocol on the $R_m$ interface, such as an AT command protocol (see 5.). If no means for user control is provided, the default packet data service features shall be determined by the manufacturer.

If packet data service is selected and the mobile station's service configuration permits connecting a packet data service option, the mobile station shall attempt to connect a

packet data service option when it is requested. If packet data service is not selected, the mobile station shall not attempt to connect packet data service options.

#### 2.2.2.2 $R_m$ Interface Protocol Options

The MT2 may provide a means for the user to select the $R_m$ interface protocol option. The control method may be provided either through a user interface on the MT2 or by means of a control protocol on the $R_m$ interface, such as the AT+CRM command described in Table 7.4.1-1.

### 2.2.3 Service Selection for STU-III Service

MT2s shall use the AT+CRM command in accordance with Table 7.4.1-1 to select STU-III service. State transitions of the STU-III service control function (see Section 2.4 of IS-707.6) are shown in Figure 2.4.2.-1 of IS-707.6. If no means for user control is provided, and if STU-III service is supported, the STU-III service shall be selected at all times. Service selection methods for MT0s are left to the manufacturer.

The MT2 may provide a means for the user to control the features of the STU-III service. The control method may be provided either through a user interface on the MT2 or by means of AT commands on the $R_m$ interface.

If a means for user control is provided, the following features should be controllable:

- Multiplex Option. The AT+CMUX command can be used to set the multiplex option to be proposed during the service negotiation procedures for connecting a STU-III secure service option. See Section 2.2.2.2 of IS-707.6 for the requirements that relate the STU-III service data rates (2.4, 4.8 and 9.6 kbps) to the choice of multplex option.
- Audio Pass Through. The AT+CAU command shall enable (or disable) the passing of analog audio signals to the TE2.
- Service control. AT Commands used to provide STU-III service control in the MT2 are described in 6. The state transitions of the STU-III Service Control Function in response to these AT commands are shown in Figure 2.4.2-1 of IS-707.6.

# 3 GENERAL REQUIREMENTS FOR AT COMMAND PROCESSING

AT commands and result codes sent on the $R_m$ interface shall be transmitted as ASCII characters, as defined in ANSI X3.4.

This page left intentionally blank.

# 4 AT COMMAND PROCESSING FOR ASYNC DATA AND FAX SERVICES

## 4.1 General Requirements

The MT2 and the IWF emulate the functionality of a landline modem. Since the actual modems reside in the IWF, and the IWF does not store modem configuration information for all potential mobile users, each MT2 stores the desired configuration of the modem and transfers the configuration information to the IWF after call initiation. Upon establishment of the transport layer, the stored modem configuration is uploaded to the IWF which then implements the functionality of a regular landline modem. Since command and result timing may not be preserved on the $U_m$ interface, the MT2 also processes time–dependent aspects of AT commands, such as result codes and time-dependent returns to online command state.

This section describes how the mobile station and the IWF process AT commands. The AT commands can be generated by the TE2 when the mobile station is an MT2 or by an application when the mobile station is an MT0. Requirements for AT command processing in this section are written with the TE2/MT2 reference model point of view. AT commands may be concatenated on a single command line as described in 5.6 of EIA/TIA-615. All requirements stated for the $R_m$ interface should also be followed by the application interface (see 2.2 of IS-707.4) in an MT0.

MT2 AT application interface has two states: command state and online state. The MT2 is in command state when the transport layer is not in the ESTABLISHED state. When in command state the MT2 processes AT commands received on the $R_m$ interface. When the MT2 is in the online state, the MT2 passes all data received on the $R_m$ interface directly to the IWF, and does not process AT commands received on the $R_m$ interface. When the transport layer is in the ESTABLISHED state the IWF reflects all AT commands (following reception of the +CFG command) back over the $U_m$ interface to the mobile station, and the mobile station can process the reflected AT commands.

The IWF application interface has command, online, and online command states, as defined in TIA/EIA-602. When in the command state or the online command state, the IWF may receive AT commands that are not implemented by the IWF. The handling of such unimplemented commands is described below.

AT commands are classified as recognized or unrecognized. An AT command is considered recognized if it is defined for async data or G3 fax in this standard and complies with all requirements of the service in this standard. An unrecognized AT command is an AT command conforming with the syntax requirements of EIA/TIA-615 that is not defined for this service, or has a parameter value not mandated by this standard. In some special cases this standard requires that AT commands defined herein be processed in the same manner as an unrecognized command.

Recognized AT commands are classified as local commands if they are processed only in the mobile station. Recognized AT commands are classified as remote commands if they are also processed by the IWF (see 4.2–4.3). Remote commands are processed only by the MT2 when the MT2 is in command state. When the MT2 is in online state, remote

commands are reflected to the MT2 on the $U_m$ interface and are processed by the MT2 as well as by the IWF.

When an AT command line is issued, the entity processing it issues a Command Response. A Command Response may consist of zero or more lines of Information Text, followed by a Result Code.

The mobile station and the IWF shall observe the following rules when processing AT commands:

1. When the MT2 is in the command state, the MT2 shall process valid AT parameter commands as follows:
   - Store the parameter provided in a SET command (see EIA/TIA-615), both for local and remote commands,
   - return the parameter stored in its memory as the response to a READ command (see EIA/TIA-615), both for local and remote commands,
   - return the supported value range as the response to a TEST command (see EIA/TIA-615) for local commands, and
   - process the TEST command for a remote command as an unrecognized command (see 4.5.1).
   - The MT2 should not store fax parameters (see 4.3) if FCLASS is not set to a value consistent with facsimile service.
2. When the MT2 is in the command state, the MT2 shall send the appropriate response on the $R_m$ interface only in response to AT commands received on the $R_m$ interface which do not cause the MT2 to change into the online state.
3. If the MT2 receives a SET parameter command (see EIA/TIA/615) for a remote command over the $R_m$ interface while the MT2 is in command state, and the parameter value is not in the range mandated by this service, the MT2 shall process the command as an unrecognized command (see 4.5.1).
4. When the MT2 is in the command state, and a command line received on the $R_m$ interface contains any unrecognized command, the MT2 shall process the entire command line as an unrecognized command. The MT2 shall process unrecognized AT commands in accordance with the setting of the AT+CXT parameter (see 4.5.1). If the transport layer is established due to reception of an unrecognized command, the MT2 shall forward the entire command line to the IWF following the initialization string.
5. When the transport layer enters the ESTABLISHED state, the mobile station and IWF shall perform the following:
   - When the transport layer enters the ESTABLISHED state, the IWF shall reset its configuration to the default settings.
   - The MT2 shall transmit the values of remote parameters to the IWF immediately following the establishment of the transport layer connection, prior to the

transmission of an ATD, ATA, or an unrecognized command (see 4.3.2 and 4.5.1).

- The MT2 shall use the AT commands defined herein to deliver this configuration to the IWF. These AT commands may be sent on multiple command lines, each of which contains one or more commands.
- The MT2 should omit parameters whose values are set to the default value and should omit the fax parameters (see 4.3) if FCLASS is not set to a value consistent with facsimile service.
- The MT2 shall send the configuration string parameter, even if it is a null string, as set by the AT+CFG command (see 4.5.2), as the last parameter in the initialization. The MT2 shall use the AT+CFG SET parameter command to deliver the configuration string parameter to the base station.[1] The command line containing the AT+CFG command shall be terminated (i.e., no further AT commands can follow the AT+CFG command in the same command line).
- Regardless of the setting of the ATE parameter, for mobile-originated data calls (see 4.1.1 of IS-707.4) the IWF shall not echo the characters of the first AT command line received following the AT+CFG command.[2]
- If extended cellular responses are enabled, the IWF should return a single extended cellular response CERROR: INIT FAILED (see Table 7.4.2-1) with the first offending AT command if it encounters errors processing the AT commands forming part of this configuration. If extended cellular responses are disabled, the IWF should return a single ERROR result code if it encounters errors processing the AT commands forming part of this configuration. The IWF should not return OK result codes for AT commands forming part of this configuration.

6. When the MT2 is in the online state, the MT2 shall forward all characters received on the $R_m$ interface to the IWF except for local flow control characters and local data stream transparent commands as specified in 4.3.4. The only processing the MT2 should perform when forwarding characters is guard time detection pertaining to a request to return to command state (see 4.2.4).
7. When the MT2 is in the online state, the MT2 shall send the appropriate response on the $U_m$ interface in response to all AT commands received on the $U_m$ interface (see 4.4.3).
8. When the IWF application interface is in the command state or the online command state, the IWF shall process all AT commands, and shall reflect all commands following the +CFG command back to the MT2 using the method of 4.4.

---

[1]The configuration string is sent in the AT+CFG command, rather than as separate AT commands, because the AT+CFG command serves to indicate the end of the initialization string.

[2]These characters will already have been echoed by the MT2 while the MT2 was in the command state.

9. The IWF shall respond to all received commands following the +CFG command with the appropriate response, via the $U_m$ interface. The MT2 shall send on the $R_m$ interface all received responses observing the timing requirements in EIA/TIA-602. The IWF shall determine the response as follows:

   - If the command is a local command or is unrecognized by the IWF, the response shall be the result code returned by the MT2 if the command was reflected to the MT2.
   - In all other cases, the IWF shall return the response from the IWF processing of the command.[3]

10. When the IWF receives a command line containing more than one command, it shall process the individual commands in the order they appear on the command line. The IWF shall process each command in sequence, in accordance with rules 8 and 9, waiting for the response from the MT2 for each reflected command. The IWF shall send to the MT2 only a single response for the entire command line. Should processing of a command result in an error, processing shall be terminated, the remainder of the command line shall be ignored, and the ERROR result code shall be issued.

## 4.2 Basic AT Command Processing

### 4.2.1 Parameters

The MT2 and the IWF shall support the parameters specified in Table 7.1.1-1.

The command &C1 requires the MT2 to assert CF when carrier is reported (see 4.2.6) by the modem in the IWF.

The command &D1 requires the MT2 to signal the IWF to transition the modem to online command state on the ON-to-OFF transition of circuit 108/2 (CD) using the mechanism described in 4.4.2.1. The MT2 should remain in the online state.

The command &D2 requires the MT2 to disconnect following the ON to OFF transition of circuit 108/2. The MT2 should enter the command state.

When the MT2 receives an ATZ (or ATZ0), on either the $R_m$ or $U_m$ interface, the stored configuration in the MT2 shall revert to the configuration specified by the default values given in this specification and the MT2 shall close the transport layer connection, if open, when the ATZ command is received.

The MT2 may store multiple configurations which may be recalled by the ATZn command and forwarded to the IWF at call setup time, using the procedure specified above.

When the MT2 receives an AT&F (or AT&Fn), on either the $R_m$ or $U_m$ interface, the stored configuration in the MT2 shall revert to the configuration specified by the manufacturer's

[3]It should be noted that the requirements of this standard do not guarantee that the mobile station and IWF process all commands in the same manner.

factory default setting. The MT2 shall close the transport layer connection, if open, when the AT&F command is received.

### 4.2.2 S-Registers

The IWF may support the S-registers categorized as “Remote” in Table 7.1.2-1.

The MT2 shall store the set of S-registers in accordance with Table 7.1.2-1 as part of the stored configuration. For the purposes of this specification, S-registers are treated as parameters (see EIA/TIA-615).

The MT2 shall permit the TE2 to modify the stored S-register values using the ATSnn= SET command and read the stored S-register values using the ATSnn? READ command.

The mobile station shall use standard EIA/TIA-602 commands when transferring S-register contents to the IWF.

The use of register S0 is described in section 4 of IS-707.4.

The READ and SET operations for register S6 shall be supported. Support of the TEST operation for register S6 is optional. IWF support of the pause before blind dial feature is optional.

Register S7 is used by the IWF in accordance with EIA/TIA-602 to time-out a PSTN data call connection and send a NO CARRRIER result code on the $U_m$ interface.

Register S8 is used by the IWF in multistage dialing to time the period of the “,” dial modifier.

The IWF should support register S9. Register S9 is used by the IWF as the period to detect a PSTN segment carrier and return carrier detection signaling to the MT2. Register S9 is an extension to EIA/TIA-602.

Register S10 is used by the IWF in accordance with EIA/TIA-602 to determine the maximum time to remain connected to the PSTN line after detecting the absence of received line signal. If register S10 is set to 255, the IWF assumes a carrier is always present.

Support of register S11 is optional.

### 4.2.3 Action Commands

The MT2 and IWF shall support the action commands defined by EIA/TIA-602, and shown in Table 7.1.3-1.

When the MT2 is in the command state, the mobile station shall process the A/ command. Otherwise, the IWF shall process the A/ command. The IWF shall process the repeated command line as if received on the $U_m$ interface, including the reflection and result code processing described in 4.1. The IWF shall not return any part of the initialization string (see 4.1) in response to an A/ command.

### 4.2.4 Call-Control Command Processing

AT call control commands are described in Table 7.1.3-1.

Upon receiving an ATD or ATA on the $R_m$ interface, the MT2 shall perform the processing required in 4.1.1 of IS-707.4. . However, if an ATD without a dial string is received and a service option has been connected, the MT2 should initiate service negotiation procedures as indicated in 4.1.3 of IS-707-A.4. Upon receiving this ATD command, the IWF shall generate and send T.30 CNG tone if the initial call was mobile originated and an AT+FCLASS2.0 has been received. After sending an ATD with a dial string or ATA command to the IWF, the MT2 shall enter the online stateThe MT2 shall remain in the online state while the transport layer connection is in the ESTABLISHED state. While in the online state, the MT2 shall forward all characters received on the $R_m$ interface to the IWF, except as specified elsewhere.[4]

When the MT2 is in the online state, the MT2 shall support at least one method of detecting a TE2 request to change the IWF to online command state. The MT2 should detect a request to change to online command state, such as receiving "+++" with the appropriate guard times.[5] When the MT2 detects a request to change to online command state, it shall signal the IWF to change to online command state using the Cellular Escape command (see Table 4.4.3-2).

When the IWF receives an ATH command, it shall return the result code and shall then close the transport layer, following the procedures of 4.2 of IS-707.4. Closing the transport layer shall place the MT2 in command state.[6] If the MT2 receives an ATH command while in command state, it shall issue the OK result code on the $R_m$ interface.

### 4.2.5 Dial Modifiers

If the "," modifier appears in the dial string, the MT2 shall forward the "," modifier to the IWF. The IWF should use the value of register S8 as the delay time between the previous and subsequent digit dialing.

If the "W" modifier appears in the dial string, the MT2 shall forward the "W" modifier to the IWF. If the IWF does not detect a second dial tone before a preset time-out (implementation dependent), the IWF should return a "NO DIALTONE" result code. If the IWF detects a second dial tone, the IWF should process the subsequent characters in the command string.

If the "@" modifier appears in the dial string, the MT2 shall forward the "@" modifier to the IWF. If the IWF does not detect a five second silence period within the time specified in register S7, the IWF should return a "NO ANSWER" result code. If the IWF detects a five

---

[4]With the appropriate setting, software flow control commands and FAX local data stream transparent commands are not forwarded in the online state.

[5]Other mechanisms are dropping circuit 108/2 and *break*. Implementation note: many applications rely on transmission of "+++".

[6]To avoid losing commands issued immediately after the result code is received, the implementation should ensure that the closure of the transport layer occurs as soon as possible after the transmission of the result code. One method for minimizing the delay is to set the FIN bit in the TCP segment containing the result code.

second silence period within the time specified in register S7, the IWF should process the subsequent characters in the command string.

If the "!" modifier appears in the dial string, the MT2 shall forward the "!" modifier to the IWF. If this dial modifier is supported, the base station should generate a hook flash or equivalent as a result of this dial modifier.

If the "$" modifier appears in the dial string, the MT2 shall forward the "$" modifier to the IWF. The IWF should wait for a billing tone before processing the subsequent characters in the command string.

If the ";" modifier appears in the dial string, the MT2 shall forward the ";" dial modifier to the IWF. The IWF modem shall enter the online command state after dialing.

### 4.2.6 Basic Result Codes

The MT2 and IWF shall support the basic result codes of Table 7.1.4-1. Sources for each result code are shown in Table 4.2.6-1.

The IWF shall encapsulate result codes (see Table 4.2.6-1) for transmission over the $U_m$ interface using the method defined in 4.4.1. The MT2 shall decapsulate the result codes and transmit them over the $R_m$ interface observing the timing requirements in EIA/TIA-602.

**Table 4.2.6-1. Result Code Sources**

| Result Code | Source |
|---|---|
| OK | MT2, IWF |
| CONNECT <rate> | IWF |
| RING | IWF |
| NO CARRIER | IWF, MT2 |
| ERROR | MT2, IWF |
| NO DIALTONE | IWF, MT2 |
| BUSY | IWF |
| NO ANSWER | IWF, MT2 |

The ERROR result code shall be returned for all commands which do not comply with the syntax rules of 5.1 of EIA/TIA-615 or Section 5 of EIA/TIA-602.

## 4.3 Service Class 2.0 AT Commands

Service Class 2.0 AT commands are taken from EIA/TIA-592 and TIA/EIA/IS-134. Mobile stations and IWFs conforming with this standard shall support these command sets for Service Class 2.0.

### 4.3.1 Facsimile Parameters

#### 4.3.1.1 Description

The mobile station and the IWF should support the parameters listed in Table 7.3.1-1. The parameters listed in Table 7.3.1-1 should be part of the stored configuration maintained by the MT2.

#### 4.3.1.2 Special Processing Requirements

##### 4.3.1.2.1 +FHS

For a fax call, the IWF shall send this parameter (via the procedure in 4.4) to the mobile station prior to closing the transport layer connection. If the transport layer connection aborts, the mobile station shall set +FHS to 0x10, 0x20, or 0x40 when the abort occurs in Phase A, Phase B, or Phase C respectively (see 8.4.5 of EIA/TIA-592). The mobile station shall support all values of this parameter. The IWF shall use the SET command construct to set the value of this parameter in the mobile station using the mechanism of 4.4.1, and shall not issue a result code to the mobile station.

##### 4.3.1.2.2 +FIS

The mobile station and the IWF shall copy the value of the +FCC parameter to the +FIS parameter whenever a new value is set for the +FCC parameter. At the end of a fax call the mobile station shall set the value of the +FIS parameter to the current value of the +FCC parameter.

##### 4.3.1.2.3 +FLP

If +FLP is set to 1, the IWF shall send the mobile station a SET command setting +FLP to 0 immediately after the successful transmission of the fax and prior to closing the transport layer connection. The IWF shall use the SET command construct to set the value of this parameter in the mobile station using the mechanism of 4.4.2, and shall not issue a result code to the mobile station.

##### 4.3.1.2.4 +FSP

If +FSP is set to 1, the IWF shall send the mobile station a SET command setting +FSP to 0 immediately after the successful reception of the fax and prior to closing the transport layer. The IWF shall use the SET command construct to set the value of this parameter in the mobile station using the mechanism of 4.4.1, and shall not issue a result code to the mobile station.

##### 4.3.1.2.5 +FMI, +FMM, +FMR

The mobile station shall process +FMI, +FMM, and +FMR as unrecognized commands. The IWF shall process +FMI, +FMM, and +FMR as remote commands.

#### 4.3.1.2.6 +FPP

Support of packet protocol (see EIA/TIA-605) is optional. Support of the value 1 for +FPP is optional.

#### 4.3.1.2.7 +FPS

Support of the values 4 and 5 for +FPS are optional. The IWF shall send a SET command to the mobile station for this parameter whenever it changes its value and prior to closing the transport layer connection. The IWF shall use the SET command construct to set the value of this parameter in the mobile station using the mechanism of 4.4.1, and shall not issue a result code to the mobile station.

### 4.3.2 Facsimile Action Commands

The MT2 and the IWF should support the facsimile action commands listed in Table 7.3.2-1.

If the MT2 receives a +FDR or +FDT prior to having sent a dialing command to the IWF, the MT2 shall return an ERROR result code.

If the TE2 issues a +FKS command and the MT2 is in command state, the MT2 shall issue the OK result code without further processing.

### 4.3.3 Responses

The format of AT command responses to all AT+F commands should be as specified in EIA/TIA-592.

### 4.3.4 Embedded Commands

There are four types of embedded commands, as shown in Table 4.3.4-1. Table 4.3.4-2 lists the data stream transparent commands and their types. Table 4.3.4-3 lists the single character commands and their types.

**Table 4.3.4-1. Embedded Command Types**

| Type | Interpretation |
|---|---|
| To Remote | Passed transparently from the TE2 to the IWF.<br>The MT2 performs no processing. |
| From Remote | Passed transparently from the IWF to the TE2.<br>The MT2 performs no processing. |
| To Local | Processed and removed from the data stream by the MT2. |
| From Local | Generated by the MT2 for processing by the TE2. |

1 **Table 4.3.4-2. Data Stream Transparent Commands**

| Command | Description | Type |
|---|---|---|
| | DLE Transparency | |
| <DLE><DLE> | Substitute one 0x10 pattern | To Remote or From Remote |
| <DLE><SUB> | Substitute two 0x10 patterns | To Remote or From Remote |
| | Transmit Commands | |
| <DLE><mps> | End of page, more to follow | To Remote |
| <DLE><eom> | End of document | To Remote |
| <DLE><eop> | End of document and session | To Remote |
| <DLE><pri> | Request procedure interrupt[1] | To Remote |
| <DLE><bc?> | Check buffer credit | for further study |
| <DLE><ETX> | Acknowledge <CAN> | To Remote |
| | Receive Commands | |
| <DLE><ETX> | End of page | From Remote |
| <DLE><“A”> | <SOH> in packet data | From Remote |
| <DLE><“W”> | <ETB> in packet data | From Remote |
| <DLE><ovr> | Overrun error marker | From Remote |
| <DLE><?> | Requests MT2 to report TX Buffer Status | for further study |
| | Transmit Data Format | |
| <DLE><vr0> | Vertical resolution normal | To Remote |
| <DLE><vr1> | Vertical resolution fine | To Remote |
| <DLE><ln0> | A4 length | To Remote |
| <DLE><ln1> | B4 length | To Remote |
| <DLE><ln2> | Unlimited length | To Remote |
| <DLE><wd0> | 1728 pels / 215 mm width | To Remote |
| <DLE><wd1> | 2048 pels / 255 mm width | To Remote |
| <DLE><wd2> | 2432 pels / 313 mm width | To Remote |
| <DLE><wd3> | 1216 pels / 151 mm width | To Remote |
| <DLE><wd4> | 864 pels / 107 mm width | To Remote |
| <DLE><df0> | 1-D Modified Huffman | To Remote |
| <DLE><df1> | 2-D Modified Read | To Remote |
| <DLE><df2> | 2-D Uncompressed | To Remote |
| <DLE><df3> | 2-D Modified Modified Read | To Remote |
| | Receive Buffer Status | |
| <DLE><DC2> | Buffer is empty | From Local |
| <DLE><rb0> | Buffer is 0-10% full | From Local |
| <DLE><rb1> | Buffer is 10-20% full | From Local |
| <DLE><rb2> | Buffer is 20-30% full | From Local |
| … | … | From Local |
| <DLE><rb9> | Buffer is 90-100% full | From Local |
| Note 1. Support of procedure interrupt is optional. | | |

2

**Table 4.3.4-3. Single Character Commands**

| Command | Description | Type |
|---|---|---|
| <DC2> | Indicates ready to receive Phase C data. | To Remote |
| <"?"> | Requests IWF to report transmit buffer status. | To Remote |
| <CAN> | Requests mobile station to stop delivering Phase C data. | From Remote |
| <CAN> | Requests IWF to stop delivering Phase C data. | To Remote |

## 4.4 AT Command Set Extensions for Modem Control

### 4.4.1 General Requirements

Certain AT commands and all AT result codes are time-sensitive. Since timing is not preserved over the $U_m$ interface, a modem control channel is implemented between the mobile station and the IWF. The modem control channel also carries the state of modem control signals between the MT2 and IWF.

Additionally, because the MT2 is unaware of any AT commands present in the $R_m$ data stream while the transport layer connection is in the ESTABLISHED state, a means to deliver local AT commands issued by the TE2 to the MT2 is required. This shall be done by reflecting AT commands received by the IWF back to the MT2 using the formats specified below.

The mobile station and the IWF shall support the inband modem control procedures defined in ANSI/TIA/EIA-617, including the cellular extensions, as described below. The escape character shall be 0x19. Any 0x99 characters in the input stream shall not be escaped. The character set 0x20-0x7E shall be used to build valid in band commands.

Processing of ANSI/TIA/EIA-617 inband commands is part of the application interface layer.

Reflected AT commands shall be carried by the AT Cmd construct shown in Table 4.4.3-1. Information text sent from the MT2 to the IWF shall be carried by the appropriate result code construct as shown in Table 4.4.3-2.

Responses delivered from the IWF to the MT2 shall be carried by zero or more instances of the extend1/0x61 construct (see Table 4.4.3-1) followed by the STATUS report command, as described in 7.4.3 of ANSI/TIA/EIA-617. The MT2 shall then issue the response received from the IWF over the $R_m$ interface.

Responses delivered from the MT2 to the IWF shall be carried by zero or more instances of the extend1/0x47 construct (see Table 4.4.3-2) followed by the appropriate result code construct.

### 4.4.2 Cellular Extensions to ANSI/TIA/EIA-617

The following extensions to ANSI/TIA/EIA-617 are employed for cellular use.

#### 4.4.2.1 Return to Online Command State

This command shall be inserted into the data stream by the MT2 after it detects a time sensitive "+++" or equivalent escape command. The IWF then processes this in band command, either directly, or by regenerating the time-sensitive instruction for use by existing modem equipment.

#### 4.4.2.2 Report Dropped Fax Line

When a Group-3 Facsimile is sent from a PSTN user to a mobile station, the air interface may provide a throughput below the PSTN rate. Thus, a buffer is required at the IWF since flow control is not possible. In the event the buffer overflows, the transmission can continue if the IWF drops scan lines when needed. This command informs the MT2 that a line has been dropped, allowing it to take appropriate action.

**Note:** This technique is not required for fax transmission below 9600 bps, or when the fax call utilizes ECM.

#### 4.4.2.3 Facsimile Voice-Request Command

This command is placed into the data stream by the MT2 in response to user input. The IWF should respond by issuing the appropriate T.30 procedure interrupt. The IWF may wait until the end of the transmission to generate the interrupt. Support of this command is optional.

#### 4.4.2.4 Extensions to ANSI/TIA/EIA-617 for Long Lines

ANSI/TIA/EIA-617 provides inband transmission of modem control commands over a serial interface, however there is a limitation (94 characters) on the maximum size of a transmitted message. Because a command line or a response line could conceivably exceed this maximum size, ANSI/TIA/EIA-617 is extended herein for this case.

When a command line, response line or result code is to be sent via ANSI/TIA/EIA-617 messages, the transmitting entity shall perform the following:

- If the length of the line is less than the maximum message size the transmitting entity shall send the line in a single ANSI/TIA/EIA-617 message using the appropriate extend code as shown in either Table 4.4.3-1, or Table 4.4.3-2.
- If the length of the line is greater than or equal to the maximum message size, the transmitting entity shall segment the line into as many maximum size segments as possible. Each maximum size segment shall be sent in order in a separate ANSI/TIA/EIA-617 message using the appropriate extend code. If there are remaining characters in the line after all maximum length segments have been sent, a ANSI/TIA/EIA-617 message of length less than the maximum shall be used as the final message in the line. If there are no remaining characters, an "empty" ANSI/TIA/EIA-617 message shall be sent.
- If the response format is set to verbose (the V parameter is set to 1), the transmitting entity shall send an "empty" ANSI/TIA/EIA-617 response message prior to transmitting a response or result code.

When the transmitting entity performs this procedure, it shall not send any intervening, independent ANSI/TIA/EIA-617 messages.

When command lines, response lines or result codes are received via ANSI/TIA/EIA-617 messages, the receiving entity shall perform the following:

If a message of size equal to the maximum length permitted by ANSI/TIA/EIA-617 is received, the receiving entity shall combine it with any previous maximum length messages of the same type (response or command).

If a message of size less than the maximum length permitted by ANSI/TIA/EIA-617 is received, the receiving entity shall combine it with any previous maximum length messages of the same type to create a single line and perform one of the following:

- If the line is a response to an AT command, the receiving entity shall append a <CR><LF> to the line.
- If an "empty" line is received, the receiving entity shall interpret this as a <CR><LF> pair.
- If a result code is received while the receiving entity is in **verbose** mode (the V parameter is set to 1), the receiving entity shall append a <CR><LF> pair to the result code.
- If a result code is received while the receiving entity is in **non-verbose** mode (the V parameter is set to 0), the receiving entity shall append a <CR> to the result code.

The receiving entity shall then perform one of the actions described in Tables 4.4.3-1 or 4.4.3-2. If the receiving entity is a mobile station and a result code is received, the mobile station shall combine the result code with the response line received earlier and send the composite response on the Rm interface.

For examples of message processing using ANSI/TIA/EIA-617 inband commands see Annex A.

### 4.4.3 Cellular Command Format

Each cellular extension command consists of an escape character, extend command character, a length octet and additional characters. The length octet specifies the size, in characters, of the Extended Command String. The length value ranges from 0x20 to 0x7e, offset by 0x1f (31 decimal), corresponding to Extended Command String sizes of 1 decimal to 95 decimal. This cellular extension command format is illustrated here:

<EM><extend><length><Extended Command String>

When reflecting AT commands to the mobile station, the IWF shall omit the initial "AT." Except for the omission of the initial "AT" for AT commands, AT command strings and result code strings sent using the cellular extension commands shall be formatted as required by EIA/TIA-602 and EIA/TIA-615.

Tables 4.4.3-1 and 4.4.3-2 give the set of hex codes used to support cellular extensions to ANSI/TIA/EIA-617.

**Table 4.4.3-1. IWF to Mobile Station Commands**

| Command Sequence | Hex Codes | Mobile Station Action | IWF Action |
|---|---|---|---|
| <EM><extend0><br><len><br><AT Cmd> | <0x19><0x60><br><len><0x42><br><string> | Process command, generate Information Text on the $U_m$ interface. | Use when reflecting AT commands. |
| <EM><extend1><br><len><br><FAX line dropped> | <0x19><0x61><br><len><0x42> | Repeat previous fax line, or other method. | Generate whenever a fax line is dropped. |
| <EM><extend1><br><len><br><response characters> | <0x19><0x61><br><len><0x43><br><string> | Wait for Result Code before processing next command and command line. | Issue when mobile generates a response to a reflected AT command. |

**Table 4.4.3-2. Mobile Station to IWF Commands**

| Command Sequence | Hex Codes | Mobile Station Action | IWF Action |
|---|---|---|---|
| <EM><extend1><br><len><escape> | <0x19><0x41><br><len><0x42> | Send in response to TE2 request to escape to online command state. | Escape to online command state. |
| <EM><extend1><br><len><br><Voice Request> | <0x19><0x41><br><len><0x43> | Issue in response to user input or a +FVO command from IWF. | Complete T.30 interrupt procedure negotiation with the participant fax terminal during phase D. |
| <EM><extend1><br><len><br><command unrecognized><br><result code> | <0x19><0x41><br><len><0x44><br><string> | Issue after receiving an unknown command on the $U_m$ interface. | Send appropriate result code to the mobile station. |
| <EM><extend1><br><len><br><illegal parameter><br><result code> | <0x19><0x41><br><len><0x45><br><string> | Issue after receiving a known command with an illegal parameter. | Send appropriate result code to the mobile station. |
| <EM><extend1><br><len><br><command valid><br><result code> | <0x19><0x41><br><len><0x46><br><string> | Issue after receiving and successfully processing a known command. | Send appropriate result code to the mobile station. |
| <EM><extend1><br><len><br><long response> | <0x19><0x41><br><len><0x47><br><string> | Issue when response is longer than one line, or insert an empty line. | Wait for complete response before sending to the mobile station. |

## 4.5 Cellular AT Command Processing

The MT2 and the IWF shall support the AT command extensions and result codes for CDMA in accordance with Section 7.4.

### 4.5.1 AT+CXT Command Processing

The AT+CXT command controls the handling of unrecognized commands by the MT2. If the TE2 issues AT+CXT=0, the MT2 shall return the ERROR result code when it is in the command state and it receives an unrecognized AT command on the $R_m$ interface. If the

TE2 issues AT+CXT=1, the MT2 shall open a transport layer connection to the IWF if it receives an unrecognized command on the $R_m$ interface. After establishing the transport layer connection and transmitting the configuration information (see 4.1), the MT2 shall send the unrecognized command to the IWF.

The default mode on power on is AT+CXT=0.

#### 4.5.2 AT+CFG Command Processing

If a configuration string has been specified via the AT+CFG command, the mobile station shall send the string to the IWF immediately after all other stored configuration data (see 4.1 and 4.2).

#### 4.5.3 AT+CAD Command Processing

The mobile station shall return result codes (see Table 7.4.1-1) indicating the presence of analog or digital service. This is a local command. AT+CAD is a read-only parameter command.

#### 4.5.4 AT+CRM Command Processing

Allows the user to set the protocol on the $R_m$ interface. The default value, 0, allows async data and fax service. A mobile station may return ERROR if provided with a value that is not within the valid range.

#### 4.5.5 AT+CBC Command Processing

The mobile station shall return responses (see Table 7.4.1-1) indicating battery status. This is a local command. AT+CBC is a read-only parameter command.

#### 4.5.6 AT+CQD Command Processing

Allows the user to set the command state inactivity timer (see 4.1.3 of IS-707.4 or 4.1.4 of IS-707-A.4).

#### 4.5.7 AT+CRC Command Processing

The command enables or disables cellular result codes. Support of cellular result codes is optional.

#### 4.5.8 AT+CHV Command Processing

The AT+CHV command should only be used to release a call initiated through the AT+CDV command. If the MT2 receives AT+CHV while in the online state, it shall return the OK result code and shall take no further action.

#### 4.5.9 AT+CDV Command Processing

When in the command state, the MT2 shall examine the dial string argument of the AT+CDV command and proceed as follows:

- If the dial string contains no dial modifiers (see 4.2.5), the MT2 shall initiate a voice call, using the dial string as the dialed digits.

- If the dial string contains any of the following dial modifiers, “W”, “,”, and “$”, the MT2 should transmit an *Origination Message* containing a voice service option with the DIGIT_MODE field set to ‘1’, the NUMBER_TYPE field set to ‘000’, and the NUMBER_PLAN field set to ‘0000’ and shall send the dial string in the *Origination Message* (and possibly *Origination Continuation Message*) as the dialed digits.
- If the dial string contains any other dial modifiers, the MT2 shall return the ERROR result code.

When in the online state, the MT2 shall return the ERROR result code in response to an AT+CDV command.

### 4.5.10 Cellular Identification AT Command Processing

The +C commands shown in Table 7.4.1-3 take the same arguments as the +G commands taken from TIA/EIA/IS-131, except the +C commands are remote and therefore provide information about the IWF. Support for the Cellular Identification AT commands is optional.

### 4.5.11 AT+CMIP Command Processing

The mobile station shall return the mobile station’s temporary IP address as a character string in the “dotted decimal” Internet format as defined in RFC 1166, followed by a final result code. If this command is issued when a temporary IP address has not been assigned, the mobile station shall return only a final result code. AT+CMIP is a read-only parameter command.

For example, if the temporary IP address is the 32-bit hexadecimal number 0xc00163fe, the mobile station returns:

192.1.99.254

OK

### 4.5.12 AT+CBIP Command Processing

The mobile station shall return the IWF’ IP address as a character string in the “dotted decimal” Internet format as defined in RFC 1166, followed by a final result code. If this command is issued when the Transport Layer is not in the ESTABLISHED state, the mobile station shall return only a final result code. AT+CBIP is a read-only parameter command.

For example, if the IWF’s IP address is the 32-bit hexadecimal number 0xc00163fe, the mobile station returns:

192.1.99.254

OK

### 4.5.13 AT+CMUX and AT+CSO Command Processing

The AT+CSO and AT+CMUX commands may be used to select alternate service options or multiplex options which are valid within the context of the data service selected by the AT+CRM command. Other uses of these commands are for further study.

This page left intentionally blank.

# 5 AT COMMAND PROCESSING FOR THE PACKET DATA SERVICES

## 5.1 AT Command Processing

The following requirements apply to an MT2 that supports an AT command protocol on the $R_m$ interface for packet data services. Support of an AT command protocol on the $R_m$ interface is optional.

If the MT2 supports an AT command protocol on the $R_m$ interface, the AT command processing shall have three states for support of packet data service: command state, online state and online command state. In the command state, packet data service shall be in the *Inactive State*, and the MT2 shall process all data on the $R_m$ interface as AT commands or responses. In the online state, the MT2 shall process all data on the $R_m$ interface (except ANSI/TIA/EIA-617 in-band control data and software flow control characters, if software flow control is enabled) as packet data. In the online command state, packet data service shall be in the *Active State*, but the MT2 shall process all data from the TE2 as commands, and send responses to the TE2. Data received from the IWF during online command state may be either discarded or retained in the MT2. Data previously transmitted by the TE2 and buffered by the MT2 may be transmitted from the buffer to the IWF during online command state, or discarded, or transmission may be deferred until the MT2 enters online state.

The AT+CRM parameter SET command (see Table 7.4.1-1) can be used to configure the $R_m$ interface to carry packet data service, and to enable the setting of any parameters specific to packet data service.

The ATD or ATA command can be used to cause packet data service to enter the *Active State*.

When the MT2 enters the online command state, it shall issue the OK result code.

The MT2 shall enter the online state when any of the following occurs:

- The packet data service enters the *Active State*.
- The MT2 is directed by the user or the TE2 to enter online state from online command state. The MT2 interprets the ATO command as a request to enter online state from online command state.

When the MT2 enters the online state, it should send the CONNECT result code to the TE2. If PPP is implemented on the $R_m$ interface, the TE2 should interpret the CONNECT result code as an indication of physical layer establishment.

If the MT2 supports circuit 109 and the &C parameter is set to '1', the MT2 should assert circuit 109 when packet data service is in the *Active State*, and should deassert circuit 109 when packet data service is in the *Inactive State*. The TE2 should interpret the assertion of circuit 109 as an indication of physical layer establishment, and should interpret deassertion of circuit 109 as an indication of physical layer closure.

The MT2 shall enter the online command state from the online state when directed by the user or TE2.

A means should be provided for the TE2 to direct the MT2 to enter the command state. The MT2 shall enter the command state when the packet data service enters the *Inactive State*. The packet data service shall enter the *Inactive State*, when any of the following occurs:

- The MT2 powers on or is reset.
- The AT+CRM or the AT+CPS parameter is changed.
- The MT2 is directed by the user or the TE2 to enter the command state from online command state. The MT2 interprets the ATH command as a request to enter the command state from online command state.

## 5.2 AT Command Processing for Packet Data Services

The following AT processing applies when the +CRM parameter is set to a value specified for a packet data service option (see Table 7.4.1-1). All commands are processed in the MT2.

### 5.2.1 Basic AT Parameters

MT2s implementing AT command processing for packet data services shall support the required basic AT parameters in accordance with Table 7.1.1-1.

If the &D parameter is set to 1, and the MT2 is in the online state, the MT2 shall enter the online command state following ON to OFF transition of circuit 108/2. The packet data service shall remain in the Active *State*.

If the &D parameter is set to 2, and the MT2 is in the online state, the MT2 shall enter the command state following ON to OFF transition of circuit 108/2. The packet data service shall enter the Inactive *State*.

If the &C parameter is set to 1, the MT2 shall assert Circuit 109 (CF) when packet data service is in the *Active State.*

### 5.2.2 Basic S-Registers

The MT2 may support the Basic S registers in accordance with Table 7.1.2-1.

### 5.2.3 Basic Action Commands

The MT2 shall support the Basic Action Commands of Table 7.1.3-1.

When the ATA command is issued, the MT2 shall transition from the command state to the online state. Packet data service shall enter the *Active State*.

When the ATD command is issued, the MT2 shall transition from the command state to the online state. Packet data service shall enter the *Active State.*

The <dial string> parameter may be omitted from the ATD command when this command is used for packet data services.

When the ATH0 command is issued, the MT2 shall transition from the online command state to the command state. This causes the packet data service to enter the *Inactive State*.

When the ATO0 command is issued, the MT2 shall enter the online state from the online command state. Packet data service remains in the *Active State*.

#### 5.2.4 Extended AT Configuration Commands

The MT2 shall support the Extended AT Configuration Commands in accordance with Table 7.2-1. If the +GCAP command is implemented, an MT2 conforming to this standard shall include as a minimum the string "+CIS707P" in the result code for the +GCAP command.

#### 5.2.5 Basic Result Codes

The MT2 shall support the basic result codes in accordance with Table 7.1.4-1.

#### 5.2.6 Extended AT Configuration Commands

The MT2 shall support the Extended AT Configuration commands in accordance with Table 7.2-1.

#### 5.2.7 CDMA AT Parameter Commands

The MT2 shall support the CDMA AT Parameter Commands in accordance with Table 7.4.1-1.

#### 5.2.8 Packet Specific AT Commands

The MT2 shall support the Packet Specific AT commands in accordance with Table 7.4.1-4.

#### 5.2.9 Packet-Specific Cellular Response Codes

The MT2 shall support the packet specific cellular response codes in accordance with Table 7.4.2-2.

### 5.3 Optional AT Commands

For MT2s implementing AT command processing, the extended AT configuration commands may be supported in accordance with Table 7.2-1.

An MT2 conforming to this standard shall include the following item, as a minimum in the result code for the +GCAP command: +CIS707P.

An MT2 conforming to this standard may support the +IBC parameter (See Table 7.1.5-1) for configuration of the inband control services of ANSI/TIA/EIA-617 on the $R_m$ interface.

The AT+CSO and AT+CMUX commands may be used to select alternative service options or multiplex options which are valid within the context of the data service selected by the AT+CRM command. Other uses of these commands are for further study.

This page left intentionally blank.

# 6 AT COMMAND PROCESSING FOR THE STU-III SERVICES

## 6.1 AT Command Processing for STU-III Service Control

Issuance of certain AT Commands on the $R_m$ interface cause STU-III service state transitions as specified in PN3676.6. The AT+CDV command shall be used to connect a clear(i.e., unencrypted) voice service option over the air interface to the remote STU-III terminal. The AT+CHV command shall be used to release the call when a clear voice service option is connected. The ATH command shall be used to release the call when a STU-III secure service option is connected.

The AT+CSO=<n> command shall be used to connect a STU-III secure service option when a clear voice service option is connected. The value of <n> in the AT+CSO command determines which of the STU-III secure service options is connected. The AT+CSO=<n> command shall be used to connect a clear voice service option when a STU-III secure service option is connected. The transitions between the clear and secure service options are part of the STU-III service call control function and are detailed in Section 2.4 of IS-707.6.

The AT+CMUX=<n> parameter shall determine the initial proposed multiplex option during service negotiation procedures for connecting a STU-III secure service in accordance with Table 7.4.1-1.

### 6.1.1 AT Command Parser States

The MT2 AT command processing shall have three states:

- Command State
- Online State
- Online Command State

The following describes AT Command Parser state transitions for the STU-III services. For definitions of the service control function states, see 2.3 of IS-707.6.

When the STU-III service control function is in the *Unselected Substate of the Inactive STU-III State* or the *Selected Substate of the Inactive STU-III State* or the *Clear Voice Substate of the Inactive STU-III State*, the STU-III MT2 AT command parser shall enter the Command State and Circuit 108/2 (CD) can be either asserted or de-asserted. When the STU-III service control function enters either the *Secure Transparent Substate of the Active STU-III State* or the *Secure Non-Transparent Substate of the Active STU-III State*, the STU-III MT2 AT command parser shall enter the Online State. This state transition occurs when the MT2 detects the assertion of Circuit 108/2 (CD) in the STU-III service invocation procedures described in Section 2.4.3 of IS-707.6.

When the STU-III service control function is either in the *Secure Transparent Substate of the Active STU-III State* or in the *Secure Non-Transparent Substate of the Active STU-III State,* the STU-III MT2 AT command parser shall enter the Online Command State when the MT2 detects that Circuit 108/2 (CD) is de-asserted. The STU-III MT2 AT command parser shall enter the Online State if the STU-III service control function remains in either the *Secure*

*Transparent Substate of the Active STU-III State* or the *Secure Non-Transparent Substate of the Active STU-III State* and when Circuit 108/2 (CD) is reasserted.

While in the Online Command State, if the STU-III service control function transitions to either the *Clear Voice Substate of the Inactive STU-III State* (as a result of issuing the AT+CSO=1 command) or to the *Selected Substate of the Inactive STU-III State* (as a result of issuing the ATH command), the STU-III MT2 AT command parser shall enter the Command State.

### 6.1.2 STU-III Service Rate Change

While a STU-III secure service option is connected, a STU-III service rate different from the service rate being used may be negotiated by the STU-III terminals using the protocols specified in FSVS-210 (see IS-707.6). This may happen as a result of a user request.

If a STU-III secure service option is connected and a STU-III service rate is requested that requires a change in the multiplex option, the TE2 first issues the AT+CMUX <n> command with a new parameter value corresponding to the desired multiplex option. Subsequently, the TE2 issues the AT+CSO <n> (where n is a STU-III secure service option) command to connect the STU-III secure service option with a different multiplex option.

When the MT2 receives an AT+CSO <n> command and the service configuration indicated by the AT+CSO and AT+CMUX commands is different from that currently established, the mobile station shall perform service negotiation to establish a service configuration including the STU-III secure service option and the multiplex option indicated by the stored AT+CMUX parameter. The MT2 shall return a CONNECT result code in response to succesful execution of the AT+CSO command during the STU-III service invocation procedure (see Section 2.4.3 of IS-707.6).

If the service configuration indicated by the AT+CSO and AT+CMUX commands is the same as that currently established (*i.e.*, the service configuration remains unchanged), the MT2 shall not engage in further service negotiation but the MT2 shall return the CONNECT result code in response to the AT+CSO command.

# 7 AT COMMAND FORMATS

## 7.1 Basic AT Commands

### 7.1.1 Basic AT Parameters

Table 7.1.1-1 specifies the basic AT parameters to be supported for the CDMA data services. Exceptions to EIA/TIA-602 are indicated in Table 7.1.1-1 by square brackets. Default settings are shown in bold.

1 **Table 7.1.1-1. Basic AT Parameters**

| Para-meter | Description | Async & Fax | Packet Data | STU-III |
|---|---|---|---|---|
| E0 | Do not echo commands in command state or online command state. | R,M | O | N/A |
| **E1** | Echo commands in command state or online command state. | R,M | O | N/A |
| **L0** | Low speaker volume. | R,L | N/A | N/A |
| L1 | Low speaker volume. | R,L | N/A | N/A |
| L2 | Med speaker volume. | R,L | N/A | N/A |
| L3 | High speaker volume. | R,L | N/A | N/A |
| **M0** | Speaker off. | R,M | N/A | N/A |
| M1 | Speaker on until carrier reported (support of this feature is optional). | R,M | N/A | N/A |
| **Q0** | Return result codes. | R,M | R | R |
| Q1 | Do not return result codes. | R,M | R | N/A |
| V0 | Display result codes as numbers. | R,M | R | R |
| **V1** | Display result codes as words. | R,M | R | R |
| X1 | Enable additional result code *CONNECT <rate>.* Disable dial tone and busy detection.[1] | R,M | N/A | N/A |
| X2 | Enable additional result codes *CONNECT <rate>* and *NO DIALTONE.* Disable busy detection. Enable dial tone detection.[1] | R,M | N/A | N/A |
| X3 | Enable additional result codes *CONNECT <rate>* and *BUSY*. Enable busy detection. Disable dial tone detection.[1] | R,M | N/A | N/A |
| **X4** | Enable additional result codes *CONNECT <rate>, BUSY* and *NO DIALTONE.* Enable busy and dial tone detection.[1] | R,M | N/A | N/A |
| Z0 | Reset to default configuration. | R,L | R | N/A |
| &C0 | Circuit 109 (CF) always ON. | R,L | R | N/A |
| **&C1** | Circuit 109 (CF) ON in accordance with the specified service. | R,L | R | N/A |
| &D0 | Ignore circuit 108/2 (CD). | R,L | R | N/A |
| [&D1] | Enter online command state following ON-to-OFF transition of circuit 108/2. See service specific AT command processing for service state transitions. | R,L | R | N/A |
| **&D2** | Enter command state following On to Off transition of circuit 108/2. See service specific AT command processing for service state processing requirements. | R,L | R | N/A |
| T | Select tone dialing. | R,M | N/A | N/A |
| P | Select pulse dialing. | R,M | N/A | N/A |
| &Fn | Set to factory-defined configuration “n.” Effect is implementation dependent. | R,L | O | N/A |

Note 1. For async data or fax settings, the dial tone detection settings do not apply.
Legend: R=Required, O=Optional, M=Remote AT Command, L=Local AT Command.

### 7.1.2 Basic S Registers

Table 7.1.2-1 specifies the basic S Registers to be supported for the CDMA data services. Exceptions to EIA/TIA-602 are indicated in Table 7.2.1-1 by square brackets. Default settings are shown in bold.

**Table 7.1.2-1. Basic S-Registers**

| Register | Value | Description | Async & Fax | Packet Data | STU-III |
|---|---|---|---|---|---|
| S0 | **0**<br>[1 to 255] | Disable automatic answering.<br>[Enable automatic answering after (Value - 1) × 6 seconds.] | R,L | N/A | N/A |
| S3 | **13** | Carriage Return character. | R,M | O | N/A |
| S4 | **10** | Line Feed character. | R,M | O | N/A |
| S5 | **8** | Backspace character. | R,M | O | N/A |
| S6 | 2 to 10<br>**2** | Pause before blind dialing. | R,M | N/A | N/A |
| S7 | 1 to 255<br>[**50**] | Number of seconds to establish end-to-end data connection. | R,M | O | N/A |
| S8 | 0 to 255<br>**2** | Number of seconds to pause when "," is encountered in dial string. | R,M | N/A | N/A |
| [S9] | 0 to 255<br>**6** | Carrier detect threshold in increments of 0.1 seconds. | R,M | N/A | N/A |
| S10 | 1 to 254<br>[**14**] | Number of tenths of a second from carrier loss to disconnect. | R,M | N/A | N/A |
| | [255] | [Disable carrier detect.] | | | |
| [S11] | 50-255<br>**95** | DTMF tone duration and spacing in milliseconds. | O,M | N/A | N/A |

### 7.1.3 Basic Action Commands

Table 7.1.3-1 specifies the Basic Action Commands to be supported for the CDMA data services. Exceptions to EIA/TIA-602 are indicated in Table 7.1.3-1 by square brackets. Default settings are shown in bold.

**Table 7.1.3-1. Basic Action Commands**

| Command | Description |
|---|---|
| A/ | Re-execute previous command. |
| A | Enter the online state. See service specific processing for further details. |
| D<dial string> | Causes the MT2 to transition from the command state to the online state. The <dial string> is optional. For circuit switched data services, the dial string may contain the following characters: Digits 0 to 9, *, #, A, B, C, and D.<br><br>The dial string may contain the following dial modifiers:<br>T Tone dialing [ignore]<br>P Pulse dialing [ignore]<br>, Pause during dialing<br>W Wait for dial tone<br>@ Wait for quiet answer<br>! Hook flash<br>[$] Wait for billing tone (for credit-card calls)<br>; After dialing, the IWF enters the online command state and maintains the connection |
| H0 | Causes the MT2 to transition from online command state to command state. Use of the digit '0' is optional (see EIA/TIA-602). |
| O0 | Causes the MT2 to transition from online command state to online state. Use of the digit '0' is optional (see EIA/TIA-602). |

### 7.1.4 Basic Result Codes

Table 7.1.4-1 specifies the Basic Result Codes to be supported for the CDMA data services. Exceptions to EIA/TIA-602 are indicated in Table 7.1.4-1 by square brackets. Default settings are shown in bold.

The ERROR result code shall be returned for all commands which do not comply with the syntax rules of 5.1 of EIA/TIA-615, or Section 5 of EIA/TIA-602.

**Table 7.1.4-1. Basic Result Codes**

| Numeric | Verbal | Description | Async & Fax | Packet Data | STU III |
|---|---|---|---|---|---|
| 0 | OK | Command executed. | R | R | R |
| 1 | CONNECT <rate> | Entering online state. | R | R | R |
| 2 | RING | Alerting signal received from network. | R | N/A | N/A |
| 3 | NO CARRIER | Unable to activate the service. | R | R | N/A |
| 4 | ERROR | Command not recognized or could not be executed. | R | R | R |
| 6 | NO DIALTONE | No dial tone detected within time-out period. | R | N/A | N/A |
| 7 | BUSY | Reorder (Busy signal) received. | R | R | N/A |
| 8 | NO ANSWER | Five seconds of silence not detected after ring back when @ dial modifier is used. | R | N/A | N/A |

### 7.1.5 ANSI/TIA/EIA-617 Control

**Table 7.1.5-1. In-Band Control AT Command**

| Command | Description | Async & Fax | Packet Data | STU III |
|---|---|---|---|---|
| +IBC | In-Band Control Compound Parameter. The AT+IBC compound parameter provides for the enabling, disabling and configuration of In-Band Control Service. See Section 8 of ANSI/TIA/EIA-617 for a complete description of this command. | N/A | O | N/A |

## 7.2 Extended AT Commands

**Table 7.2-1. Extended AT Configuration Commands (Part 1 of 5)**

| Com-mand | Value per | Description | Async & Fax | Packet Data | STU III |
|---|---|---|---|---|---|
| +DR | IS-131 | Data Compression Reporting. This extended-format numeric parameter controls whether or not the extended-format "+DR:" intermediate result code is transmitted from the IWF over the $U_m$ interface. | R,M | O | N/A |
| +DS | IS-131 | Data Compression. This extended-format compound parameter controls the V.42*bis* data compression function on the PSTN link if provided in the IWF. | R,M | O | N/A |
| +EB | IS-131 | Break Handling in Error Control Operation. This extended-format compound parameter is used to control the manner of V.42 operation on the PSTN link (if present in the IWF). | R,M | O | N/A |
| +EFCS | IS-131 | This extended-format numeric parameter controls the use of the 32-bit frame check sequence option in V.42 on the PSTN link (if present in the IWF). | R,M | N/A | N/A |
| +ER | IS-131 | Error Control Reporting. This extended-format numeric parameter controls whether or not the extended-format "+ER:" intermediate result code is transmitted from the IWF over the $U_m$ interface. | R,M | O | N/A |
| +ES | IS-131 | Error Control Selection. This extended-format compound parameter is used to control the manner of operation of the V.42 protocol on the PSTN link (if present in the IWF). | R,M | N/A | N/A |
| +ESR | IS-131 | This extended-format numeric parameter controls the use of the selective repeat (SREJ) option in V.42 on the PSTN link (if present in the IWF). | R,M | N/A | N/A |
| +ETBM | IS-131 | This extended-format compound parameter controls the handling of data remaining in IWF buffers upon service termination. | R,M | O | N/A |

**Table 7.2-1. Extended AT Configuration Commands (Part 2 of 5)**

| Com-mand | Value per | Description | Async & Fax | Packet Data | STU III |
|---|---|---|---|---|---|
| +GCAP | IS-131 | This extended-format command causes the MT2 to transmit one or more lines of information text in a specific format. The content is a list of additional capabilities command +<name>s, which is intended to permit the user of the MT2 to identify the minimum capabilities of the MT2.<br>An MT2 conforming to this standard shall include the following items, as a minimum, in the result code for the +GCAP command:[7]<br>+CIS707, +MS, +ES, +DS, +FCLASS | R,L | O | N/A |
| +GMI | IS-131 | This command causes the MT2 to transmit one or more lines of information text, determined by the manufacturer, which is intended to permit the user of the MT2 to identify the manufacturer. Typically, the text will consist of a single line containing the name of the manufacturer, but manufacturers may choose to provide more information if desired (e.g., address, telephone number for customer service, etc.). | R.L | O | N/A |
| +GMM | IS-131 | This command causes the MT2 to transmit one or more lines of information text, determined by the manufacturer, which is intended to permit the user of the MT2 to identify the specific model of the device. Typically, the text will consist of a single line containing the name of the product, but manufacturers may choose to provide any information desired. | R.L | O | N/A |

[7]The +CIS707 result code indicates support of the AT commands and result codes in Tables 7.4.1-1, 7.4.1-2, 7.4.1-3, and 7.4.1-4.

1 **Table 7.2-1. Extended AT Configuration Commands (Part 3 of 5)**

| Com-mand | Value per | Description | Async & Fax | Packet Data | STU III |
|---|---|---|---|---|---|
| +GMR | IS-131 | This command causes the MT2 to transmit one or more lines of information text, determined by the manufacturer, which is intended to permit the user of the MT2 to identify the version, revision level or date, or other pertinent information of the device. Typically, the text will consist of a single line containing the version of the product, but manufacturers may choose to provide any information desired. | R.L | O | N/A |
| +GOI | IS-131 | This command causes the MT2 to transmit one or more lines of information text, determined by the manufacturer, which is intended to permit the user of the MT2 to identify the device, based on the ISO system for registering unique object identifiers. Typically, the text will consist of a single line containing numeric strings delimited by period characters. | R.L | O | N/A |
| +GSN | IS-131 | This command causes the MT2 to transmit one or more lines of information text, determined by the manufacturer, which is intended to permit the user of the MT2 to identify the individual device. Typically, the text will consist of a single line containing a manufacturer determined alpha-numeric string, but manufacturers may choose to provide any information desired. | R.L | O | N/A |
| +ICF | IS-131 | TE2-MT2 Character Framing. This extended-format compound parameter is used to determine the local serial port start-stop (asynchronous) character framing that the MT2 shall use while accepting TE2 commands and while transmitting information text and result codes to the TE2, if this is not automatically determined (see +IPR). | R.L | R | N/A |

2

**Table 7.2-1. Extended AT Configuration Commands (Part 4 of 5)**

| Com-mand | Value per | Description | Async & Fax | Packet Data | STU III |
|---|---|---|---|---|---|
| +IFC | IS-131 | TE2-MT2 Local Flow Control. This extended-format compound parameter is used to control the operation of local flow control between the TE2 and MT2 [1]. | R.L | R | N/A |
| +ILRR | IS-131 | TE2-MT2 Local Rate Reporting. This extended-format numeric parameter controls whether or not the extended-format +ILPR:<rate> information text is transmitted from the MT2 to the TE2. | R.L | O | N/A |
| +IPR | IS-131 | Fixed $R_m$ Rate. This numeric extended-format parameter specifies the data rate at which the MT2 will accept commands, in addition to 1200 bit/s or 9600 bit/s (as required in EIA/TIA-602). It may be used to select operation at rates at which the MT2 is not capable of automatically detecting the data rate being used by the TE2. | R.L | R | N/A |
| +MA | IS-131 | Modulation Automode Control. This extended-format compound parameter is a list of modulations that the base station may use to connect with the remote DCE in Automode operation, for answering or originating data calls, as additional alternatives to the modulation specified in the +MS command. | R.M | N/A | N/A |
| +MR | IS-131 | Modulation Reporting Control. This extended-format numeric parameter controls whether or not the extended-format +MCR:<carrier> and +MRR:<rate> intermediate result codes are transmitted from the IWF to the mobile station. | R.M | N/A | N/A |
| +MS | IS-131 | Modulation Selection. This extended-format compound parameter is used to control the manner of operation of the modulation capabilities in the IWF. | R.M | N/A | N/A |

**Table 7.2-1. Extended AT Configuration Commands (Part 5 of 5)**

| Com-mand | Value per | Description | Async & Fax | Packet Data | STU III |
|---|---|---|---|---|---|
| +MV18R | IS-131 | V.18 Reporting Control. This extended-format numeric parameter controls whether or not the extended-format "+MV18R:" result code is transmitted from the IWF to the mobile station. | O,M | N/A | N/A |
| +MV18S | IS-131 | V.18 Selection. This extended-format compound parameter is used to control the manner of operation of the V.18 capabilities (if present in the IWF). | O,M | N/A | N/A |
| Note 1. TIA/EIA/IS-131 states that this command only applies when V.42 error control is being used, or when fallback to non-error control mode is specified to include buffering and flow control. In this standard this command applies independently of the use and setting of V.42. If V.42 is not used or not configured appropriately data loss may occur. | | | | | |

## 7.3 Facsimile Service Class 2.0 AT Commands

### 7.3.1 Facsimile Service Class 2.0 Parameters

**Table 7.3.1-1. Fax Parameters (Part 1 of 2)**

| Parameter | Value (per) | Description | Type |
|---|---|---|---|
| +FAA | EIA/TIA-592 | Adaptive-answer parameter (see +FCLASS) | Remote |
| +FAP | TIA/EIA/IS-134 | Addressing and polling capabilities parameter | Remote |
| +FBO | EIA/TIA-592 | Phase-C data-bit-order parameter | Remote |
| +FBS | EIA/TIA-592 | Buffer size parameter (read-only) | Local |
| +FBU | EIA/TIA-592 | HDLC-frame-reporting parameter | Remote |
| +FCC | | DCE-capabilities parameters | Remote |
| VR | EIA/TIA-592 | Vertical-resolution subparameter | |
| [BR] | | Bit-rate subparameter | |
| | 0<br>1<br>2<br>3[1] | • 2400 bits/s<br>• 4800 bits/s<br>• 7200 bits/s<br>• 9600 bits/s | |
| WD | EIA/TIA-592 | Page-width subparameter | |
| [LN] | EIA/TIA-592[2] | Page-length subparameter | |
| [DF] | EIA/TIA-592[2] | Data-compression-format subparameter | |
| [EC] | EIA/TIA-592[2] | Error-correction subparameter | |
| BF | EIA/TIA-592 | Binary-file-transfer subparameter | |
| ST | EIA/TIA-592 | Scan-time-per-line subparameter | |
| [+FCLASS] | | Service-class selection parameter | Remote |
| | **0**<br>1<br>2.0[3] | • Class-0<br>• [Class-1 support unavailable]<br>• Class-2.0 fax service (EIA/TIA-592) | |
| +FCQ | EIA/TIA-592 | Copy-quality-checking parameter | Remote |
| [+FCR] | EIA/TIA-592[2] | Capability-to-receive parameter | Remote |
| +FCS | EIA/TIA-592 | Current-session results parameters | Remote |
| +FCT | EIA/TIA-592 | DTE Phase-C timeout parameter | Remote |
| +FEA | EIA/TIA-592 | Phase-C received EOL-alignment parameter | Remote |

1 **Table 7.3.1-1. Fax Parameters (Part 2 of 2)**

| Parameter | Value (per) | Description | Type |
|---|---|---|---|
| +FFC | EIA/TIA-592 | Format-conversion parameter | Remote |
| +FHS | EIA/TIA-592 | Call-termination-status parameter | Remote |
| +FIE | EIA/TIA-592 | Procedure-interrupt-enable parameter | Remote |
| +FIS | EIA/TIA-592 | Current-session negotiation parameters | Remote |
| [+FLI] | EIA/TIA-592[2] | Local-ID-string parameter (TSI or CSI) | Remote |
| +FLO | EIA/TIA-592[2] | Flow-control-select parameter | Local |
| +FLP | EIA/TIA-592 | Indicate-document-to-poll parameter | Remote |
| +FMI | EIA/TIA-592 | Request DCE manufacturer identification | See 4.3.1.2.5 |
| +FMM | EIA/TIA-592 | Request DCE model | See 4.3.1.2.5 |
| +FMR | EIA/TIA-592 | Request DCE revision | See 4.3.1.2.5 |
| [+FMS] | EIA/TIA-592[2] | Minimum-Phase-C-speed parameter | Remote |
| +FNR | EIA/TIA-592 | Negotiation-message-reporting control parameters | Remote |
| +FNS | EIA/TIA-592 | Nonstandard-frame FIF parameter | Remote |
| +FPA | TIA/EIA/IS-134 | Selective Polling Address Parameter | Remote |
| [+FPI] | EIA/TIA-592[2] | Local-polling-ID-string parameter | Remote |
| [+FPP] | EIA/TIA-592[4] | Packet-protocol-control parameter | Local |
| +FPR | EIA/TIA-592 | Serial-port-rate-control parameter | Local |
| [+FPS] | EIA/TIA-592[5] | Page-status parameter | Remote |
| +FPW | TIA/EIA/IS-134 | Password parameter (Sending or Polling) | Remote |
| [+FRQ] | EIA/TIA-592[2] | Receive-quality-threshold parameters | Remote |
| +FRY | EIA/TIA-592 | ECM-retry-value parameter | Remote |
| +FSA | TIA/EIA/IS-134 | Subaddress Parameter | Remote |
| [+FSP] | EIA/TIA-592[2] | Request-to-poll parameter | Remote |

**Notes**

1. Use of option 3 may cause degradations in the quality of certain faxes.
2. Some values for this parameter are optional in EIA/TIA-592. In this standard, all parameters of this command shall be supported.
3. Class 2.0 represents EIA/TIA-592.
4. Support of packet protocol is optional.
5. Values 4 and 5 of this parameter are optional.

2 7.3.2 Fax Action Commands

**Table 7.3.2-1. Fax Action Commands**

| Command | Description | Type |
|---|---|---|
| +FDR | Receive Phase-C data. | Remote |
| +FDT | Transmit Phase-C data. | Remote |
| +FIP | Initialize facsimile parameters. | Remote |
| +FKS | Terminate session. | Remote |

## 7.4 Cellular Extensions AT Commands

AT command lines containing the commands specified in Tables 7.4.1-1, 7.4.1-2, and 7.4.1-3 start with "AT" and end with a carriage return. Default configurations appear in boldface type.

### 7.4.1 CDMA AT Parameters

**Table 7.4.1-1. CDMA AT Parameter Commands (Part 1 of 4)**

| Command | Description | Async & Fax | Packet Data | STU III |
|---|---|---|---|---|
| +CAD? | Query Analog or Digital Service.<br>Returns:<br>0 if no *service* is available<br>1 if CDMA Digital service available<br>2 if TDMA *Digital* service available<br>3 if Analog *service* is available<br>(values 4-255 reserved) | O,L | O | N/A |
| +CAU = <n> | Audio passthrough between DTE and MT2<br>**0** Audio Pass Through Disabled<br>1 Audio Pass *Through* Enabled | N/A | N/A | R,L |

| | | | | |
|---|---|---|---|---|
| +CBC? | Battery Charge.<br>Read-only. Returns <BCS>,<BCL><br>BCS:<br>0 MT2 powered by battery, BCL = status<br>1 MT2 connected to external power<br>2 Battery status not available<br>3 Recognized power fault. Calls inhibited.<br>BCL:<br>0-100 Remaining battery capacity is 0-100%. | R,L | O | N/A |
| +CBIP? | Base Station IP Address.<br>Read-only. Returns the base station's IP address. | R,L | O | N/A |
| +CDR | $U_m$ Interface Data Compression Reporting. This extended-format numeric parameter controls whether or not the extended-format "+CDR:" intermediate result code is transmitted by the MT2. The result code is the same as for the TIA/EIA/IS-131 +DR: result code. | R,L | N/A | N/A |
| +CDS | $U_m$ Interface Data Compression. This extended-format compound parameter controls the V.42*bis* data compression function on the $U_m$ interface. The command format is the same as for the TIA/EIA/IS-131 +DS command. | R,L | N/A | N/A |

| | | | | |
|---|---|---|---|---|
| +CFC=<value> | $U_m$ Interface Fax Compression.<br>**0** No compression<br>1 V.42*bis* compression with parameters as set by the +CDS command<br>2 Modified Modified Read compression | R,L | N/A | N/A |
| +CFG="<string>" | Configuration String.<br>The string (up to and including the termination character) will be stored by the MT2 and sent to the base station prior to dialing. Each transmission of an AT+CFG command from the TE2 replaces the contents of the previous string. The string may be up to 248 characters. | R,L | N/A | N/A |
| +CMIP? | Mobile Station IP Address.<br>Read-only. Returns the mobile station's temporary IP address. | R,L | N/A | N/A |
| +CMUX = <fwd>,<rev> | Select Multiplex Option<br><fwd> is the forward MUX option specified in hexadecimal format (e.g., 80A).<br><rev> is the reverse MUX option specified in hexadecimal format (note: if <rev> is omitted, it is assumed to have the same value as <fwd>) | O,L | O,L | R,L |
| +CQD=<value> | Command State Inactivity Timer (see 3.9.1.3).<br>0 Ignored<br>1-255 Release call after 5x<value> seconds have elapsed without activity. The default <value> shall be 10, corresponding to 50 seconds. | R,M | N/A | N/A |
| +CRC=<value> | Cellular Result Codes (see Table 7.4.2-1).<br>**0** Disable Cellular Result Codes<br>1 Enable Cellular Result Codes | R,M | N/A | N/A |
| +CREP=<value> | Activate Received Energy Present Indicator (Circuit 135, CK)<br>**0** Disable the indicator<br>1 Enable the indicator | O,M | N/A | N/A |

| | | | | |
|---|---|---|---|---|
| +CRM=<value> | Set $R_m$ interface protocol.<br>0 Asynchronous Data or Fax<br>1 Packet data service, Relay Layer $R_m$ interface<br>2 Packet data service, Network Layer $R_m$ interface, PPP<br>3 Packet data service, Network Layer $R_m$ interface, SLIP<br>4 STU-III Service<br>5-127 Reserved for future use<br>128-255 Reserved for manufacturer specific use<br>Note: The default value for the +CRM parameter shall be 0 if this value is supported by the MT2. If 0 is not supported, the default +CRM value shall be manufacturer specific. | R,L | R | R |
| +CSO = <n> | Change Service Option to Service Option <n>. | O,L | O,L | R,L |

| | | | | |
|---|---|---|---|---|
| +CSS? | Serving System.<br>Read-only. Returns <Band_Class>,<Band>,<SID>, <P_REV_IN_USE><br>Band_class:<br>0 The current band class is unsupported by this command.<br>1 Band Class 0 (e.g., 800 MHz Cellular) is supported.<br>2 Band Class 1 (e.g., 1900 MHz PCS) is supported.<br>Band:<br>A through F<br>If the band is *x*, the mobile station is registered with an *x*-band system under the band class specified in <Band_class>.<br>Z The mobile station is not registered.<br>SID:<br>0-16383 The mobile station is registered with the system indicated.<br>99999 The mobile station is not registered.<br>P_REV_IN_USE:<br>0 For unrecognized systems or non-CDMA systems<br>1 IS-95 or J-STD-008<br>2 IS-95-A<br>3 IS-95-A + TSB74<br>4 TIA/EIA-95-B<br>5 TIA/EIA-95-B<br>6 IS-2000<br>7 IS-2000-A<br>8 IS-2000-B<br>9 IS-2000-C<br>10 IS-2000-C | R,L | O | N/A |

| | | | | |
|---|---|---|---|---|
| +CXT=<value> | Cellular Extension.<br>**0** Do not pass unrecognized commands to the IWF.<br>1 When detecting an unrecognized AT command, open transport layer connection and pass unrecognized command to the IWF. | R,L | N/A | N/A |
| Note 1. The exact meaning of the Signal Quality Measure shall be manufacturer defined. The lowest quality reported by SQM shall be defined as value 00. The highest quality reported by SQM shall be defined as value 31.<br>Note 2. R=Required, O=Optional, M=Remote AT Command, L=Local AT Command. | | | | |

1

**Table 7.4.1-1. CDMA AT Parameter Commands (Part 2 of 4)**

| Command | Description | Async & Fax | Packet Data | STU III |
|---|---|---|---|---|
| +CDS | $U_m$ Interface Data Compression. This extended-format compound parameter controls the V.42*bis* data compression function on the $U_m$ interface. The command format is the same as for the TIA/EIA/IS-131 +DS command. | R,L | N/A | N/A |
| +CRM=<value> | Set $R_m$ interface protocol.<br>0 Asynchronous Data or Fax<br>1 Packet data service, Relay Layer $R_m$ interface<br>2 Packet data service, Network Layer $R_m$ interface, PPP<br>3 Packet data service, Network Layer $R_m$ interface, SLIP<br>4 STU-III Service<br>5-127 Reserved for future use<br>128-255 Reserved for manufacturer specific use<br>Note: The default value for the +CRM parameter shall be 0 if this value is supported by the MT2. If 0 is not supported, the default +CRM value shall be manufacturer specific. | R,L | R | R |
| +CBC? | Battery Charge.<br>Read-only. Returns <BCS>,<BCL><br>BCS:<br>0 MT2 powered by battery, BCL = status<br>1 MT2 connected to external power<br>2 Battery status not available<br>3 Recognized power fault. Calls inhibited.<br>BCL:<br>0-100 Remaining battery capacity is 0-100%. | R,L | O | N/A |

1 **Table 7.4.1-1. CDMA AT Parameter Commands (Part 3 of 4)**

| Command | Description | Async & Fax | Packet Data | STU III |
|---|---|---|---|---|
| +CQD=<value> | Command State Inactivity Timer (see 3.9.1.3).<br>0 Ignored<br>1-255 Release call after 5x<value> seconds have elapsed without activity. The default <value> shall be 10, corresponding to 50 seconds. | R,M | N/A | N/A |
| +CRC=<value> | Cellular Result Codes (see Table 7.4.2-1).<br>**0** Disable Cellular Result Codes<br>1 Enable Cellular Result Codes | R,M | N/A | N/A |
| +CMIP? | Mobile Station IP Address.<br>Read-only. Returns the mobile station's temporary IP address. | R,L | N/A | N/A |
| +CBIP? | Base Station IP Address.<br>Read-only. Returns the base station's IP address. | R,L | O | N/A |
| +CSS? | Serving System.<br>Read-only. Returns <Band_Class>,<Band>,<SID><br>Band_class:<br>0 The current band class is unsupported by this command.<br>1 800 MHz Cellular.<br>2 1900 MHz PCS.<br>Band:<br>A through F<br>If the band is *x*, the mobile station is registered with an *x*-band system under the band class specified in <Band_class>.<br>Z The mobile station is not registered.<br>SID:<br>0-16383 The mobile station is registered with the system indicated.<br>99999 The mobile station is not registered. | R,L | O | N/A |

2

1 **Table 7.4.1-1. CDMA AT Parameter Commands (Part 4 of 4)**

| Command | Description | Async & Fax | Packet Data | STU III |
|---|---|---|---|---|
| +CSQ? | Query Received Signal Quality.<br>Returns the Signal Quality Measure <SQM> and the Frame Error Rate <FER> as follows:<br>Signal Quality Measure <SQM><br>0-31 Signal Quality Measurement (see Note 1).<br>99 SQM is not known or is not detectable.<br>All other values are reserved.<br>Frame Error Rate <FER><br>0 <0.01%<br>1 0.01% to less than 0.1%<br>2 0.1% to less than 0.5%<br>3 0.5% to less than 1.0%<br>4 1.0% to less than 2.0%<br>5 2.0% to less than 4.0%<br>6 4.0% to less than 8.0%<br>7 ≥8.0%<br>99 <FER> is not known or is not detectable.<br>All other values are reserved. | R,L | O | N/A |
| AT+CSO = <n> | Change Service Option to Service Option <n>. | O,L | O,L | R,L |
| AT+CMUX = <fwd>,<rev> | Select Multiplex Option<br><fwd> is the forward MUX option specified in hexadecimal format (e.g. 80A).<br><rev> is the reverse MUX option specified in hexadecimal format (note: if <rev> is omitted, it is assumed to have the same value as <fwd>) | O,L | O,L | R,L |
| AT+CAU = <n> | Audio passthrough between DTE and MT2<br>0 Audio Pass Through Disabled<br>1 Audio Pass Through Enabled | N/A | N/A | R,L |
| +CFC=<value> | $U_m$ Interface Fax Compression.<br>**0** No compression<br>1 V.42*bis* compression with parameters as set by the +CDS command<br>2 Modified Modified Read compression | R,L | N/A | N/A |

| |
|---|
| Note 1. The exact meaning of the Signal Quality Measure shall be manufacturer defined.<br>The lowest quality reported by SQM shall be defined as value 00.<br>The highest quality reported by SQM shall be defined as value 31. |

1

2

**Table 7.4.1-2. Cellular AT Command Extensions in Support of Voice Services**

| Command | Description | Async & Fax | Packet Data | STU III |
|---|---|---|---|---|
| +CHV<value> | Hangup Voice<br>0 Hangup voice call<br>1-255 Reserved | O,L | N/A | R |
| +CDV<dial string> | Dial command for voice calls.<br>The format of <dial string> is identical to that for the ATD command. This command does not cause the MT2 to change to the online state. | O,L | N/A | R |

1 **Table 7.4.1-3. Cellular Identification AT Command Extensions (Part 1 of 2)**

| Com-mand | Value per | Description | Async & Fax | Packet Data | STU III |
|---|---|---|---|---|---|
| +CGCAP | IS-131 | This extended-format command causes the IWF to transmit one or more lines of information text in a specific format. The content is a list of additional capabilities command +<name>s, which is intended to permit the user of the IWF to identify the minimum capabilities of the IWF.<br>IWFs conforming to this standard shall include the following items, as a minimum, in the result code for the +CGCAP command:[8]<br>+CIS707, +MS, +ES, +DS, +FCLASS | O,M | N/A | N/A |
| +CGMI | IS-131 | This command causes the IWF to transmit one or more lines of information text, determined by the manufacturer, which is intended to permit the user of the IWF to identify the manufacturer. Typically, the text will consist of a single line containing the name of the manufacturer, but manufacturers may choose to provide more information if desired (e.g., address, telephone number for customer service, etc.). | O,M | N/A | N/A |
| +CGMM | IS-131 | This command causes the IWF to transmit one or more lines of information text, determined by the manufacturer, which is intended to permit the user of the IWF to identify the specific model of the device. Typically, the text will consist of a single line containing the name of the product, but manufacturers may choose to provide any information desired. | O,M | N/A | N/A |

2

[8]The +CIS707 result code indicates support of the AT commands and result codes in Tables 7.4.1-1, 7.4.1-2, 7.4.1-3 and 7.4.1-4 and 7.4.2-1.

**Table 7.4.1-3. Cellular Identification AT Command Extensions (Part 2 of 2)**

| Com-mand | Value per | Description | Async & Fax | Packet Data | STU III |
|---|---|---|---|---|---|
| +CGMR | IS-131 | This command causes the IWF to transmit one or more lines of information text, determined by the manufacturer, which is intended to permit the user of the IWF to identify the version, revision level or date, or other pertinent information of the device. Typically, the text will consist of a single line containing the version of the product, but manufacturers may choose to provide any information desired. | O,M | N/A | N/A |
| +CGOI | IS-131 | This command causes the IWF to transmit one or more lines of information text, determined by the manufacturer, which is intended to permit the user of the IWF to identify the device, based on the ISO system for registering unique object identifiers. Typically, the text will consist of a single line containing numeric strings delimited by period characters. | O,M | N/A | N/A |
| +CGSN | IS-131 | This command causes the IWF to transmit one or more lines of information text, determined by the manufacturer, which is intended to permit the user of the IWF to identify the individual device. Typically, the text will consist of a single line containing a manufacturer determined alpha-numeric string, but manufacturers may choose to provide any information desired. | O,M | N/A | N/A |
| Note: The format of these +C commands shall comply with the corresponding format of the +G commands specified in TIA/EIA/IS-131.<br>The MT2 shall treat all commands in this table as unrecognized commands (see 4.1). | | | | | |

**Table 7.4.1-4. Cellular AT Commands for Packet Data Services**

| Command | Description |
|---|---|
| +CTA=<value> | Set/Read/Test $U_m$ packet data inactivity timer.<br>0 Traffic Channel not released during inactivity periods.<br>**20**-255 Release the Traffic Channel after <value> 1-second intervals have elapsed since last sending or receiving RLP data frames on the $U_m$ interface. |
| +CPS=<value> | Select the service option to be used for packet data service. Values shall be as specified in TSB58. |
| +CPSR=<value> | Enables/disables packet call state reporting.<br>**0** Disables call state reporting<br>1 Enables call state reporting |
| +CPTC=<value> | Controls Traffic Channel state without affecting the IWF Link Layer connection.<br>**0** Release Traffic Channel<br>1 Originate Traffic Channel |
| +CPER=<value> | Enables/disables packet call event reporting.<br>**0** Disables call event reporting<br>1 Enables call event reporting |

## 7.4.2 Cellular Result Codes

**Table 7.4.2-1. Cellular Result Codes**

| Result Code | Description | Async & Fax | Packet Data | STU III |
|---|---|---|---|---|
| +CERROR: BAD REQUEST | Intercept received after call origination. | R | N/A | N/A |
| +CERROR: INIT FAILED <failed command> | Initialization string failed (see 5.1). | R | N/A | N/A |
| +CERROR: LINK FAIL | Mobile station has declared a loss of the Traffic Channel. | R | N/A | N/A |
| +CERROR: NO SERVICE | Origination was attempted while the mobile station was not able to monitor a CDMA Paging Channel. | R | N/A | N/A |
| +CERROR: NO <service option> SERVICE | The indicated service option was rejected. The <service option> shall be “ASYNC” or “FAX.” | R | N/A | N/A |
| +CERROR: PAGE FAIL | Mobile station received a page but not an alert. | R | N/A | N/A |

| | | | | |
|---|---|---|---|---|
| +CERROR: PAGED | Mobile station attempted to originate after receiving a page. | R | N/A | N/A |
| +CERROR: RELEASE | Indicates call release. | R | N/A | N/A |
| +CERROR: RESPONSE NOT SUPPORTED | Indicates that the AT command was processed properly but the proper response code is not supported. | R,L | N/A | N/A |
| +CERROR: RETRY | Reorder received after call origination. | R | N/A | N/A |
| +CPROG: ANSWER | Indicates remote DCE has answered. | R | N/A | N/A |
| +CPROG: BONGTONE | Billing Tone was detected. | R | N/A | N/A |
| +CPROG: DIALING <number> | Indicates PSTN Dialing. | R | N/A | N/A |
| +CPROG: DIALTONE | Dialtone was detected. | R | N/A | N/A |
| +CPROG: QUIET ANSWER | Indicates Quiet Answer. | R | N/A | N/A |
| +CPROG: RINGING | Indicates PSTN Ringing. | R | N/A | N/A |
| +CPROG: VOICE | Voice detected on the PSTN connection. | R | N/A | N/A |
| RING <service option> | Specifies active service option. The <service option> shall be “ASYNC”, “FAX” or “STU-III.” | R | N/A | N/A |

1 **Table 7.4.2-2. Cellular Result Codes for Packet Data Services**

| Result Code | Description |
|---|---|
| +CPACKET | May be returned after AT+CRM=1 or 2 or 3. Indicates packet data service is in the *Active State*. |
| +CPSR:<value> | Packet call state. Sent autonomously when +CPSR=1.<br>0 Packet data service is in the *Inactive State*<br>1 Packet data service is in the *Active State*, and the call control function is in the *Initialization/Idle State*<br>2 Packet data service is in the *Active State*, and the call control function is in the *Initialization/Traffic State*<br>3 Packet data service is in the *Active State*, the call control function is in the *Connected State,* and the packet data service option is using primary traffic<br>4 Packet data service is in the *Active State*, the call control function is in the *Connected State,* and the packet data service option is using secondary traffic<br>5 Packet data service is in the *Active State*, and the call control function is in the *Dormant/Idle State*<br>6 Packet data service is in the *Active State*, and the call control function is in the *Dormant/Traffic State*<br>7 Packet data service is in the *Active State*, and the call control function is in the *Reconnect/Idle State*<br>8 Packet data service is in the *Active State*, and the call control function is in the *Reconnect/Traffic State*<br>9-255 Reserved |
| +CPER:<value> | Packet call event. Sent autonomously when +CPER=1.<br>0 Enter Idle State<br>1 Idle handoff, same system<br>2 Idle handoff, new system<br>3 Page received<br>4 Origination sent<br>5 Traffic Channel assigned<br>6 Hard handoff<br>7-255 Reserved |
| +CERROR: LINK FAIL | Mobile station has declared a loss of the Traffic Channel |
| +CERROR: NO SERVICE | Mobile station is not able to monitor a Paging Channel |
| +CERROR: RETRY | Reorder received during reconnect attempt |

2

# 8 ANNEX A: IS-707 REFLECTION EXAMPLES

## 8.1 Introduction

This annex contains two examples citing how an MT2 and IWF would send responses for various commands. Each example shows both the expected action in verbose mode (the V parameter is set to 1) and non-verbose mode (the V parameter is set to 0).

Consider a command AT+ABC? which would return a single line containing ten copies of each of the letters of the alphabet followed by a CR/LF pair (i.e., 260 characters prior to the <CR><LF>). Let us also say that there was a command called AT+Q94? which returns a single line consisting of 94 occurrences of the letter Q followed by a CR/LF pair. Using these fabricated commands, we can give the following examples of how to handle information responses which have 94 or more characters on a single line.

Also, consider the real commands S0?, and +GMM, both of which yield informational responses prior to their result codes.

Suppose the user enters the command line:

at+ABC?+Q94?<CR> See Example 1 (Section A.2)

or

atS0?+GMM<CR> See Example 2 (Section A.3)

The figure below shows the sequence of events. All reflection messages are shown in thick lines.

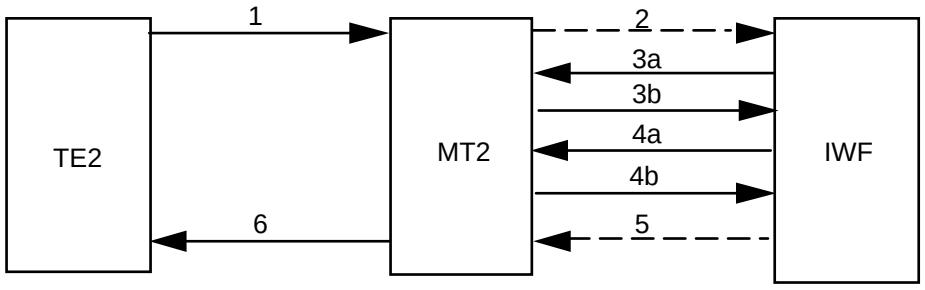


**Figure A.1-1. Sequence of Events for Command Responses**

The AT command line entered by the user (1) is passed on by the MT2 to the IWF (2). The IWF reflects the first AT command back to the MT2 (3a) and waits for a response from it (3b). The second command is then reflected to the MT2 (4a), after which the MT2's response is received (4b). Lastly, the IWF sends the result message (5) to the MT2 to be forwarded to the user terminal (6).

## 8.2 Example 1: User Enters at+ABC?+Q94?<CR>

### 8.2.1 Verbose Mode

The format of the first IWF reflected AT commands and responses are given below.

**IWF Reflect (Step 3a, Figure A.1-1):**

Hex Code (IS-707): <0x19><0x60><len><0x42><string>

| **Actual Stream Sent by the IWF to the MT2** |
|---|
| <0x19><0x60><0x25><0x42>+ABC? |

**MT2 Response (Step 3b, Figure A.1-1):**

Hex Code (IS-707): <0x19><0x41><len><0x47><string>

| **Actual Stream Sent by the IWF to the MT2** | **Representative of** |
|---|---|
| <0x41><0x20><0x47> | <CR><LF> |
| <0x19><0x41><0x7E><0x47>aaa…ddd….iiijjjj | 10 a's10b's … 4j's |
| <0x19><0x41><0x7E><0x47>jjjjjj….rrrsssssssss | 6j's10k's … 10r's8s's |
| <0x19><0x41><0x68><0x47>ssttt…yyyzzzzzzzzzz | 2s's10t's … 10z's<CR><LF> |
| <0x19><0x41><0x20><0x47> | <CR><LF> |
| <0x19><0x41><0x22><0x46>OK | OK<CR><LF> |

**IWF Reflect (Step 4a, Figure A.1-1):**

Hex Code (IS-707): <0x19><0x60><len><0x42><string>

| **Actual Stream Sent by the IWF to the MT2** |
|---|
| <0x19><0x60><0x25><0x42>+Q94? |

**MT2 Response (Step 4b, Figure A.1-1):**

Hex Code (IS-707): <0x19><0x41><len><0x47><string>

| Actual Stream Sent by the IWF to the MT2 | Representative of |
|---|---|
| <0x19><0x41><0x20><0x47> | <CR><LF> |
| <0x19><0x41><0x7E><0x47>QQQQ … QQQQQ | 94Q's |
| <0x19><0x41><0x20><0x47> | <CR><LF> |
| <0x19><0x41><0x20><0x47> | <CR><LF> |
| <0x19><0x41><0x22><0x46>OK | OK<CR><LF> |

**The result string returned by the IWF (Step 5, Figure A.1-1) is of the form:**

Hex Code (IS-707): <0x19><0x61><len><0x43><string>

| Actual Stream Sent by the IWF to the MT2 | Representative of |
|---|---|
| <0x19><0x61><0x20><0x43> | <CR><LF> |
| <0x19><0x61><0x7E><0x43>aaaaa……jjjj | 10a's10b's … 4j's |
| <0x19><0x61><0x7E><0x43>jjjjjj…ssssssss | 6j's10k's … 8s's |
| <0x19><0x61><0x68><0x43>ss..yyyyzzzzzzzzzz | 2s's10t's … 10z's<CR><LF> |
| <0x19><0x61><0x20><0x43> | <CR><LF> |
| <0x19><0x61><0x7E><0x43>QQQQ….QQQQ | 94Q's |
| <0x19><0x61><0x20><0x43> | <CR><LF> |
| <0x19><0x61><0x20><0x43> | <CR><LF> |
| <0x19><0x60><0x22><0x62>OK | OK<CR><LF> |

### 8.2.2 Non-Verbose Mode

The format of the first IWF reflected AT commands and responses are given below.

**IWF Reflect (Step 3a, Figure A.1-1):**

Hex Code (IS-707): <0x19><0x60><len><0x42><string>

| Actual Stream Sent by the IWF to the MT2 |
|---|
| <0x19><0x60><0x25><0x42>+ABC? |

**MT2 Response (Step 3b, Figure A.1-1):**

Hex Code (IS-707): <0x19><0x41><len><0x47><string>

| Actual Stream Sent by the IWF to the MT2 | Representative of |
|---|---|
| <0x19><0x41><0x7E><0x47>aaaaa….iiiii….jjjj | 10a's10b's … 4j's |
| <0x19><0x41><0x7E><0x47>jjjjjj….rrrrrsssssss | 6j's10k's … 8s's |
| <0x19><0x41><0x68><0x47>ss…..yyyyzzzzzzzzzz | 2s's10t's… 10z's<CR><LF> |
| <0x19><0x41><0x21><0x46>0 | 0<CR> |

**IWF Reflect (Step 4a, Figure A.1-1):**

Hex Code (IS-707): <0x19><0x60><len><0x42><string>

| Actual Stream Sent by the IWF to the MT2 |
|---|
| <0x19><0x60><0x25><0x42>+Q94? |

**MT2 Response (Step 4b, Figure A.1-1):**

Hex Code (IS-707): <0x19><0x41><len><0x47><string>

| Actual Stream Sent by the IWF to the MT2 | Representative of |
|---|---|
| <0x19><0x41><0x7E><0x47>QQQQ….QQQQ | 94Q's |
| <0x19><0x41><0x20><0x47> | <CR><LF> |
| <0x19><0x41><0x21><0x46>0 | 0<CR> |

**The result string returned by the IWF (Step 5, Figure A.1-1) is of the form:**

Hex Code (IS-707): <0x19><0x61><len><0x43><string>

| Actual Stream Sent by the IWF to the MT2 | Representative of |
|---|---|
| <0x19><0x61><0x7E><0x43>aaaaa……jjjj | 10a's10b's … 4j's |
| <0x19><0x61><0x7E><0x43>jjjjjj……ssssssss | 6j's10k's … 8s's |
| <0x19><0x61><0x68><0x43>ss..yyyyzzzzzzzzzz | 2s's10t's…10z's<CR><LF> |
| <0x19><0x61><0x7E><0x43>QQQQ….QQQQ | 94Q's |
| <0x19><0x61><0x20><0x43> | <CR><LF> |
| <0x19><0x60><0x21><0x62>0 | 0<CR> |

## 8.3 EXAMPLE 2: User Enters atS0?+GMM<CR>

### 8.3.1 Verbose Mode

The format of the first IWF reflected AT commands and responses are given below.

**IWF Reflect (Step 3a, Figure A.1-1):**

Hex Code (IS-707): <0x19><0x60><len><0x42><string>

| Actual Stream Sent by the IWF to the MT2 |
|---|
| <0x19><0x60><0x23><0x42>S0? |

**MT2 Response (Step 3b, Figure A.1-1):**

Hex Code (IS-707): <0x19><0x41><len><0x47><string>

| Actual Stream Sent by the IWF to the MT2 | Representative of |
|---|---|
| <0x19><0x41><0x20><0x47> | <CR><LF> |
| <0x19><0x41><0x23><0x47>000 | 000<CR><LF> |
| <0x19><0x41><0x20><0x47> | <CR><LF> |
| <0x19><0x41><0x22><0x46>OK | OK<CR><LF> |

**IWF Reflect (Step 4a, Figure A.1-1):**

Hex Code (IS-707): <0x19><0x60><len><0x42><string>

| Actual Stream Sent by the IWF to the MT2 |
|---|
| <0x19><0x60><0x24><0x42>+GMM |

**MT2 Response (Step 4b, Figure A.1-1):**

Hex Code (IS-707): <0x19><0x41><len><0x47><string>

| Actual Stream Sent by the IWF to the MT2 | Representative of |
|---|---|
| <0x19><0x41><0x20><0x47> | <CR><LF> |
| <0x19><0x41><0x25><0x47>REV B | REV B<CR><LF> |
| <0x19><0x41><0x2B><0x47>Model QC-M2 | Model QC-M2<CR><LF> |
| <0x19><0x41><0x20><0x47> | <CR><LF> |
| <0x19><0x41><0x22><0x46>OK | OK<CR><LF> |

**The result string returned by the IWF (Step 5, Figure A.1-1) is of the form:**

Hex Code (IS-707): <0x19><0x61><len><0x43><string>

| Actual Stream Sent by the IWF to the MT2 | Representative of |
|---|---|
| <0x19><0x61><0x20><0x43> | <CR><LF> |
| <0x19><0x61><0x23><0x43>000 | 000<CR><LF> |
| <0x19><0x61><0x20><0x43> | <CR><LF> |
| <0x19><0x61><0x25><0x43>REV B | Rev B<CR><LF> |
| <0x19><0x61><0x2B><0x43>Model QC-M2 | Model QC-M2<CR><LF> |
| <0x19><0x61><0x20><0x43> | <CR><LF> |
| <0x19><0x60><0x22><0x62>0K | OK<CR><LF> |

### 8.3.2 Non-Verbose Mode

The format of the first IWF reflected AT commands and responses are given below.

**IWF Reflect (Step 3a, Figure A.1-1):**

Hex Code (IS-707): <0x19><0x60><len><0x42><string>

| Actual Stream Sent by the IWF to the MT2 |
|---|
| <0x19><0x60><0x23><0x42>S0? |

**MT2 Response (Step 3b, Figure A.1-1):**

Hex Code (IS-707): <0x19><0x41><len><0x47><string>

| Actual Stream Sent by the IWF to the MT2 | Representative of |
|---|---|
| <0x19><0x41><0x23><0x47>000 | 000<CR><LF> |
| <0x19><0x41><0x21><0x46>0 | 0<CR> |

**IWF Reflect (Step 4a, Figure A.1-1):**

Hex Code (IS-707): <0x19><0x60><len><0x42><string>

| Actual Stream Sent by the IWF to the MT2 |
|---|
| <0x19><0x60><0x24><0x42>+GMM |

**MT2 Response (Step 4b, Figure A.1-1):**

Hex Code (IS-707): <0x19><0x41><len><0x47><string>

| **Actual Stream Sent by the IWF to the MT2** | **Representative of** |
|---|---|
| <0x19><0x41><0x25><0x47>REV B | REV B<CR><LF> |
| <0x19><0x41><0x2B><0x47>Model QC-M2 | Model QC-M2<CR><LF> |
| <0x19><0x41><0x21><0x46>0 | 0<CR> |

The result string returned by the IWF (Step 5, Figure A.1-1) is of the form:

Hex Code (IS-707): <0x19><0x61><len><0x43><string>

| **Actual Stream Sent by the IWF to the MT2** | **Representative of** |
|---|---|
| <0x19><0x61><0x23><0x43>000 | 000<CR><LF> |
| <0x19><0x61><0x25><0x43>REV B | Rev B<CR><LF> |
| <0x19><0x61><0x2B><0x43>Model QC-M2 | Model QC-M2<CR><LF> |
| <0x19><0x60><0x21><0x62>0 | 0<CR> |

This page left intentionally blank.