



ISATDATA PRO: MODEM MESSAGES

VERSION 1.2

PUBLICATION DATE: 12-FEB-2021

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1: Introduction

IsatData Pro (IDP) is a global L-band satellite network service optimized for Machine-to-Machine (M2M) and Internet of Things (IoT) applications. IsatData Pro is intended for event-driven data collection and remote control, but also enables applications such as forms and text messaging through Human-Machine Interfaces. Typical applications include tracking, fleet management, security, remote monitoring, telematics and SCADA.

For more detail, refer to the *IsatData Pro Service Description* document.

1.1: Scope and purpose

This document provides a specification of the Core Modem messages that are available to remotely address core modem functions. More information on the methods on exchanging message with the IDP modem is available in the *IsatData Pro API: Messaging API* document.

1.2: Intended audience

This document is intended for technical users, support and system engineering resources.

1.3: Documents Referenced

- > *IsatData Pro Service Description*
- > *IsatData Pro API: Messaging API*

Documents are available in the IsatData Pro section on the Inmarsat Developer Portal:

<https://developer.inmarsat.com>

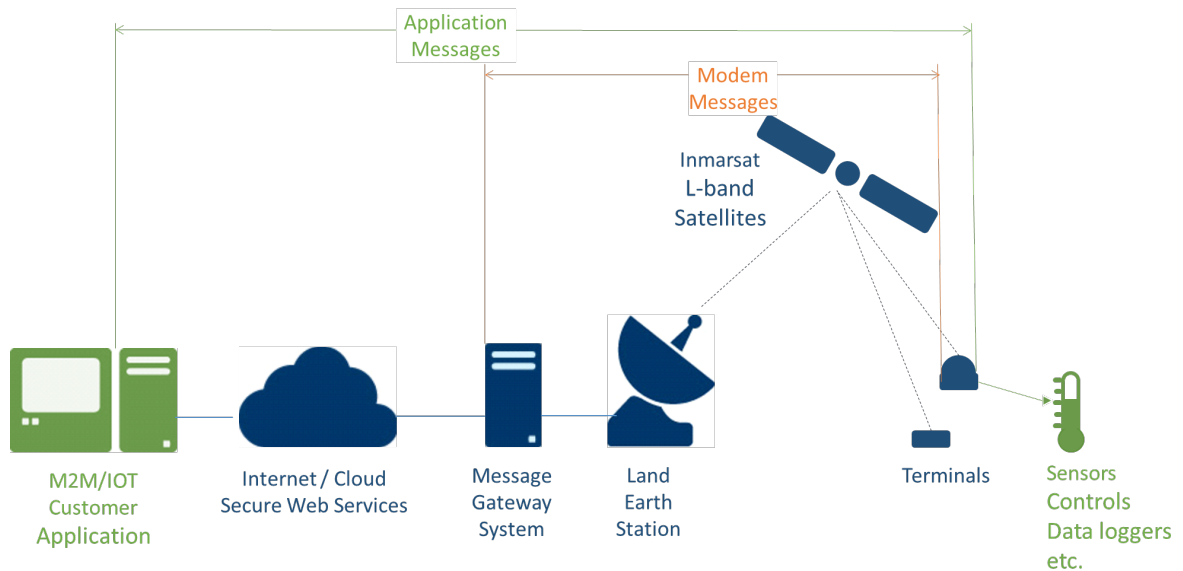
1.4: Notation

In the specification in this document the following notation is used

Item	Description	Example
0xnn	denoting a hexadecimal number	0x10: value 16
Bitn	Denoting a n-bit data element	Bit4: 4-bit value 0-15 Bit16: 16-bit value 0-65535
From-Mobile	Return or Mobile-Originated messages	
To-Mobile	Forward or Mobile-Terminated	

2: IsatData Pro Core Modem Messages

Core modem messages are system-defined operations fundamental to the operation of all IDP modems or terminals. In most cases core modem messages are rarely used by a service provider or customer application, but can be useful for certain remote configuration and troubleshooting operations.



2.1: Message Format

All IsatData Pro messages consist of a serial stream of bytes. The Service Identification Number (SIN) and Message Identification Number (MIN) are the first two bytes of each message. Together the SIN and MIN can be used to uniquely identify a remote operation (message identifier) within a set of related functions (service identifier). SIN values 0x00 through 0x0F (0..15) are reserved for system and manufacturer-specific use. SIN values 0x10 and higher (16..255) may be used for customer applications.

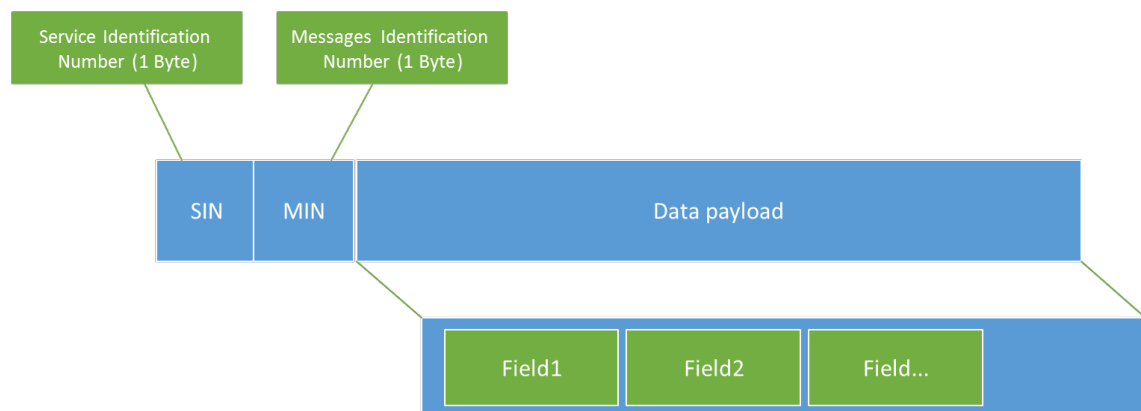


Figure 1. Message format

All IDP terminals support a number of "core modem" system messages with SIN value 0x00 (zero) that allow for remote query and configuration of the IDP modem. All core modem messages make use of the SIN and MIN bytes, followed by operation-specific data fields. The data fields in the core modem messages are encoded as little Endian, network byte order - for example an 8-bit field binary value 01101101 would represent a decimal value 109, or a bitmask with bit zero value of 1.

MIN values are used to distinguish individual operations or data sets within a given service. In most cases, MIN are context dependent on the direction of communication. In the case of the core modem service the same MIN is used in both directions of communication for request-reply operations. *Table 1* illustrates an example of such a request/reply pair.

Direction	SIN	MIN	Description	Details
To-Mobile	0x00	0x48	Request Position	Query GPS location
From-Mobile	0x00	0x48	Reply Position	Respond to GPS query

Table 1. Message Types

Core modem service messages can be summarized into various functional groups, described in more detail below:

- > (Automatic) Modem Operation
- > Remote Configuration
- > Remote Query

2.2: Synchronous Low Power Operation

Synchronous low power operation is an optional system feature supported by some modem manufacturers. The concept is that the modem conserves power by shutting down all non-critical subsystems and wakes up periodically on a predetermined interval to listen for possible to-mobile messages. Any to-mobile messages submitted by the customer application will be queued in the network and automatically delivered when the modem wakes up. If no to-mobile messages are pending, the modem can immediately revert to its low power state within 5 seconds of wakeup. The valid wakeup intervals are defined by Inmarsat as an enumerated list detailed below.

WakeupInterval	Description
0	None. Modem will receive every 5 seconds.
1	30 seconds
2	60 seconds
3	3 minutes
4	10 minutes
5	30 minutes
6	2 minutes
7	5 minutes
8	15 minutes

WakeupInterval	Description
9	20 minutes
10..255	Reserved for future use

Table 2. Modem Wakeup Intervals

2.3: Modem Operation messages

2.3.1: Modem Registration (From-Mobile MIN 0)

A modem registration message is sent by the modem automatically after a power-up or reset. The modem registration message requests access to the network. If the modem is activated and authorized, the network will reply with a Registration Reply Message (see [Beam Change Notification \(From-Mobile MIN 1\)](#) on page 8) enabling regular data communications.

Customer applications cannot communicate with a modem if the modem has not registered successfully at least once. Each modem registration message is delivered to the modem's assigned mailbox for use by the Customer application.

Field	Description	Size [bits]
SIN	Service Identification Number 0x00 - core modem	8
MIN	Message Identification Number 0x00 - modem registration	8
HwVersion	Modem hardware version (manufacturer specific)	16
SwVersion	Modem software version (manufacturer specific)	16
ProductId	Modem product identifier (manufacturer specific)	8
WakeupInterval	Modem wakeup interval (see <i>Table 2</i>)	8
LastResetReason	Specifies the reason for registration (enumerated type) 0 - Unknown 1 - Power On 2 - New traffic channel (virtual carrier) 3 - Local/External Reset 4 - Remote Reset Message 5 - Low Voltage / Brown Out 6 - Watchdog 7 - Software 8..255 - reserved / manufacturer specific	8
VirtualCarrierId	Specifies the to-mobile traffic channel in use (0 = invalid/error)	12
BeamNumber	Specifies the beam number of the traffic channel in use (0 = invalid/error)	4

Field	Description	Size [bits]
VAIN	Reserved for Inmarsat Use	16
Reserved	Reserved for Manufacturer Use	2
OperatorTxState	Operator Transmission Control Level 0 - normal 1..4 - reserved 5 - muted (SIN 0 messages only) 6..7 - reserved	3
UserTxState	Customer Transmission Control Level 0 - normal 1..4 - reserved 5 - muted (SIN 0 messages only) 6..7 - reserved	3
BroadcastIdCount	Number of broadcast IDs provisioned in the modem	8

2.3.2: Beam Change Notification (From-Mobile MIN 1)

A beam change notification is sent by the modem when it changes beams due to a change in location or better signal.

Each beam change message is delivered to the modem's assigned mailbox for optional notification to the customer application.

Field	Description	Size [bits]
SIN	Service Identification Number 0x00 - core modem	8
MIN	Message Identification Number 0x01 - beam change	8
VirtualCarrierId	Specifies the to-mobile traffic channel in use (0 = invalid/error)	12
beamNumber	Specifies the beam number of the traffic channel in use (0 = invalid/error)	4

2.3.3: Modem Error (From-Mobile MIN 2)

The modem error message is returned when the modem encounters an error that prevents successful to-mobile message processing.

Modem error messages are delivered to the modem's assigned mailbox for notification to the customer application.

Field	Description	Size [bits]
SIN	Service Identification Number 0x00 - core modem	8
MIN	Message Identification Number 0x02 - modem/protocol error	8
Reserved	Reserved	5
MessageReferenceNumber	A reference number of the to-mobile message causing this error (0..2047)	11
errorCode	Specifies the particular error encountered 0 - reserved 1 - unable to allocate message buffer 2 - unknown message type (invalid MIN) 3..255 - reserved	8
errorInfo	If errorCode=2, this byte contains the offending MIN	8

2.4: Remote Configuration

2.4.1: Reset (To-Mobile MIN 68)

The Reset message can be used to cause various types of resets on the remote device.

Reset types 2 and 3 may be supported by some manufacturers as a means to trigger a reset of a host application connected to the modem. Contact your modem manufacturer for details.

Field	Description	Size [bits]
SIN	Service Identification Number 0x00 - core modem	8
MIN	Message Identification Number 0x44 - reset	8
ResetType	Indicates the type of reset (enumerated type) 0 - "modemPreserve" Messages are re-attempted following reset. 1 - "modemFlush" messages are flagged as not delivered. Messages are not reattempted after the reset. 2 - (optional, manufacturer-dependent) "Terminal" host application reset 3 - "TerminalModemFlush" combines reset type 1 and 2 4-255 - Reserved	8

2.4.2: Set Wake-up Interval (To-Mobile MIN 70)

The set wakeup interval message configures a modem operating in synchronous low power mode. A corresponding from-mobile MIN 70 response will be sent by the modem.

Support for synchronous low power operation is optional and manufacturer-dependent.

Field	Description	Size [bits]
SIN	Service Identification Number 0x00 - core modem	8
MIN	Message Identification Number 0x46 - set wakeup interval	8
WakeupInterval	Duration between modem wakeups to receive (see <i>Table 2</i>)	8
Reserved	Reserved	8

2.4.3: Wakeup Interval Changed (From-Mobile MIN 70)

The wakeup interval changed message is sent by the modem to confirm that a new wakeup interval has been set. The wakeup interval could be changed remotely using to-mobile SIN 0 MIN 70, or locally via the modem's serial port.

Not all modems support synchronous low power operation. However the wakeup interval changed message will be sent even if the modem does not support low power mode - in this case the confirmation will be returned with wakeup interval value of 0.

Field	Description	Size [bits]
SIN	Service Identification Number 0x00 - core modem	8
MIN	Message Identification Number 0x46 - wakeup interval changed	8
WakeupInterval	Interval between modem wakeups to receive (see <i>Table 2</i>)	8
LocallyInitiated	Flag indicates if the change was initiated locally via the modem. 0 - initiated remotely (to-mobile SIN 0 MIN 70) 1 - initiated locally	1
setWakeupMsgRefNo	Message reference number of the to-mobile request. Set to 0 if request was locally initiated.	11
Reserved	Reserved	4

2.4.4: Mute/Unmute Transmit (To-Mobile MIN 71)

The mute message can be used to remotely control modem transmit capability.

If muteFlag is set to 1 (mute) then the modem will not be able to send any messages except for registration, beam login messages and responses to SIN 0 to-mobile messages.

Field	Description	Size [bits]
SIN	Service Identification Number 0x00 - core modem	8
MIN	Message Identification Number 0x47 - mute/unmute transmit	8
Reserved	Reserved	7
muteFlag	Flag that sets the Modem transmission state. 0 - normal (unmuted) 1 - muted (SIN 0 messages only)	1

2.4.5: Subscribe to Broadcast Group

This message is used to provision up to 16 Broadcast IDs onto the modem. Each broadcast ID uses only the 8-digit numeric preamble of the full ID.

Field	Description	Size [bits]
SIN	Service Identification Number 0x00 - core modem	8
MIN	Message Identification Number 0x24 - reply broadcast IDs	8
id[n]	Array of up to n=16 Broadcast ID fields, each 24 bits long	24 (x n)

2.5: Remote Query Services

2.5.1: Request Position (To-Mobile MIN 72)

The request position message polls the modem for its location. The modem responds by sending a reply position message (from-mobile SIN 0 MIN 72).

Field	Description	Size [bits]
SIN	Service Identification Number 0x00 - core modem	8
MIN	Message Identification Number 0x48 - request position	8

2.5.2: Reply Position (From-Mobile MIN 72)

The reply position message is sent in response to the request position message (to-mobile SIN 0 MIN 72).

Field	Description	Size [bits]
SIN	Service Identification Number 0x00 - core modem service	8
MIN	Message Identification Number 0x48 - reply position	8
fixStatus	Status of GNSS fix 0 - invalid 1 - valid 2..255 - reserved	8
latitude	Latitude in 0.001 minutes (2's complement)	24
longitude	Longitude in 0.001 minutes (2's complement)	25
altitude	Altitude in meters (2's complement)	15
speed	Speed in km/h	8
heading	Heading in 2° increments (North = 0)	8
DayOfMonth	Day of Month GNSS fix taken (1..31, other values invalid)	5
MinuteOfDay	Minutes of Day GNSS fix taken (0..1439 UTC, other values invalid)	11

2.5.3: Request Configuration (To-Mobile MIN 97)

The request configuration message queries the status and configuration of the modem.

Field	Description	Size [bits]
SIN	Service Identification Number 0x00 - core modem	8
MIN	Message Identification Number 0x61 - request configuration	8

2.5.4: Reply Configuration (From-Mobile MIN 97)

The reply configuration message is sent by the modem in response to the request configuration to-mobile message. The reply contains the same content as the modem registration (from-mobile SIN 0 MIN 0) message. The modem should be reset if there are inconsistencies in this data.

Field	Description	Size [bits]
SIN	Service Identification Number 0x00 - core modem	8
MIN	Message Identification Number 0x61 - reply configuration	8
(remaining fields)	See description of modem registration message (from-mobile SIN 0 MIN 0)	(104)

2.5.5: Request Modem Last Rx Info (To-Mobile MIN 98)

The request last Rx info message queries diagnostic information about the last message received by the modem.

Field	Description	Size [bits]
SIN	Service Identification Number 0x00 - core modem	8
MIN	Message Identification Number 0x62 - request last Rx info	8

2.5.6: Reply Modem Last Rx Info (From-Mobile MIN 98)

The reply last Rx info message is sent by the modem in response to the corresponding request message.

Field	Description	Size [bits]
SIN	Service Identification Number 0x00 - core modem	8
MIN	Message Identification Number 0x62 - reply last Rx info	8
sipValid	System Information Segment was valid (1 = true)	1
SubframeNumber	Valid range is 0..17279	15
NumSegmentsDetected	Segments detected	8
NumSegmentsOk	Segments successfully decoded	8
FrequencyOffset	Measured frequency offset in 0.1Hz increments	9
TimingOffset	Measured time offset in milliseconds	5
segmentCN0	Carrier to Noise ratio of segments in 0.1 increments	9
uwCN0	Carrier to Noise ratio of unique words in 0.1 increments	9
uwRSSI	Unique word signal strength	32
NumUWSymbols	Unique word symbols count	16
NumUWErrors	Unique word errors count	16
NumSegmentSymbols	Segment symbols count	16
NumSegmentErrors	Segment errors count	16

2.5.7: Request Modem Receive Metrics (To-Mobile MIN 99)

The request modem receive (forward link) metrics message queries diagnostic information about the forward (to-mobile) link measured by the modem.

Field	Description	Size [bits]
SIN	Service Identification Number 0x00 - core modem	8

Field	Description	Size [bits]
MIN	Message Identification Number 0x63 - request modem receive metrics	8
Reserved	Reserved	4
MetricsPeriod	Period over which metrics are reported (enumerated type): 0 - reserved 1 - Last partial minute 2 - Last full minute 3 - Last partial hour 4 - Last full hour 5 - Last partial day 6 - Last full day 7..15 - reserved	4

2.5.8: Reply Modem Receive Metrics (From-Mobile MIN 99)

The reply modem receive (forward link) metrics message returns diagnostic information for the corresponding request.

Field	Description	Size [bits]
SIN	Service Identification Number 0x00 - core modem	8
MIN	Message Identification Number 0x63 - reply modem receive metrics	8
Reserved	Reserved	4
MetricsPeriod	Period over which metrics are reported (enumerated type): 0 - reserved 1 - Last partial minute 7 - Last full minute 7 - Last partial hour 7 - Last full hour 5 - Last partial day 6 - Last full day 7..15 - reserved	4
numSegments	Total number of received segments	32
numSegmentsOk	Total number of segments successfully decoded	32

Field	Description	Size [bits]
AvgCN0	Average C/No in 0.1 increments	9
SamplesCN0	Number of samples used in the C/No average	15
ChannelErrorRate	Total channel error rate percentage	8
uwErrorRate	Total unique word error rate percentage	8

2.5.9: Request Modem Transmit Metrics (To-Mobile MIN 100)

The request modem transmit (return link) metrics message queries diagnostic information about the return (from-mobile) link measured by the modem.

Field	Description	Size [bits]
SIN	Service Identification Number 0x00 - core modem	8
MIN	Message Identification Number 0x64 - request modem transmit metrics	8
Reserved	Reserved	4
MetricsPeriod	Period over which metrics are reported (enumerated type): 0 - reserved 1 - Last partial minute 7 - Last full minute 7 - Last partial hour 7 - Last full hour 5 - Last partial day 6 - Last full day 7..15 - reserved	4

2.5.10: Reply Modem Transmit Metrics (From-Mobile MIN 100)

The reply modem transmit metrics message returns diagnostic information for the corresponding request.

Field	Description	Size [bits]
SIN	Service Identification Number 0x00 - core modem	8
MIN	Message Identification Number 0x64 - request modem transmit metrics	8

Field	Description	Size [bits]
Reserved	Reserved	4
MetricsPeriod	Period over which metrics are reported (enumerated type): 0 - reserved 1 - Last partial minute 2 - Last full minute 3 - Last partial hour 4 - Last full hour 5 - Last partial day 6 - Last full day 7..15 - reserved	4
MaskSegmentTypes	A bitmask of which segment types (coding rates) have non-zero statistics. The statistics follow in the arrays. Bit 0 - Acknowledgements Bit 1 - 0.5s subframe, 1/3 rate coding Bit 2 - 0.5s subframe, 1/2 rate coding Bit 3 - 0.5s subframe, 3/4 rate coding Bit 4 - reserved Bit 5 - 1s subframe, 1/3 rate coding Bit 6 - 1s subframe, 1/2 rate coding The number of ones in the bitmask specifies the size of the array. Rates with no statistics are not reported. For example, if the bitmask contains all 0, no array would follow. Another example, the bitmask 00100100 has the first array for 0.5s 1/2 rate coding, and the second array for 1s 1/3 rate coding.	8
Array [n].NumSegmentsSent	Total number of segments transmitted at this coding rate	32 (x n)
Array [n].TxSegmentsSuccess	Number of successful segments (acknowledged)	32 (x n)
Array [n].TxSegmentsFailed	Number of failed segments (unacknowledged)	32 (x n)

2.5.11: Ping Modem Request (To-Mobile MIN 112)

The ping modem message can be sent to the modem to solicit a ping reply (from-mobile SIN 0 MIN 112). The sender can provide a timestamp (seconds since midnight UTC) that will be returned in the

response together with a timestamp from the modem.

Field	Description	Size [bits]
SIN	Service Identification Number 0x00 - core modem	8
MIN	Message Identification Number 0x70 - ping modem request	8
requestSent	Time this request was submitted to the Gateway (modulo of seconds since midnight UTC). Must be set by the customer application	16

2.5.12: Ping Modem Reply (From-Mobile MIN 112)

The ping modem reply message is sent by the modem in response to the ping modem request (to-mobile SIN 0 MIN 112). If the request contained a user timestamp it will be returned in the ping reply.

Field	Description	Size [bits]
SIN	Service Identification Number 0x00 - core modem	8
MIN	Message Identification Number 0x70 - ping modem reply	8
requestSent	Time the original request was sent (modulo of seconds since midnight UTC). Copied by the modem from the ping modem request message	16
replySent	Time this reply was created by the modem (modulo of seconds since midnight UTC)	16

2.5.13: Ping Network Request (From-Mobile MIN 113)

The ping network request message can be sent locally to the modem by a user application/host to solicit a corresponding reply from the gateway.

Element	Description	Size [bits]
SIN	Service Identification Number 0x00 - core modem	8
MIN	Message Identification Number 0x71 - ping network request	8
requestSent	Time this request was submitted locally to the modem (seconds since midnight UTC)	16

2.5.14: Ping Network Reply (To-Mobile MIN 113)

The ping network reply message is sent by the gateway in response to the ping network request (from-mobile SIN 0 MIN 113) message.

Field	Description	Size [bits]
SIN	Service Identification Number 0x00 - core modem	8
MIN	Message Identification Number 0x71 - ping network reply	8
requestSent	Time the original request was sent (seconds since midnight UTC). Copied by the network from the ping network request message	16
replySent	Time the reply was created by the network (seconds since midnight UTC)	16

2.5.15: Request Broadcast IDs To Mobile (From-Mobile MIN 115)

The request broadcastIDs message is used to query broadcast IDs provisioned in the modem. The modem responds with a list of broadcast IDs using reply broadcastIDs (from-mobile SIN 0 MIN 115).

Field	Description	Size [bits]
SIN	Service Identification Number 0x00 - core modem	8
MIN	Message Identification Number 0x73 - request broadcast IDs	8

2.5.16: Reply Broadcast IDs (From-Mobile MIN 115)

The reply broadcast IDs message is the response to the request broadcast IDs message, and contains the entire list of up to 16 broadcast IDs. An ID value of 0 represents null (no broadcast ID provisioned).

Field	Description	Size [bits]
SIN	Service Identification Number 0x00 - core modem	8
MIN	Message Identification Number 0x73 - reply broadcast IDs	8
id[n]	Array of up to n=16 Broadcast ID fields, each 24 bits long	24 (x n)