OpenAMIP Standard

ST Engineering

Version 1.17

Revision F

October 30, 2020

powered by Newtec iDirect

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Document Name: OpenAMIP_Standard_T0000682_RevF_10302020.pdf

Document Part Number: T0000682

Revision History

The following table shows all revisions for this document. To determine if this is the latest revision, check the Technical Assistance Center (TAC) Web site. Refer to on page viii for TAC access information.

Revision	Date	Updates
A	August 4, 2015	• First release of the OpenAMIP Standard (version 1.8) document in iDirect Technical Publications template. For changes from version 1.7 to 1.8, see *Modified OpenAMIP* on page 44. • The time parameter of the w command is now made mandatory. See *Message Types, Sender (M)* on page 5.
B	October 12, 2016	Updated to OpenAMIP Standard version 1.9 to 1.12.
C	November 1, 2016	Updated “w, W, H, and C” type message descriptions.
D	September 8, 2017	Here are the changes from version 1.12 to 1.16: • Time is now always accepted as float. • New reserved parameters in "N" and "s" messages. • New parameter in "s" message for detailed enumerated status code. • New reserved parameter in "F" message and new reserved "f" message. • Reason Code = 0 should be used when the modem may transmit. • Added a note about optional parameters in 2.1. • Added an example of 's' in a blockage zone in 2.6.2. • Deleted Section 3.1.1; it was redundant with the Revision History.
E	September 27, 2018	Updated the F message to remove unsupported descriptions.

F	October 30, 2020	OpenAMIP Standard version 1.17 release, with the following enhancements: • Significant new commands and modifications to existing commands • Modem commands extended with new parameters: B, F, H, I, L, M, N, P, S, T, V, W, Y • New Modem commands: G, O, R • *Message Types, Sender (M)* on page 5 • Antenna commands extended with new parameters: i, s, v, w, y • New Antenna commands: g • *Message Types, Sender (A)* on page 22 • Added new status codes: • *Antenna Status Codes* on page 34

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About

Purpose

This document describes the Open Antenna Modem Interface Protocol (OpenAMIP™) for satellite terminals. OpenAMIP is an ASCII message-based protocol for the interchange of information between an antenna controller and a satellite modem. OpenAMIP allows the modem to command the controller to seek a particular satellite. OpenAMIP also allows the modem and controller to exchange information necessary to initiate and maintain communications through the satellite.

OpenAMIP is a command set which can be used for various satellite terminal implementations. Not all commands are required for a given implementation and the subset of commands required for a given implementation will be modem/ACU integration specific and will need to be validated for proper functionality at the terminal level. OpenAMIP is designed to be extensible for vendor-specific enhancements.

Disclaimer

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Audience

The intended audience for this document is an engineering team responsible for integrating a satellite terminal.

1 Introduction

This document describes the Open Antenna Modem Interface Protocol (OpenAMIP™) for satellite terminals. OpenAMIP is an ASCII message-based protocol to exchange information between an antenna controller and a satellite modem. OpenAMIP allows the modem to command the controller to seek a particular satellite. OpenAMIP also allows the modem and controller to exchange information necessary to initiate and maintain communications through the satellite.

OpenAMIP is primarily intended to permit a modem and a controller to perform synchronized automatic beam selection, with status logging and diagnostic functions in support of that main goal. There is no explicit provision in OpenAMIP for security or validation. The controller and the modem may choose to use any of several security measures at lower protocol layers.

2 Protocol Specification

This chapter contains the following sections:

2.1 Introduction

OpenAMIP is intended to be simple and flexible. Communications are in the form of messages that are readable ASCII characters. A message consists of one or more space-separated variable-length fields. The command is terminated by a new line **<lf>** character or by the **<cr><lf>** sequence.

The first field is a message type, a single alphabetic character in the standard command set. Each type of message requires a minimum number of parameters. The last parameter may optionally be separated from the new line by a comment that begins with a **#**. The **#** can be followed by a string containing any characters other than a new line.

The OpenAMIP protocol is a peer protocol: neither side is the master. The messages are sent through any of the several lower-level protocols, such as HTTP, TCP/IP over a LAN, UDP over a LAN, or using a high-speed serial connection.

For broadest compatibility, most parameters, and the ability to use the parameters, is optional. Naturally, any unsupported parameter may result in an unsupported result, but basic operation should function. Owing to the evolution of the standard, mandatory and optional legacy parameters are not named, whereas more recently defined parameters are in key-value pair format. When transmitting a parameter list, no mandatory parameters may be omitted from the beginning or the middle of the list, although optional unnamed parameters or key-value parameters may be omitted.

Because the unnamed parameters are not named, the receiving device can only distinguish parameters from each other by their sequence. This requirement does not apply to parameters specified as key-value pairs: for these, parameters are named, and may be selectively excluded.

2.2 Syntax

The OpenAMIP format specified here is in Backus-Naur form (BNF). The format specification below accommodates both legacy commands and key-values introduced in the OpenAMIP Standard version 1.17 release.

Key value names are lower camel case (initial letter lower case, subsequent words first letter capitalized).

```
<msg>::=<msg_body><optional_whitespace>'\n'
   |<msg_body><optional_whitespace>'#'<comment_body>'\n'
<comment_body>::=<non_newline>|<non_newline><comment_body>
<non_newline>::={any printable character except '\n'}
<msg_body>::=<o_message>|<normal_message>
<o_message>::=O' '{line1, 69 times any char}' '{line 2, 69 times any
char}<satname>
<satname>::=''|' '{satname, at most 24 times any char}
<normal_message>::=<msg_type><param_list><kv_list>
<msg_type>::=<string>
<param_list>::=''|<whitespace><param><param_list>
<param>::=<binary>|<float>|<int>|<string>
<binary>::= '1'|'0'
<int>::='-'<natural>|<natural>
<float::=<int>'.'<natural>|<int>
<natural>::=<digit>|<digit><natural>
<digit>::='0'|'1'|'2'|'3'|'4'|'5'|'6'|'7'|'8'|'9'
<string>::=<string_char>|<string_char><string>
<string_char>::={any printable character except '=', '#', ' ' and '\n'}
<kv_list>::=''|<whitespace><kv_pair><kv_list>
<kv_pair>::=<string>'='<param>
<optional_whitespace>::=''|<whitespace>
<whitespace>::=<whitespace_char>|<whitespace><whitespace_char>
<whitespace_char>::=' '|'\t'|'\r'
```

2.3 Message Types, Sender (M)

Table 2-1. Message Types, Sender (M)

Type	Description	No. of Parameter(s)	Name of the Parameters
A	Alive interval Antenna should send a status message at least this often. 0 means never repeat.	1	int interval, seconds

B	Beat frequency oscillator (local oscillator) frequencies; effective amount of down-conversion (Rx) or up-conversion (Tx).
	
	(Optional key-value format parameters)
	
	Multiband Rx or Tx LO Frequencies (rx(N), tx(N))
	
	LO frequencies for additional devices (LNBs) may be specified. Each additional Rx is identified by an index number, starting with index '2' (that is, rx2, rx3, rx4, and so on.) There is no maximum number of receivers specified.
	
	LO frequencies for additional devices (BUCs) may be specified. Each additional Tx is identified by an index number, starting with index '2' (that is, tx2, tx3, tx4, and so on). There is no maximum number of transmitters specified.
	
	Command format with minimum set of parameters:
	`B <Rx LO freq> <Tx LO freq>`
	Command format with 6 additional optional parameters:
	`B <Rx LO freq> <Tx LO freq> rx2=<rx2 LO freq> rx3=<rx3 LO freq> rx4=<rx4 LO freq> tx2=<tx2 LO freq> tx3=<tx3 LO freq> tx4=<tx4 LO freq>`
	
	Example: `B 18000.500 28000.500 rx2=18200 rx3=18500.750 tx2=28000.625 tx3=28000.750`
	
	To query the capabilities of the available oscillators which may be configured, see the '`Y extCmd=getConfigB`' command and corresponding '`y`' response.
		2
		(minimum)
			float Rx LO frequency, MHz
			float Tx LO frequency, MHz
			
			(Optional)
			
			`rx2=<float Rx2 LO frequency MHz>`
			
			`rx3=<float Rx3 LO frequency MHz>`
			(…)
			`tx2=<float Tx2 LO frequency MHz>`
			
			`tx3=<float Tx3 LO frequency MHz>`
			(…)

Table 2-1. Message Types, Sender (M) (continued)

Type	Description	No. of Parameter(s)	Name of the Parameters
C	Carrier to Noise Ratio for Conical Scan Reporting rate is configured by "c" message. Default "C" message rate is zero (if "c" message reporting rate parameter is not present, the "C" message is disabled). It is recommended to provide this message by UDP as a separate stream.	5	float CNR (SNR) in dB, measured on headers and pilots float CNR (SNR) in dB, measured on data float time in seconds. This free running counter may wrap around through zero periodically; it is recommended to use enough resolution for at least an hour between wrap events. received carrier lock state where 0 means invalid, 1 means not locked, 7 means fully locked, and values in between are intermediate states of lock (intermediate state details are product-specific). float composite power, dBm, measured at the IF input to the modem.
D	Reserved		

Table 2-1. Message Types, Sender (M) (continued)

Type	Description	No. of Parameter(s)	Name of the Parameters
E	Expected power Maximum Tx power to be expected at input to the antenna (BUC), the output of the modem minus cable loss, in dBm. The power specified could be for signals at I/Q, L-band (or any IF), or RF, depending on system implementation.	1	float max power
F	Find the satellite Antenna should now begin using the satellite specified by either {`S, P, B, R, X,` and `H`} or {`O, P, B, R, X,` and `H`} commands. This command overrides the N command. (Optional key-value format parameters) Execution time (time) The time when this command is expected to have completed. Time is specified as (seconds since the GPS epoch). When no time tag is added, or the execution time specified has past, the command will be executed immediately.	0 (minimum)	(Optional) `time=<float time (GPS seconds)>`

Table 2-1. Message Types, Sender (M) (continued)

Type	Description	No. of Parameter(s)	Name of the Parameters
G	Check the satellite This command is similar to '**F**' command, except that ACU does not act (that is, repoint the antenna, select new bands, change polarization) on the information. ACU will only respond to whether new proposed antenna pointing is valid (that is, non-blocked, and so on). The antenna responds immediately to each '**G**' command with a single '**g**' response. Modem has already sent satellite information to the Antenna specified by either command. (Optional key-value format parameters) Execution time (time) If this parameter is specified, the antenna will respond immediately with a '**g**' message containing the expected antenna status at the future point in time specified. (Note that this differs from the '**F**' command, where the 'time' key is used to delay the execution of the '**F**' command to a future point in time.) Time is specified as (seconds since the GPS epoch) Cache Start Beam (**cacheStartBeam**) This key indicates to the antenna that the configuration provided prior to the '**G**' command should be stored (cached) by the antenna for future use as a default start beam. If this key is used, the value is always '**1**'.	0 (minimum) (Optional) **time=<float time (GPS seconds)>** **cacheStartBeam=1**

Table 2-1. Message Types, Sender (M) (continued)

Type	Description	No. of Parameter(s)	Name of the Parameters

H	Hunt frequency in MHz. Modem expects antenna to use this receive hunt center frequency when commanded.
	
	Bandwidth in MHz (should be specified down to 1 Hz resolution) Receive RF frequency can be determined through combination of RX LO (LNB) frequency in the "B" message and the center IF frequency specified here in the "H" message
	
	(Optional key-value format parameters)
	
	Roll-off Factor (rof)
	Available options are (1.05, 1.1, 1.15, 1.20, 1.25, 1.30, or 1.35), represented as a float. For any receiver, if the roll-off factor is not provided, it will be assumed to be 1.2. In cases where there are multiple Rx devices configured (see 'B' command), the roll-off factor will by default apply to rxDevice =1, unless another rxDevice is specified (see rxDevice parameter below).
	
	Carrier Type
	Identify Carrier Type antenna is being commanded to hunt. Defined types = `{service, signaling}` If the carrier type is not defined, it is assumed to be 'service'
	
	Receive Device (rxDevice)
	In cases where there are multiple Rx devices configured (see 'B' command), the modem may specify which of the devices to use. If the device is not specified, it is assumed to be '1'.
	
	Example (default device, no roll-off specified):
	`H 1800.500 2100.500`
	
	Example (device 2, with roll-off specified):
	`H 1800.500 2100.500 rof=1.25 rxDevice=2 carrierType=service`
	
	Spectral Inversion
	Spectral Inversion is the means of indicating to the antenna whether expected carrier is spectrally inverted or not.
		2
		(minimum)
			float frequency,
			
			float bandwidth
			
			(Optional)
			
			`rof=<float roll-off factor>`
			
			`carrierType=<string>,`
			`{service, signaling}`
			
			`rxDevice=<int device>`
			
			`specInv=<binary>,`
			`1 = spectrally inverted,`
			`0 = no spectral inversion`

Table 2-1. Message Types, Sender (M) (continued)

Type	Description	No. of Parameter(s)	Name of the Parameters

I	ID of the modem type (optional)
	
	Upon initial connection with the antenna, the modem is expected to transmit this information without being solicited (that is, '`i`' command) by the antenna.
	
	If the 'I' command is sent to the antenna without any parameters, the antenna is expected to respond with an '`i`' response providing antenna information.
	The antenna should respond with its own details, as described in the '`i`' command below.
	
	(Optional key-value format parameters)
	
	Modem Serial Number
	A string containing the modem's manufacture serial number.
	
	Modem SW Rev (`modemSwRev`)
	
	Example:
	`I iDirect cx780 modemSerialNo=14758 modemSwRev=2.0`
	
	In addition to the keys defined above, vendor specific keys may be defined, following this syntax:
	`<vendorname>:<keyname>`
	The vendor-defined key may be any valid data type (int, float, string, char, binary).
	
	Example:
	Where Manufacturer is iDirect, the model is `Yoyo1`, and there is a specific opid key they have defined;
	`I iDirect Yoyo1 iDirect:opid=123`
		2
		(minimum)
			string: modem manufacturer and string: modem model
			
			(optional)
			
			`modemSerialNo=<string>`
			
			`modemSwRev=<string>`

J	Reserved		
K	Maximum and minimum sKew of the beam short axis to the geosynchronous arc, in degrees. Transmitter should be disabled when these limits are exceeded. Minimum skew defaults to zero if absent.	2	float max skew float min skew

Table 2-1. Message Types, Sender (M) (continued)

Type	Description	No. of Parameter(s)	Name of the Parameters

L	Lock status of receiver
	The modem should send this message immediately when the status changes. The modem should send this message periodically at intervals specified by the antenna in the "`a`" message.
	
	Antenna is free to transmit, or not. This command may be used by the antenna to remove power from the Tx amplifiers. (Note, if '`M`' command is used, it will take precedence over any action expected by setting Tx Enable flag to `0` 'Tx off').
	
	NOTE: The Tx Enable parameter can be used to support a power calibration mode, in which the final power amplifier is disabled or terminated, but the preamplifier is still enabled and capable of measuring RF power at the preamp.
	
	(Optional key-value format parameters)
	
	Network Status (`networkStatus`)
	An indication of terminal's status in the network
	`{online, offline}`
	
	Fault Status `(faultStatus)`
	An indication of modem's fault status `{fault, ready}`
		2
		(minimum)
			RX Lock State: binary
			`1 (locked)`
			or
			`0 (unlocked)`
			
			binary TX Enable:
			`1 (Tx on)`
			or
			`0 (Tx off)`
			
			(optional)
			
			`networkStatus=<string online status>`
			`{online, offline}`
			
			`faultStatus=<string fault status>`
			`{fault, ready}`

M	BUC Mute.
	Explicit Tx mute enable/disable. This command overrides any action taken by the antenna as a result of the '`L x 0`' command (L command Tx Enable flag).
	
	Mute State (txMuteState) Indicates whether the antenna should mute (1 = enable) or unmute (0 = disable) the BUC.
	`{1, 0}`
	
	(Optional key-value format parameters)
	Execution Time (`muteTime`)
	
	Time, in seconds since the GPS epoch, at which the Mute command is expected to be complete.
	
	When no time tag is added, or the execution time specified has past, the command will be executed immediately.
		1
		(minimum)
			`txMuteState=<binary state>`
			
			where
			`1 (muted)`
			or
			`0 (unmuted)`
			
			(optional)
			`muteTime=<float GPS seconds>`

Table 2-1. Message Types, Sender (M) (continued)

Type	Description	No. of Parameter(s)	Name of the Parameters
N	Not Track-test mode The antenna should be aimed in a non-interfering direction, away from any satellites offering active service. This is intended to support installation tests such as power measurements **NOTE:** The `N` command is intentionally redundant with the L command; it is not intended to be the sole means of preventing interference during tests. This command overrides the `F` command, but should not cause the antenna to lose the parameters previously specified by { `S, P, B, R, X`, and `H` } or { `O, P, B, R, X,` and `H}`.	0 (minimum)	
	Optional antenna_number parameter indicates the 'requested antenna number'. This parameter is an integer type with a range of [0 – n], where n is the number of antennas connected. For single antenna use cases, the value reported should be '1'. If this parameter is set to '0' or not present, the ACU will infer that single antenna is connected.		(optional) int antenna number
	(Optional key-value format parameters)		(optional)

	Antenna Test Mode (antennaTestMode)
	Used to differentiate between test modes that may be supported by the antenna. Stow and Park positions are expected to be statically configured at commissioning.
	
	Antenna test modes defined are
	• Reserved
	• Stop (current location)
	• Park (predefined location)
	• Stow (predefined location)
			`antennaTestMode=<string mode>,`
			`where 'mode' may be,`
			`{reserved, stop, park, stow}`

Table 2-1. Message Types, Sender (M) (continued)

Type	Description	No. of Parameter(s)	Name of the Parameters
O	Ephemeris (Orbit) information. The **O** command parameter is a string containing lines 1 and 2 of a standard Two Line Element (TLE) string at fixed positions separated by a space character. (https://en.wikipedia.org/wiki/Two-line_element_set). The optional Title Line (satellite name) may be appended after lines 1 and 2, after a space separator. Once sent to the antenna, the tracking of the satellite defined in the TLE string is activated by sending the '**F**' command Example `O 1 25544U 98067A 08264.51782528 -.00002182 00000-0 -11606-4 0 2927 2 25544 51.6416 247.4627 0006703 130.5360 325.0288 15.72125391563537 ISS (ZARYA)`	1	TLE string (139 characters): Where the string must contain, TLE Line 1 (69 char) + space separator (1 char) + TLE Line 2 (69 char) or TLE string (164 characters): Where the string must contain TLE Line 1 (69 char) + space separator (1 char) + TLE Line 2 (69 char) + space separator (1 char) + TLE Title Line (24 char)

Table 2-1. Message Types, Sender (M) (continued)

Type	Description	No. of Parameter(s)	Name of the Parameters
P	Polarization Modem commands antenna to use these polarizations. Command must contain minimum of 2 parameters for primary Rx and Tx. Additional polarizations are optional. (Optional key-value format parameters) Additional Rx and/or Tx polarizations may be specified. No upper limit on the number of Rx and Tx polarizations is defined, but these should match the number of Rx and Tx configured in '**B**'. Additional polarizations beyond the first Rx and first Tx are specified in key,value pair format. Command format with minimum set of parameters: **P <Rx Pol> <Tx Pol>** Command format with additional parameters: **P <Rx Pol> <Tx Pol> rx2=<Rx2 Pol> rx3=<Rx3 Pol> … tx2=<Tx2 Pol> tx3=<Tx3 Pol>** Example: **P L R rx2=R tx2=L** **(Left (Rx), Right (Tx), Right (Rx2), Left (Tx2))** To query the polarization configuration options available, see the '**Y extCmd=getConfigP**' command and corresponding '**y**' response.	2 (minimum)	char Rx Polarization: **L, R, V,** or **H** char Tx Polarization: **L, R, V,** or **H** (optional) **rx2=<char L, R, V, or H >** **rx3=<char L, R, V, or H >** (…) **tx2=<char L, R, V, or H >** **tx3=<char L, R, V, or H >** (…)
Q	Reserved		

Table 2-1. Message Types, Sender (M) (continued)

Type	Description	No. of Parameter(s)	Name of the Parameters
R	Regulation Type Selection Identification of the Regulatory Regime to be applied. It is expected that this command will be sent as part of configuration commands prior to an '**F**' command, to occur at beam-switch. The antenna will report back with information in the '**q**' message. If no reporting interval (reportingInterval) is specified, the antenna will report back only once. Each regime name represents a different set of antenna data.	1 (minimum)	
	Regulatory Regime (**regulatoryRegime**) String defining the regulatory regime to be applied. The names defined below are not considered to be an exhaustive list, additional regulatory regime names may be defined at the discretion of antenna and modem vendors. • FCCGEO • FCCNGSO • ETSIGEO • ETSINGSO		**regulatoryRegime=<string name>** **defined names, {FCCGEO, FCCNGSO, ETSIGEO, ETSINGSO}**
	(Optional key value pairs)		(optional)
	Max ESD Reporting Interval (**reportingInterval**) Interval (in seconds) at which the antenna should report various metrics related to maximum ESD. These metrics are reported by the antenna with the '**q**' message. If this parameter is omitted, the antenna will respond only once.		**reportingInterval=<int seconds>**
	Regulatory Offsets (**offset1, offset2**, and so on). Offset to be applied to the resulting maxESD. Multiple offsets (up to 5) are possible and are a way for the modem to set exclusions or amendments. Offsets are specified in dB. Example: **R regulatoryRegime=FCCMEO reportingInterval=2**		**offset1=<float dB>** **offset2=<float dB>** **offset3=<float dB>** **offset4=<float dB>** **offset5=<float dB>**

Table 2-1. Message Types, Sender (M) (continued)

Type	Description	No. of Parameter(s)	Name of the Parameters
S	GEO Satellite longitude Modem expects antenna to use this satellite when commanded. Maximum excursion in satellite's latitude (for inclined- orbit satellites) Satellite's nominal polarization offset in degrees (for skewed satellites) (Optional key value pairs) Name (name) String defining the name of the GEO satellite.	3 (minimum)	float longitude (degrees) float latitude variance (degrees) float polarization skew (degrees) From behind the dish, facing towards the satellite; clockwise is positive. `name=<string>`
T	Transmit frequency. Modem intends to transmit at this frequency (MHz) and bandwidth (MHz) Transmit RF frequency can be determined through combination of TX LO (BUC) frequency in the "`B`" message and the center IF frequency specified here in the "`T`" message. (Optional key value pairs) Transmit Device (txDevice) In cases where there are multiple Tx devices available, the modem should specify which one the parameters commanded here apply to. If the device is not specified, it is assumed to be '`1`'.	2 (minimum)	float Tx frequency, MHz and float Tx bandwidth, MHz (Optional) `txDevice=<int>`
U	Reserved		

Table 2-1. Message Types, Sender (M) (continued)

Type	Description	No. of Parameter(s)	Name of the Parameters

V	Supported OpenAMIP Commands.
	Supported commands are explicitly communicated from Modem to Antenna: the Modem indicates by a series of key value pairs which commands are supported, and up to how many parameters are supported by the command.
	
	'Supported commands' should include both those the modem may transmit to the antenna, and antenna commands supported by the modem.
	
	The modem spontaneously sends out the V/v upon connection to the antenna. Also, after receiving an empty v command the antenna, the modem sends out all V messages again. There is no query mechanism for individual commands.
	
	Per supported command, one V message is sent out:
	
	`V <command> <nof_unnamed_parameters> <kv_list_supported_keys>`
	where,
	`<command>`: the command which is supported by the sender
	`<nof_unnamed_parameters>`: the number of unnamed parameters the sender supports
	`<kv_list_supported_keys>`: the list of keys the sender supports, all values will be 1
	
	To indicate that the series of commands to the modem has completed, the antenna sends this final key:
	`V end=1`
	
	Examples:
	Modem requests antenna to send commands supported
	`[Modem] V`
	
	Modem indicating commands it supports
	`[Modem] V A 1`
	`[Modem] V B 2 rx2=1 tx2=`1
	
	Modem indicates it has completed sending command list to antenna
	`[Modem] V end=1`
		0
		(minimum)
			char command
			
			int parameters supported
			
			`end=1`

Table 2-1. Message Types, Sender (M) (continued)

Type	Description	No. of Parameter(s)	Name of the Parameters
W	Where (location) Interval Antenna should send w message immediately, and then repeat at least this often. `0` means "never repeat" **NOTE:** integer is a valid subset of the float type. Non-integer time is used only for specialized highly dynamic terminals, by agreement between modem and antenna vendor. The modem shall not request non-integer time unless the antenna is known to support it. Decimal point and digits after decimal may be omitted, unless modem and antenna both support high-rate reporting for highly dynamic terminals, and modem has requested rate > 1Hz.	1 (minimum)	int repeat interval, seconds. Should be float, if the modem requests antenna to transmit "`w`" at rates higher than 1 Hz
	(Optional key-value format parameters)		(optional)
	GPS Time (time) Time in seconds since the GPS epoch.		`time=<float GPS seconds>`
	UTC offset (utcOffset) Time difference (in seconds) between UTC time and GPS time. utc + utcOffset = gps		`utcOffset=<int seconds>`

	Leap Second Notify (leapNotify)
	Indicates if a leap second is upcoming.
	Valid notifications are,
	
	`noLeapSecond` = No leap second upcoming
	
	`lastMinOfDay61Sec` = Last minute of day will have 61 seconds (represented in UTC as 23:59:60)
	
	`lastMinOfDay59Sec` = Last minute of day will have 59 seconds (UTC goes from 23:59:58 to 00:00:00)
	
	`notInSync` = Not in sync, indicates receiver did not get leap second info yet, conversion to UTC is not possible
			`leapNotify=<string notification>`
			
			`Where 'notification' may be,`
			`{noLeapSecond,`
			`lastMinOfDay61Sec,`
			`lastMinOfDay59Sec,`
			`notInSync}`

	Clock Stratum (`clockStratum`) The number of hops required for the antenna to reach a valid reference clock. Acceptable range is `1-16` with `1` denoting a direct connection to a timing source and `16` denoting that the antenna is not synchronized with a valid timing source.		`clockStratum=<int>`

Table 2-1. Message Types, Sender (M) (continued)

Type	Description	No. of Parameter(s)	Name of the Parameters
X	eXtra hunt parameters This is a fixed string to be configured by the operator and sent as part of the lookup. Note that the contents of this message are processed on receipt of an **F**. The antenna vendor specifies the string. If the controller does not need this command, the modem does not need to send it, but the modem may send it anyway, in which case the controller will ignore it. **NOTE:** If ARINC 791 is supported, the '**x**' message is intended to support transfer of the block zone file.	1	string

Table 2-1. Message Types, Sender (M) (continued)

Type	Description	No. of Parameter(s)	Name of the Parameters
Y	Miscellaneous and Custom Commands. '**Y**' command may to be used to send custom asynchronous messages to the antenna in a key-value pair formatted string. Vendor specific commands may be used here, as long as they are prefixed with a vendor key (as described in the '**I**'/'**i**' commands) according to the following this syntax: **<vendorname>:<keyname>** The vendor-defined key may be any valid data type (int, float, string, char, binary). Example: **Y iDirect:specialCmd=123** Additionally, a number of standard key-value pair commands are defined below.	1 (minimum)	String
	(Optional key-value format parameters) extCmd indicates to the antenna that it is to provide the modem with further information. The type of information requested is specified by parameter. getConfigB. Get Tx/Rx band Information (getConfigB) Retrieve the Tx and Rx band capabilities from the Antenna getConfigP Get Polarization Information (getConfigP) Retrieve the Polarization capabilities of the Tx/Rx equipment from the Antenna. getExtAntStatus. Get Extended Antenna Status (getExtAntStatus). Retrieve the extended ACU status string from the antenna. getExtTransceiverStatus. Get Extended Transceiver status information from the antenna.		(Options) ***extCmd=<string cmd>,*** ***where cmd is one of {getConfigB, getConfigP, getExtAntStatus, getExtTransceiverStatus}***
	extCmdRepeatInterval indicates the repeat interval at which the antenna is to repeat the information. '0' indicates that the information is only to be sent once. If this parameter is not specified, it is assumed to be '0'.		***extCmdRepeatInterval=<int seconds>***
	Modem Restart Reason (**restartReason**) Inform ACU of a pending reboot (SW updates, config file updates, and so on). restartReason codes: **{noRestart, modemSwUpdate, modemConfigUpdate, modemReboot, modemSwRestart**		***restartReason=<string reason>,*** where 'reason' may be, **{noRestart, modemSwUpdate, modemConfigUpdate, mdoemReboot, modemSwRestart}**
	Maximum Outage Duration (**maxOutageDuration**) The maximum duration expected for the reboot outage, specified in seconds.		**maxOutageDuration=<int seconds>**

Table 2-1. Message Types, Sender (M) (continued)

Type	Description	No. of Parameter(s)	Name of the Parameters
Z	Reserved		

2.4 Message Types, Sender (A)

Table 2-2. Message Types, Sender (A)

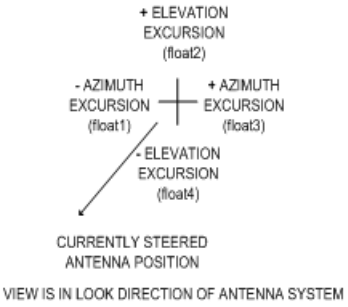
Type	Description	No. of Parameter(s)	Name of the Parameters
a	alive interval Antenna requests to see an L message from the modem at least this often. 0 means "never repeat".	1	int repeat interval, seconds
b	Reserved		
c	conical scan setup (optional) Sent when conical scan performed. The four floating point values represent the times (UTC or GPS epochal) of beam steering excursions from the previously steered coordinates. Azimuth and elevation delta scan excursions are pre-determined by the antenna manufacturer and would be on the order of ±0.25°. The antenna may request periodic carrier-to-noise estimates ("c" message) by setting the fifth parameter. Default "c" message rate is zero (if "c" message reporting rate parameter is not present, the "c" message is disabled). ***NOTE:*** Some terminal implementations will use only the fifth parameter of this message; in that case, the first four parameters may be set to zero, or may optionally be set to describe the intended scan timing.	5	float1 -AZ: see drawing, float2 +EL: see drawing, float3 +AZ: see drawing, float4 -EL: see drawing, and int reporting rate in Hertz for "c" message 
d - f	Reserved		

Table 2-2. Message Types, Sender (A) (continued)

Type	Description	No. of Parameter(s)	Name of the Parameters
g	Status of the antenna. Antenna sends this immediately in response to the G command from the modem. The format of this response is meant to mirror that of the '**s**' response, although not all parameters are relevant. "**Not functional**" means that the antenna cannot currently operate and will never operate with this configuration. This can be temporary (for example, an illegal configuration) or permanent (for example, motor frozen).	4 (minimum)	binary Antenna Functional: 1 – antenna functional 0 - antenna not functional
	"**Modem must not transmit**" means that the antenna has detected a condition (loss of lock, blockage, cable unwrap, max skew exceeded) that does not require a reconfiguration, but that does require the modem to cease transmission.		binary Modem May Transmit 1 – Modem may transmit 0 – Modem must not transmit
	The third parameter should be set to 0. (Search Count is not relevant when validating configuration commands).		int Search Count 0 (Always set to 0)
	The fourth parameter 'Tx Disabled' should be set to 0. If an **F** command was sent more recently than an **N** command. If omitted, this parameter is assumed to be 0. **NOTE:** If the antenna cannot ensure it is ready for a transmitter test without regulatory violation, the fourth parameter should be set to 0.		binary Tx Disabled: antenna (1 - has, 0 - has not) successfully disabled transmission toward the geosynchronous arc (response to N command). If this parameter is "1" antenna is in a state to support installation tests such as power measurements; any power from the transmitter test is either terminated in a dummy load or otherwise prevented from interfering with satellites.
	The optional fifth parameter is an enumerated detailed status of the current antenna selected. (See Table 2-3, Enumerated Antenna Status Codes.)		**int antenna_status 0 to 65535**
	The optional sixth parameter indicates to the modem the number of RF chains supported by the terminal. For single RF Chain (antenna) use cases, the value reported should be '1'. This parameter is an integer type with a range of [0 - n], where n is the number of RF chains antennas connected. (If this parameter is set to '0' the modem will infer that single antenna is connected)		**int RF_chains**
	The optional seventh parameter indicates to the modem the index of the active RF chain. For single antenna use cases, the value reported should be '1'. This parameter is an integer type with a range of [0 - n], where n is the number of antennas connected. (If this parameter is set to '0' the modem will infer that single antenna is connected)		**int active_RF_chain_index**
	Time before Blockage (blockTime) This parameter should accompany status message 18, warning of an impending blockage. blockTime indicates the number of seconds remaining before the blockage is expected to occur. If the 'G' command was sent with an execution time specified, the blockTime will be reported relative to that execution time.		**blockTime=<int sec>**
	Additional Antenna Status (statusCode) If there are additional status messages from the selected antenna, beyond that communicated in the fifth parameter above, each additional status message is transmitted as an individual key-value pair. Example: **g 1 1 0 0 0 0 0 statusCode=20**		**statusCode=<int 0 to 65535>**
h	Reserved		

Table 2-2. Message Types, Sender (A) (continued)

Type	Description	No. of Parameter(s)	Name of the Parameters
i	ID of the antenna type Upon initial connection with the modem, the antenna is expected to transmit this information without being solicited (that is, '`I`' command) by the modem. If the '`i`' command is sent to the modem without any parameters, the modem is expected to respond with an '`I`' response providing modem information.	2 (minimum)	string: manufacturer and string: model
	(Optional key value pairs)		(Optional)
	RF Terminal Type (`rfTermType`). An integer identifying the RF Terminal Type assigned by the network operator's type approval process. Range 1 to 32767.		`rfTermType=<int>`
	Antenna Serial Number (`antennaSerialNo`)		`antennaSerialNo=<string>`
	Antenna SW Rev (`antennaSwRev`)		`antennaSwRev=<string>`

	In addition to the keys defined above, vendor specific keys may be defined, following this syntax:
	`<vendorname>:<keyname>`
	The vendor-defined key may be any valid data type (int, float, string,char, binary).
	Example:
	Where Manufacturer is Yoyodyne, the model is Yoyo1, and there is a specific opid key they have defined;
	`i Yoyodyne Yoyo1 Yoyodyne:opid=123`
			Vendor specific key
			`<vendorname>:keyname>=<int, float,string,char, or binary>`

j - p	Reserved		

Table 2-2. Message Types, Sender (A) (continued)

Type	Description	No. of Parameter(s)	Name of the Parameters
q	EIRP Spectral Density (ESD) calcuation information. The reporting interval of this message from the Antenna is configured with the '**reportingInterval**' parameter of the '**R**' message. This message from the antenna includes the data the modem needs for performing the calculation. The modem is expected to enforce the ESD limit at the antenna/radome output based on the ESDMax limit (esdMax), the symbol rate (Rs), modem output power, and RF chain gain information: **esdMax = eirp – 10log(Rs / bandUnits)** The calculated EIRP Spectral Density (ESD) is compared with ESD limit and modem transmission power is set accordingly.	2 (minimum)	
	(Optional key value pairs)		**(optional)**
	EIRP Spectral Density Maximum (**esdMax**) The current peak ESD of the antenna based on current skew angle, scan angle and so on. ESD maximum is the peak EIRP spectral density while in compliance with off-axis regulations such as FCC 25.218 and ETSI EN 303 978. Units are dBW/bandUnits, where bandUnits is itself specified below. If **bandUnits** is not specified, the bandwidth units are assumed to be 1Mhz.		**esdMax=<float dBW/bandUnits>**
	G/T (**gt**) The current value of G/T in dB/K based on pointing angle. For mechanically steered antennas, this will usually be a constant. For Electronically steered arrays, it will vary with scan angle.		**gt=<float dB/K>**
	EIRP (**eirp**) The current maximum value of EIRP in dBW based on pointing angle. For mechanically steered antennas, this will usually be a constant. For Electronically steered arrays, it will vary with scan angle. This may not be the EIRP that is currently being transmitted due to modem backoff and other factors		**eirp=<float dBW>**
	Bandwidth Units (**bandUnits**) Units of bandwidth for which the regulatory limit applies, that is, 40kHz, 400kHz, 1000kHz (1Mhz). If not specified, it is assumed that units of bandwidth is 1000kHz(1MHz) Examples, to select units of 400Khz, set bandUnits=400 to select units of 1Mhz, set bandUnits=1000		**bandUnits=<int kHz>**
	Skew Angle (**skewAngle**) (float degrees)		**skewAngle=<float degrees>**
	Transceiver Temperature (**transceiverTemperature**) Transceiver temperature, required for accurately determining transceiver gain. Temperature is specified in degrees Celcius.		**transceiverTemperature=<float degrees>**

Table 2-2. Message Types, Sender (A) (continued)

Type	Description	No. of Parameter(s)	Name of the Parameters
	Transceiver Power (**transceiverPower**) Transceiver power detector reading, in dB.		**transceiverPower=<float dB>**
	Antenna Azimuth (**antennaAz**) Azimuth. Useful for determining the radome loss, if not constant, in degrees.		**antennaAz=<float degrees>**
	Antenna Elevation (**antennaEl**) Elevation. Useful for determining radome loss, if not constant, in degrees.		**antennaEl=<float degrees>**
r	Reference frequency required for BUC and LNB. Frequency is in MHz.	2	int frequency MHz
	Reference required to be present on Rx (R), Tx (T) or both (B)		string Reference Used By: R, T, or B (for example,"**r 10 B**")

Table 2-2. Message Types, Sender (A) (continued)

Type	Description	No. of Parameter(s)	Name of the Parameters
s	Status of the antenna. Antenna sends this immediately in response to the F command from the modem, or immediately when any of the two statuses changes, or periodically. The period is set by the A command from the modem. "Not functional" means that the antenna cannot currently operate and will never operate with this configuration. This can be temporary (for example, an illegal configuration) or permanent (for example, motor frozen). “Modem must not transmit" means that the antenna has detected a condition (loss of lock, blockage, cable unwrap, max skew exceeded) that does not require a reconfiguration, but that does require the modem to cease transmission. This flag should not be set as a result of **L** (that is, **L 0 1** or **L 1 1**) or **M** (that is, **M txMuteState=1**) or C (4th parameter set to '1', indicating loss of lock) messages sent from the modem: it should be solely based on other Antenna considerations. The third parameter ‘Search Count’ is the number of full sweeps the antenna has performed while searching for the satellite. It should be set to 0 upon receipt of an F command, and incremented when the antenna has performed a full sweep for the satellite. If omitted, this parameter is assumed to be 0. This parameter should be zero if an N command is more recent than an F command. (Optional) The optional fourth parameter ‘Tx Disabled’ should be set to 0 if an F command was sent more recently than an **N** command. If omitted, this parameter is assumed to be 0. **NOTE:** If the antenna cannot ensure it is ready for a transmitter test without regulatory violation, the fourth parameter should be set to 0. The optional fifth parameter is an enumerated detailed status of the current antenna selected. (See Table 2-3, Enumerated Antenna Status Codes.) The optional sixth parameter indicates to the modem the number of RF chains supported by the terminal. For single RF Chain (antenna) use cases, the value reported should be '1'. This parameter is an integer type with a range of [0 - n], where n is the number of RF chains antennas connected. (If this parameter is set to '0' the modem will infer that single antenna is connected)	3 (minimum)	binary Antenna Functional: 1 – antenna functional 0 - antenna not functional Binary Modem May Transmit 1 – Modem may transmit 0 – Modem must not transmit Int Search Count binary Tx Disabled: antenna (1 - has, 0 - has not) successfully disabled transmission toward the geosynchronous arc (response to **N** command). If this parameter is "1" antenna is in a state to support installation tests such as power measurements; any power from the transmitter test is terminated in a dummy load or otherwise prevented from interfering with satellites. **int antenna_status 0 to 65535** **int RF_chain**

Table 2-2. Message Types, Sender (A) (continued)

Type	Description	No. of Parameter(s)	Name of the Parameters
	The seventh parameter indicates to the modem the index of the active RF chain. For single antenna use cases, the value reported should be '1'. This parameter is an integer type with a range of [0 - n], where n is the number of antennas connected. (If this parameter is set to '0' the modem will infer that single antenna is connected)		`int active_RF_chain_index`
	(Optional key value pairs)		
	Time to Blockage (`blockTime`) This parameter should accompany status message 18, warning of an impending blockage. BlockTime indicates the number of seconds remaining before the blockage is expected to occur.		`blockTime=<int sec>`
	Additional Antenna Status (`statusCode`) If there are additional status messages from the selected antenna, beyond that communicated in the fifth parameter above, each additional status message is transmitted as an individual key-value pair.		`statusCode=<int 0 to 65535>`
t	Reserved		
u	Reserved		

Table 2-2. Message Types, Sender (A) (continued)

Type	Description	No. of Parameter(s)	Name of the Parameters

v	Supported OpenAMIP commands are explicitly communicated from Antenna to the Modem: the Antenna indicates by a series of key, value pairs which commands are supported, and up to how many parameters are supported by the command.
	
	'Supported commands' should include both those the antenna may transmit to the modem, and modem commands supported by the antenna.
	
	The antenna spontaneously sends out the v upon connection to the modem. Also, after receiving an empty V command form the modem, the antenna sends out all v messages again. There is no query mechanism for individual commands.
	
	Per supported command, one v message is sent out:
	`v <command> <nof_unnamed_parameters> <kv_list_supported_keys>`
	where,
	`<command>`: the command which is supported by the sender
	`<nof_unnamed_parameters>`: the number of unnamed parameters the sender supports
	`<kv_list_supported_keys>`: the list of keys the sender supports, all values will be 1
	
	To indicate that the series of commands to the modem has completed, the antenna sends this final key:
	`v end=1`
	
	Examples:
	Antenna requests modem to send commands
	`[Antenna] v`
	Antenna indicating commands it supports
	`[Antenna] v a 1`
	Antenna indicates it has completed sending command list to the modem
	`[Antenna] v end=1`
		0
		(minimum)
			char command
			
			int parameters supported
			
			`end=1`

Table 2-2. Message Types, Sender (A) (continued)

Type	Description	No. of Parameter(s)	Name of the Parameters
w	Where the platform is located. Antenna sends this to modem periodically. The period is set by the W command from the modem. If the location is not valid, the antenna may put 0 in the remaining parameters. The precision of the floating point numbers should reflect the precision of the location information. Typically six to eight digits is desirable for lat/lon values. The antenna should send a w immediately if its internal GPS status changes from "invalid" to "valid". If the antenna does not know the time, the time parameter should be set to 0. The time parameter is mandatory if Doppler compensation is to be applied. **NOTE:** integer is a valid subset of the float type. Non-integer time is used only for specialized highly dynamic terminals, by agreement between modem and antenna vendor. The modem shall not request non-integer time unless the antenna is known to support it. Decimal point and digits after decimal may be omitted, unless modem and antenna both support high-rate reporting for highly dynamic terminals, and modem has requested rate > 1Hz. If provided, timestamp must correspond to the latitude/longitude values. If omitted, all following values must also be omitted, and Doppler compensation is not possible. If the altitude parameter is not known, then it is set to zero. (Optional key-value format parameters) Clock Stratum (**clockStratum**) The number of hops required for the antenna to reach a valid reference clock. Acceptable range is 1-16 with 1 denoting a direct connection to a timing source and 16 denoting that the antenna is not synchronized with a valid timing source. UTC offset (**utcOffset**) Time difference (in seconds) between UTC time and GPS time. **UTC + UTCOffset = GPS** Leap Second Notify (**leapNotify**) Indicates if a leap second is upcoming. Valid notifications are, **noLeapSecond = No leap second upcoming** **lastMinOfDay61Sec** = Last minute of day will have 61 seconds (represented in UTC as 23:59:60) **lastMinOfDay59Sec** = Last minute of day will have 59 seconds (UTC goes from 23:59:58 to 00:00:00) **notInSync** = Not in sync, indicates receiver did not get leap second info yet, conversion to UTC is not possible	4 (minimum)	binary Location Valid: 1 – valid 0 – invalid float latitude (degrees) negative is south float longitude (degrees) negative is west of prime meridian float time (GPS seconds) time in seconds since the GPS epoch. float altitude (meters) float heading referenced to true north (degrees) float GPS computed speed (m/s) float pitch angle (degrees). Positive is up, negative is down. float roll angle (degrees). Positive is rolled to starboard, negative is rolled to port. float yaw angle (degrees). Positive is inclined to starboard. Negative is inclined to port. float skew angle (degrees). Positive is CW when facing satellite from ground. Negative is CCW when facing satellite. (optional) **clockStratum=<int 1-16>** **utcOffset=<int seconds>** **leapNotify=<string notification>** where '**notification**' may be, **{noLeapSecond,** **lastMinOfDay61Sec,** **lastMinOfDay59Sec,** **notInSync}**

Table 2-2. Message Types, Sender (A) (continued)

Type	Description	No. of Parameter(s)	Name of the Parameters
x	Reserved		
y	Key, value pair formatted string used to respond to '**Y**' messages sent to the modem, or to asynchronously send message to the modem. Vendor specific commands may be used here, as long as they are prefixed with a vendor key (as described in the '**I**'/'**i**' commands). (Optional key-value format parameters) **replyTo** is the response to information requests sent with '**Y extCmd**' key. It identifies the request being responded to, and subsequent expected key-value pairs. The set of valid responses matches the set of requests specified in the '**YextCmd**' key, namely **{getConfigB, getConfigP, getExtAntStatus getExtTransceiverStatus}** **getConfigB** response In response to '**Y**' command with the request getConfigB, the antenna will respond with information about available Tx and Rx bands. The prefixes (that is, rx2, rx3, tx2, and so on) used in the '**y**' response should be used when the modem later specifies a configuration with 'B' command. For each band, the following parameters are provided: **rx(N)Band(M)LO**: float LO frequency MHz **rx(N)Band(M)Start**: float, Band Start frequency MHz **rx(N)Band(M)Stop**: float, Band Stop frequency Mhz **rx(N)Band(M)Inv**: binary, Spectral Inversion flag 1 = LO is above the Tx or Rx (inverted), or 0 = LO is below the Tx or Rx (not-inverted) If the inversion key is omitted, the spectrum is assumed to not be inverted (0).	1 (minimum)	String **replyTo=<string extCmd>,** where cmd is one of **{getConfigB, getConfigP, getExtAntStatus, getExtTransceiverStatus}** rx1Band1LO=<float freq MHz> rx1Band1Start=<float freq MHz> rx1Band1Stop=<float freq MHz> rx1Band1Inv=<binary> rx1Band1Active=<binary> (…) rx1Band2LO=<float freq MHz> rx1Band2Start=<float freq MHz> rx1Band2Stop=<float freq MHz> rx1Band2Inv=<binary> rx1Band2Active=<binary> (…) tx1Band1LO=<float freq MHz> tx1Band1Start=<float freq MHz> tx1Band1Stop=<float freq MHz> tx1Band1Inv=<binary> tx1Band1Active=<binary> (…)

Table 2-2. Message Types, Sender (A) (continued)

Type	Description	No. of Parameter(s)	Name of the Parameters

	rx(N)Band(M)Active: binary,
	1 = band is active (in use)
	0 = band is inactive (not in use)
	
	Response format with minimum set of parameters:
	y replyTo=getConfigB rx1Band1LO=<float freq MHz> rx1Band1Start=<float freq MHz> rx1Band1Stop=<float freq MHz> tx1Band1LO=<float freq MHz> tx1Band1Start=<float freq MHz> tx1Band1Stop=<float freq MHz>
	
	Example:
	`[Modem] Y extCmd=getConfigB`
	`[Antenna] y replyTo=getConfigB rx1Band1LO=17300.000 rx1Band1Start=18250.000 rx1Band1Stop=18750.000 rx1Band1Inv=0 rx1Band1Active=1 tx1Band1LO=28500.000 tx1Band1Start=29000.000 tx1Band1Stop=29500.000 tx1Band1Inv=0 tx1Active=1`		

	`getConfigP` response
	In response to '`Y`' command with the request getConfigP, the Antenna will respond with a string indicating the supported polarization settings for TX and RX (`L,R,H,V`).
	
	The '`X`' setting indicates that only cross-pol configurations are supported (Rx and Tx must be opposite polarities).
	
	The '`C`' setting indicates that only co-pol configuarions are supported (Rx and Tx must be the same polarity).
	
	Note that '`X`' and '`C`' settings are mutually exclusive.
	
	rx(N) applies to receiver N.
	tx(N) applies to transmitter N.
	
	rx(N)PolOpts
	tx(N)PolOpts
	
	String describing which polarization options are available on this band: (L,R,H, V, and/or X)
	rx(N)PolActive
	tx(N)PolActive
	
	String describing which polarization is active (L, R, H or V)
	The response `p` provides the information in the following form:
	`[Modem] Y`
	`[Antenna] y rx1PolOpts=LRHV rx1PolActive=V tx1PolOpts=LR tx1PolActive=R`
			`rx1PolOpts= <string L, R, H, V, and/or X | C>`
			`tx1PolOpts= <string L, R, H, V, and/or X | C>`
			(…)
			
			`rx1PolActive=<string L. R. H or V>`
			`tx1PolActive=<string L, R, H or V>`
			(…)

Table 2-2. Message Types, Sender (A) (continued)

Type	Description	No. of Parameter(s)	Name of the Parameters
	For Example: **[Modem] Y extCmd=getConfigP** **[Antenna] y replyTo=getConfigP rx1PolOpts=LRHV rx1PolActive=L tx1PolOpts=LRHV tx1PolActive=L rx2PolOpts=LRHV rx2PolActive=R tx2PolOpts=LRHV tx2PolActive=L**		
	Extended Antenna Status (extAntStatus) response Extended Transceiver Status (extTransceiverStatus) response When requested by the Modem with Y command ('Y extCmd=getExtAntStatus' or 'extCmd=getExtTransceiverStatus'), the antenna may respond with a set of vendor specific metrics providing additional antenna status metrics. These metrics are reported in key-value pair format.The information is provided for logging purposes, and the modem is not expected to act on this information. A dictionary of suggested parameters are provided in Appendix A, but ultimately the reported metrics are left to the antenna vendor. For Example: **[Modem] Y extCmd=getExtAntStatus** **[Antenna] y replyTo=getExtAntStatus metric=2 metric3=3.456 metric4=enabled metric5=32.4**		See Appendix A, *Extended Antenna Status* on page 45
	Signal Carrier Enable/Disable (**sigCarriersEnable**) Add ability for ACU to instruct modem to enable/disable use of signaling carriers. **sigCarriersEnable=<string>** **{disable, enable}**		**sigCarriersEnable=<string status>** where '**status**' may be, {disable, enable}
z	Reserved		

2.5 Antenna Status Codes

This displays the enumerated antenna status codes.

Table 2-3. Enumerated Antenna Status Codes

Code	Description
0	Modem May Transmit - No problems detected.
1	Cable Unwrap - Antenna has reached its Azimuth motion limit and is performing an azimuth move away from the limit; no longer tracking the satellite.
2	Blockage Zone - The Antenna is tracking in a Blockage Zone defined for the vessel where obstructions can inhibit or degrade satellite communication.
3	RF Hazard Zone - The Antenna is tracking in a No Transmit area defined for the vessel for RF radiation hazard reasons.
4	Sidelobe Check - The Antenna is performing a search pattern to determine if it is has peaked the RF signal on the main beam or the sidelobe.
5	Elevation Limit - The Antenna is tracking above or below the specified elevation limits for the system.
6	AZ/SKEW Limit - The Antenna is tracking and the Azimuth or Skew Pointing Error exceeds the transmit limit indicating it may be mispointed (primarily for keyhole tracking).
7	Gyro Cap - The Antenna is tracking and the Azimuth or Elevation acceleration exceeds the transmit limit indicating it may be mispointed.
8	Ant Search State - The Antenna is commanded to go to a new satellite and is searching for that satellite.
9	RSSI Below Threshold - The Antenna is tracking and it detects that the RSSI has fallen below RSSI valid threshold for a duration of time as dictated by FCC regulations.
10	Initializing - The Antenna boots up or gets restarted and is in its initialization process.
11	LNB Voltage Error
12	BUC Voltage Error
13	RF Configuration Error
14	RF Communication Error
15	On Ground (aircraft is prohibited from transmitting)
16	Geographic Restriction for regulatory reasons
17	HW Mute Switch (for example, for safety interlock).
18	Blockage Warning – based on ephemeris of current NGSO satellite being tracked and Blockage zones defined, a blockage is anticipated in XX seconds (where XX is communicated to the modem as a key-value parameter).
19	RF antenna resources are busy
20	Antenna Muted by Modem
21	Peaking
22	Pending Operator Authorization

Table 2-3. Enumerated Antenna Status Codes

Code	Description
23	Solar Outage
24	Stabilisation Error
25	Motor Error/Failure
26	Encoder Error/Failure
27	Sensor Error/Failure
28	ACU Communications Error/Failure
29	Power Error
30	Antenna Out of Calibration

2.6 Physical Layer

2.6.1 TCP Interface

A modem and controller may communicate using TCP. The method of discovering the IP address and TCP port is outside the scope of OpenAMIP. In the reference implementation, the antenna listens on a configured TCP port and accepts calls from a configured (range of) modem IP addresses. The modem initiates a TCP connection to a configured antenna IP address and TCP port.

Whenever the TCP connection is disconnected, the antenna sets its keep-alive timers to infinity. When a new TCP connection is established, the modem will send an ‘A’ to the antenna, and the antenna will send an 'a' to the modem. Typically each side will then set a disconnect timer to three times the requested interval. For example, the modem might send "A 3" and set its disconnect timer to 9 seconds. If at any time after that, the modem waits more than 9 seconds to receive an "s" message, the modem will break the TCP connection. It may then choose to periodically (or at random intervals) attempt to make a new TCP connection. Similarly, the antenna might send "a 2" and then break the connection if it must wait more than 6 seconds between received "L" messages.

Neither the antenna nor the modem is obliged to accept more than one TCP connection at a time, but this is not prohibited. In a system with two modems, one may be acting as a backup. In this arrangement, the antenna should only honor satellite selection requests from one modem.

TCP is a "stream-oriented" protocol: there is no particular mapping of an OpenAMIP message into an IP packet. A single packet may contain a fragment of a message, a complete message, or multiple messages. In the reference implementation, the modem sends an entire initial set of seven messages in a single POSIX "write" command immediately after opening the connection. On most POSIX systems, this will result in a single TCP/IP packet. The reference receiver implementation accumulates characters until a new line is found and then processes the result as an OpenAMIP message. Accumulation of the next message starts with the first character after the new line.

2.6.2 UDP Interface

Each message fits in a single UDP packet. A packet may contain more than one message, but any given message must be fully contained within one packet. The antenna has a configured IP address and well-known port, as does the modem. The initial state of the OpenAMIP interface is "idle" (that is, no keepalive) until the partner sends a keepalive timer. The interface reverts to the "idle" state if three keepalives are missed.

In Version 1.9, the modem may create a UDP stream for the "C" message, alongside the primary TCP connection for all other OpenAMIP messages. Because the "C" message will be sent at a relatively high rate (tens of Hertz), the UDP stream is more practical; it avoids TCP handshaking overhead. It is recommended that the modem and antenna use the same IP address and port for both TCP and UDP connections, although this is not mandatory. Because TCP and UDP use separate address spaces, this does not cause any conflict.

2.6.3 Asynchronous Serial Interface

This is beyond the scope of OpenAMIP. However, SLIP can be used to establish an IP connection on the serial link. Alternatively, any packet-over-serial technique may be used. (Note that a checksum should be used here.)

2.7 Semantics

The protocol is primarily intended to convey state change information based on external events. The following notes are intended to provide functional guidance for various common events and message sequences. It is not intended to be a comprehensive list of messages nor a syntax dictionary.

To comply with regulatory constraints, the modem must disable its transmitter within 100ms when the antenna loses lock on a satellite, and must also disable the transmitter immediately when a blockage occurs. The antenna must minimize the interval between detecting a change in condition and sending the status message to the modem. Similarly, the antenna may choose to use the modem lock signal as part of its satellite search. The modem must also minimize the interval between detecting the condition and sending the message to the controller. Status changes should be reported within 10ms. However, since this will not be practical on a slow serial link, the links are deprecated.

Prior to any communication between the modem and the controller, the OpenAMIP state is unspecified. The timers are all set to infinite. The modem initiates communications by sending the commands needed to deliver the satellite parameters to the controller. It then sends an "F" message.

When the controller receives an "F" message, it must respond within 10 milliseconds with an "s" message. This is necessary to ensure regulatory compliance in the case when the modem needs to mute. The controller must also send a status every "keepalive" interval, and every time the status changes. When the controller responds to an "F" message, the "may transmit" status must reflect the status with respect to the newly-selected satellite parameters. This means that if the modem has just commanded the antenna to "Find" the satellite that it is already tracking and is already locked on, then the immediate status can be "may transmit". However, if the antenna is already tracking a satellite and is successfully locked to it, and the modem then sends new parameters and issues a new "Find" command, the controller must immediately send a status of "must not transmit" because it is not locked to the new satellite (it is locked to the old satellite). After the antenna locks to the new satellite, it will send a new status message indicating that the modem may transmit.

The modem should send an "L" message whenever the modem lock changes. It should also send the "locked" status every time its keepalive timer expires. Whenever the modem sends the "L" message for any reason, it restarts its keepalive timer.

When the modem issues a "W", the controller immediately responds with a "w". The controller responds thereafter every "repeat interval" seconds (zero seconds means never). If the controller sends a "w" to the modem which indicates that the location information is invalid, the controller should send a new "w" message immediately as soon as valid location information becomes available.

Latitude and longitude are reported in floating point decimal degrees. The range for latitude is -90.0 to 90.0, where -90.0 is the South Pole. The range for longitude is -360.0 to 360.0, where negative is west from the prime meridian and positive is east from the prime meridian.

The overlap is intentional: the sender is free to use zero to 360 or -180 to 180 (or even -360 to 0 or a mixed system). The receiver must be able to handle the full -360 to 360. Leading zeros are optional for the sender, except that the number must have at least one digit before the decimal point. Trailing zeros are optional for the sender, except that the number must have at least one digit after the decimal. The receiver must be able to handle leading and trailing zeros correctly. If the fractional part is zero, the number may be specified as an integer (that is, without a decimal point). Note that the syntax does not permit the use of the "+" character.

The precision of the latitude and longitude is not specified by the OpenAMIP syntax; the number of digits after the decimal point is arbitrary. However, the sender should provide as much precision as is actually available. As a practical matter, OpenAMIP contemplates the ability to use this information for logging and transmission restrictions as mandated by regulatory authorities, so accuracy to about one kilometer is needed: this implies that latitudes and longitudes to a precision of one thousandth of a degree are needed.

If the modem issues a "P", "B", or "F" command that is incompatible with the antenna hardware, the antenna may either ignore the incompatible parts of the command or may set the "functional" status to "not functional" in the 's' response.

The "K" message conveys the maximum skew of the short axis of a non-circular beam to the geosynchronous arc. If the antenna has a beam shape that is radially symmetric about the bore sight, this parameter may be ignored. Otherwise, the antenna must use the current skew as a factor in computing the "must not transmit" or "may transmit" status. When all other factors permit transmission, the antenna will immediately send a status message with a status of "must not transmit" when the angle transitions from below to above the maximum skew, and will immediately send a status message with a status of "may transmit" when the angle transitions from above to below the maximum skew. In contrast to some other messages, the "K" message takes effect immediately and the modem may send a new "K" message with a new max skew angle at any time. The "K" message also includes a minimum skew parameter, to support protection of non-geostationary satellites. The minimum skew parameter operates analogously to the maximum skew parameter; the antenna controller should send a status of "must not transmit" when the skew is less than this value.

When the antenna reports with an "s" message that the antenna is functional, it indicates that the antenna should currently be working. "Non-functional" means that the antenna is not currently in service. This does not include blockage, loss of lock, system initialization, loss of heading information, cable unwrap, or any condition that can correct itself without intervention. It does include detection of a fatal mechanical failure, or an operator command to the antenna controller from its front panel or other source, or an illegal configuration.

When the modem detects this status, it will not attempt to recover by, for example, switching to a different satellite or clearing and re-establishing the OpenAMIP connection. The modem waits until the antenna sends a "functional" message. The antenna provides a "may transmit" when it is locked on the satellite and ready to transmit. The antenna signals "must not transmit" if there is any reason the modem should not transmit: blockage, loss of lock, cable unwrap, sea too rough, and so on.

2.8 Examples

This section is intended to describe the purpose of each message. The formal syntax and semantics are described in later sections. Note that the messages here make use of the "comment" syntax. It is unlikely that operational implementations of the protocol will ever transmit messages with comments, but they are useful in descriptive documents such as this one and in test scripts. Typically, implementations of the receive side of the protocol will properly detect and ignore comments.

The modem must be able to convey all of the information needed by the controller to describe a satellite. This must be sufficient for the controller to identify the satellite and to command the controller to find the satellite.

2.8.1 Messages from Modem to Antenna Controller

"Keepalive" messages are sent to the modem regularly to ensure that communications connectivity with the controller are not lost.

A 10 # Alive: Antenna should resend status "s" every N seconds.

B 18000.500 28000.500 rx2=18200 rx3=18500.750 tx2=28000.625 tx3=28000.750 # "Beat Frequency" for installation with 3 LNBs and 3 BUCs

E 0.5 # Expected power: Maximum L-band Tx power to be expected at the antenna, in dBm.

F time=1293537618 # execute F on Jan 1 2021 12:00 AM UTC

G # Use the recent S/O, P, B, R, X and H parameters to indicate whether blockage will result. Expect 'g' response from antenna with result.

G time=1293537618 # Same as above, except antenna will report on whether antenna will be blocked at time=1293537618. Expect 'g' response with result.

H 1123.321 0.256 rof=1.05# Hunt: floating point center frequency and bandwidth in MHz.

The modem informs the controller when the modem has detected the downstream carrier:

I iDirect 5100 # ID: modem manufacturer and type strings.

K 45 15 # sKew: maximum and minimum skew. The antenna controller must disable transmission when outside these angles (in degrees). This is typically used with non-circular apertures.

L 1 1 networkStatus=online # Lock status: Rx locked (1 is locked, 0 is unlocked), Tx OK (1 means antenna MAY transmit; 0 means antenna MUST NOT transmit). Modem may optionally indicate its network status.

M txMuteState=enable # Modem explicitly commands antenna to MUTE transmit. This takes precedence over any default action taken as a result of L x 0 command.

N antennaTestMode=stow # Non Track Test mode.. No transmission. The antenna should be placed in a state to aimed away from the geosynchronous arc. This is intended to support installation tests such as power measurements. An optional antennaTestMode may be specified.

O 1 25544U 98067A 08264.51782528 -.00002182 00000-0 -11606-4 0 2927 2 25544 51.6416 247.4627 0006703 130.5360 325.0288 15.72125391563537 ISS (ZARYA) #TLE string including the Title Line (Satellite Name)

P L R #Polarization: H, V, L or R for Rx and Tx, respectively.

P L R rx2=R tx2=L #Polarization: system with multiple Rx and/or Tx devices.

R regulatoryRegime=FCCMEO reportingInterval=2 #Regulatory Regime: Modem informs antenna that FCC MEO Tx ESD limits apply, requests antenna to report values required to adjust power every 2 seconds. Antenna reports those values back via the 'q' message.

S -20.1 1.0 3.5 # GEO Satellite longitude: All parameters are floating point degrees, "-" is West. Wander in latitude is 1.0. Polarization skew 3.5.

T 1450 4.5 # Transmit frequency: The modem intends to transmit at this L-Band frequency and bandwidth.

V B 2 rx2=1 tx2=1 # Command supported: Modem indicates to Antenna that it supports the 'B' command, with two unnamed parameters along with the keys identified, rx2 and tx2.

The modem requests periodic location information:

W 1 # Where: Antenna should send "w" location report every N seconds.

X nid=1234 # Xtra string: vendor-specific string for antenna controller.

Y extCmd=getConfigB #Modem requests the Antenna send BUC and LNB configuration options. Antenna responds with 'y replyTo=getConfigB', followed by configuration information.

Y extCmd=getConfigP #Modem requests the Antenna send Polarization configuration options. Antenna responds with 'y replyTo=getConfigP', followed by configuration information.

2.8.2 Messages from Antenna Controller to Modem

The controller must be able to provide status information to the modem such as, when it is locked onto the satellite, when it is functional and unblocked, how many attempts has it made to search for the satellite and (for installation support) when it is in a safe state for dummy transmission measurements. The controller sends an "s" message immediately after receiving an "F" message, and periodically at the interval defined by the "A" message:

a 60 # alive: modem should send keepalive messages every N seconds.

c 0.25 0.25 0.33 0.33 # conical scan setup: not supported by iDirect; included as a placeholder for compatibility with other vendors' systems.

g 1 1 0 0 18 blockTime=120 #In response to a configuration check specified by 'G' command, the antenna responds that in 120 seconds it will be in blockage. In this example, only the optional 5th parameter is used.

i YoyoDyne 1234 antennaSerialNo=13478 # ID command: antenna controller manufacturer, type, and serial number strings

q esdMax=23.1 gt=4.6 eirp=17.0 bandUnits=400 skewAngle=15.0 transceiverTemperature=45.3 transceiverPower=14.2 antennaAz=30.2 antennaEl=50.3 #Response from antenna to information requested in 'R' message, to be used by the modem in properly adjusting its output power to remain within regulatory compliance

r 10 B # reference frequency required for BUC and LNB.

s 1 1 1 0 # s: four parameters: functional, OK-to-transmit, searched once, not in transmitter test mode.

s 1 1 1 0 18 blockTime=45 # s: functional (1), OK-to-transmit (1), searched once (1), not in test mode (0), but a blockage is imminent (18) in 45 seconds (blockTime=45)

s 0 0 1 0 11 statusCode=12 StatusCode=25 # s with multiple errors detected: antenna not functional (0), modem transmit is not permitted (0), searched once (1), not in test mode (0), LNB Voltage Error (11), BUC Voltage Error (statusCode=12), and Motor Error (statusCode=25) detected.

The antenna controller sends GPS information to the modem:

w 1 -10.123 20.235 123456789 10000 91.0 223.52 0.10 -0.51 91.0 # where:

location report. valid, lat, lon, time, altitude, heading, speed,

pitch, roll, yaw.

The "w" message parameters require more explanation:

- Valid (1) or invalid (0)
- Latitude in floating point degrees (South is negative)
- Longitude in floating point degrees (West is negative)
- GPS time in seconds; if the antenna does not have GPS time, set this to zero
- Altitude, heading, speed, pitch, roll, yaw are not physically required for system operation, but support logging for regulatory compliance and system performance management

The “y” command can be used to asynchronously send information to the modem, and is also used to respond to specific modem requests for information: getConfigB, getConfigP, and getExtAntStatus. The example below shows a sample response to a request for BUC and LNB information in a system with a multiband LNB and a single-band BUC:

```
y replyTo=getConfigB rx1Band1LO=17300.000 rx1Band1Start=18250.000
rx1Band1Stop=18750.000 rx1Band1Inv=0 rx1Band1Active=1
rx1Band2LO=19300.000 rx1Band2Start=20250.000 rx1Band2Stop=20750.000
rx1Band2Inv=0 rx1Band2Active=0 tx1Band1LO=28500.000
tx1Band1Start=29000.000 tx1Band1Stop=29500.000 tx1Band1Inv=0
tx1Active=1
```

A further example of the ‘y’ response for command ‘getExtAntStatus’ is provided in *Extended Antenna Status* on page 45.

3 Compatibility

This chapter contains the following sections:

3.1 Version Compatibility

New versions of the OpenAMIP protocol may be published. New versions will be strict supersets of older versions and may extend the protocol in only two ways:

- A new version may add new message types
- A new version may add new parameters to the end of an existing message type

Do not use any other syntactic extensions. Any extension to the semantics of the protocol must not affect the semantics of earlier versions. The intent of this specification is that any older implementation of the protocol can interoperate with any newer implementation without loss of any of the older functionality. A compliant implementation of OpenAMIP must ignore any unexpected message type that it receives, and must ignore any unexpected parameters at the end of a message. Furthermore, a compliant implementation must operate successfully if it receives a message with too few parameters. Parameters that are added to the protocol in version 1.5 or later will have default values that the receiver will use if a message does not provide the parameter.

New versions of the protocol are required to be backward-compatible with older versions. This is ensured by requiring that the meanings of parameters never change from version to version. New parameters may be added to a message, and new messages may be added. The receiver is required to ignore extra parameters and unknown messages; this allows an older receiver version to work with a newer sender. The receiver is required to operate properly when it receives a message that does not have enough parameters; this allows a newer receiver version to work with an older sender (the older version will not implement functionality that requires the newer version), but the older version will continue to provide its functionality when operating with a partner that is using a newer version.

3.2 Modified OpenAMIP

Any antenna or modem manufacturer can extend the protocol by creating an extended type field. The extended type field consists of the manufacturer's name (with no spaces) followed by a colon, followed by a type (with no spaces). If a modem or antenna controller receives a message of unknown type, the modem or antenna controller will ignore the message. If the messages are optional for operation of the equipment, then the protocol still qualifies as "unmodified" OpenAMIP. If the messages must be used for a particular antenna or modem, then the resulting implementation must be called "modified OpenAMIP".

Examples:

```
Yoyodyne:NID 1132  # additional search parameter
```

```
iDirect:stow 1 # command specified by iDirect
```

3.3 Hardware Compatibility

OpenAMIP is intended for a typical installation with a specific modem and a specific antenna are installed and configured to work together. These are installation issues and the protocol was developed to focus on operations. It is the responsibility of the installer to assure that the parameters are compatible. Essentially all incompatibilities will cause loss of service and the need for intervention, so the mechanisms needed for auto-negotiation have no practical benefit. The obvious examples of incompatibilities occur in the "P", "H", and "B" commands. An antenna that is mechanically configured for LHCP and that has no polarization switch hardware will not operate correctly for RHCP or linear polarization. Similarly, an antenna with a mechanical polarizer will not be able to select Tx polarization independently from Rx polarization. Similarly, an antenna whose downconversion offset frequency ("LNB local oscillator") is fixed cannot implement a B command to change to another frequency, and more generally an antenna with a selectable downconversion frequency can only change to one of a small set of downconversion frequencies. Finally, an antenna whose tracking receiver supports a specific set of (one or more) bandwidths cannot select an arbitrary hunt bandwidth. It is the responsibility of the installer to ensure that the modem does not send parameters that the antenna does not support. For the hunt bandwidth, the antenna may choose to operate with a different hunt bandwidth. Do not operate the antenna for other unsupported "P", "B", and "H" parameters. When the antenna does not have a controllable down conversion frequency, the antenna may choose to ignore the "B" command. The modem may choose to not send the B command.

Appendix A Extended Antenna Status

In some deployments, the modem may request additional detailed status from the antenna for the purposes of system logging. The request and response are as follows:

[Modem] Y extCmd=getExtAntStatus

[Antenna] y replyTo=getExtAntStatus <sequence of k-v defined parameters>

or,

[Modem] Y extCmd=getExtTransceiverStatus

[Antenna] y replyTo=getExtTransceiverStatus <sequence of k-v defined parameters>

Implementations will vary widely between antenna manufacturers, so it is not the intention to codify these response parameters in the standard, nor is it the intention that the modem should parse this string and take action upon values within it. The modem is simply expected to forward this set of logging information.

Since the modem is not expected to act on any of the values contained in the dictionary below, the proposed extended Antenna or Transceiver status parameters below are not to be reported to the modem as part of the 'V'/'v' supported commands.

Nonetheless, there are many features common to antennas that can be reported on, the table below proposes names and descriptions for commonly monitored metrics. This list is not meant to be prescriptive or comprehensive.

Example,

```
[Modem] Y extCmd=getExtAntStatus
```

```
[Antenna] y replyTo=getExtAntStatus antAbsAz=87.50 antAbsEl=52.00
antAbsCL=12.00 antRltAz=30.50 antTrgAz=10.25 antTrgEl=8.25
antErrAz=5.00 antErrEl=2.00 feedSkew=20.0 antMD=manual trkMD=stepTrack
stOffset={-25.0,15.0,30.0,-20.5} antStats=motorError orbitType=meo
feedSkew=25.0 lnbLOSetting=18100 trkFreq=3333.2500 trkBw=100.00
rfband=Ka lat=10 long=10 alt=10000 speed=550.50 heading=30.25
time=12345678 roll=10.10 pitch=4.0 yaw=25.0 bucFwdPower=30.00
bucInputPower=15.50
```

Example,

```
[Modem] Y extCmd=getExtTransceiverStatus
[Antenna] y replyTo=getExtTransceiverStatus txState=ok
bucLatchedFault={externalReferenceFault} bucTemp=55.50 bucLOSetting=27500
lnbState=OK
```

A.1 getExtAntStatus Responses

Status parameters related to the status of the antenna.

A.1.1 Hardware

Table A-1. Antenna: Hardware

Parameter	Description	Data Type
antMan	Antenna Manufacturer	string
antPN	Manufacturer Part Number (P/N)	string
antSN	Manufacturers Serial Number (S/N)	string
antID	ID / hostname assigned to the antenna	string
antSW	Software Version of the Antenna	string

A.1.2 Dynamic Operating Data

Table A-2. Antenna: Dynamic Operating Data

Parameter	Description	Units (Type/Format)
trkLevel	Tracking receiver level / RSSI / AGC. Signal level reported by the ACU tracking receiver	dBm (float, +/-nnn.nn) -999.99 to +999.99
antAbsAz	Antenna Absolute Azimuth Angle. Current azimuth angle of the antenna	degrees (float, nnn.nn) 000.00 to 360.00
antAbsEl	Antenna Absolute Elevation Angle. Current elevation angle of the antenna	degrees (float, +/-nnn.nn) -90.00 to +90.00
antAbsCL	Antenna Absolute Cross-Level Angle. Current cross-level angle of the antenna	degrees (float, +/-nnn.nn) -90.00 to +90.00
antRltAz	Antenna Relative Azimuth Angle. Current antenna azimuth angle relative to the vessel heading	degrees (float, nnn.nn) 000.00 to 360.00

Table A-2. Antenna: Dynamic Operating Data

Parameter	Description	Units (Type/Format)
antTrgAz	Antenna Target Azimuth Angle. Calculated azimuth target angle	degrees (float, nnn.nn) 000.00 to 360.00
antTrgEl	Antenna Target Elevation Angle. The calculated elevation target angle	degrees (float, +/-nnn.nn) -90.00 to +90.00
antErrAz	Antenna Azimuth Error Error between absolute and target angle	degrees (float +/- nnn.nn) -360.00 to +360.00
antErrEl	Antenna Elevation Error Error between absolute and target angle	degrees (float, +/-nnn.nn) -90.00 to +90.00
stOffset	Step Track Offset. Step-track delta angles (consistent with data from conical scan 'c' from antenna)	degrees (list {float -Az, +El, +Az, -El}) {+/-nn.nn, +/-nn.nn, +/-nn.nn, +/-nn.nn} each float: -99.99 to +99.99
antMD	Antenna Mode. Operating mode of the antenna	string Defined options: {manual, search, acquiring, peaking, tracking, stop, park, stow, standby, maintenance, calibrating, fault} or custom string

Table A-2. Antenna: Dynamic Operating Data

Parameter	Description	Units (Type/Format)
trkMD	Tracking Mode. Tracking mode of the antenna	string Defined options: {stepTrack, programTrack, autoTrack, conicalScan} or custom string
antStatus	Antenna Status. Any faults or conditions that are present with the antenna.	list {string} ({status-1,status-2, … status-n}) Defined options: {ok, blocked, solarOutage, stabilisationError, motorError, encoderError, sensorError, acuCommsError, powerError, antennaOutOfCalibration, bucError, lnbError} or custom string

A.1.3 Configuration

Table A-3. Antenna: Configuration

Parameter	Description	Data Type
trgSatPos	Target Satellite Position. Longitude of the current target	degrees (float, +/-nnn.nn) -180.00 to +180.00
orbitType	Orbit Type. LEO / MEO / GEO	string Defined orbits: {leo, meo, geo} or custom string
txFeedPolSetting	Transmit Feed Polarization Setting Vertical / Horizontal / RHCP /LHCP	string Defined options {L, R, V, H}
rxFeedPolSetting	Receive Feed Polarization Setting Vertical / Horizontal / RHCP /LHCP	string Defined options {L, R, V, H}
satSkew	Satellite Skew Inherent skew angle of the satellite	degrees (float, +/-nnn.nn) -180.00 to +180.00
trkFreq	Tracking Receiver Frequency Receive tracking carrier frequency (L-band)	MHz (float, nnnn.nnnn) 0000.0000 to 3000.0000
trkBW	Tracking Receiver Bandwidth Receive tracking carrier bandwidth	MHz (float, nnn.nn) 000.00 to 999.99
rfBand	RF Band For multi-band antennas (C/Ku/Ka)	string Defined options {C, Ku, Ka, X} or Custom string
tleStatus	TLE File Status. TLE file / data state (good, bad)	String Defined options: {ok, invalid, none} or custom string
satID	Satellite ID. Current tracking satellite ID	string

A.1.4 Geolocation, Movement, Time

Table A-4. Antenna: Geolocation, Movement, Time

Parameter	Description	Data Type
lat	Terminal Latitude (-ve is south)	degrees (float, +/-nn.nnnn) -90.0000 to +90.0000
long	Terminal Longitude (-ve is west)	degrees (float, +/-nnn.nnnn) -180.0000 to +180.0000
alt	Terminal Altitude	metres (int, +/-nnnnn) -99999 to +99999
speed	Terminal Speed	metres/sec (float, nnn.nn) 000.00 to 999.99
heading	Heading Terminal movement direction relative to North	degrees (float, nnn.nn) 0.00 to 360.00
time	GPS Time	seconds (integer, nnnnnnnnnn) 0 to 9999999999
roll	Terminal Roll	degrees (float, +/-nn.nn) -90.00 to +90.00
pitch	Terminal Pitch	degrees (float, +/-nn.nn) -90.00 to +90.00
yaw	Terminal Yaw	degrees (float, +/-nnn.nn) -180.00 to +180.00

A.2 getExtTransceiverStatus Responses

Status parameters related to the status of the transceiver.

A.2.1 Transceiver

Table A-5. Transceiver

Parameter	Description	Data Type
txState	BUC / Transmitter status This should include any faults or conditions that are present with the BUC	list {string} ({status-1,status-2, … status-n}) Defined options: {ok, transmitterOn, externalMute, mute, externalReferenceFault, highForwardPowerFault, lowForwardPowerFault, internalFault, overTemperatureFault, fanFault, noConnection} or custom string
bucLatchedFault	BUC / Transmitter Latched Fault Latched faults within the BUC	list {string} ({fault-1,fault-2, … fault-n}) Defined options: {externalReferenceFault, highForwardPowerFault, lowForwardPowerFault, internalFault, overTemperatureFault, fanFault, noConnection} or custom string
bucFwdPower	BUC / Transmitter forward power	dBm (float, nn.nn) 00.00 to 99.99

Table A-5. Transceiver

Parameter	Description	Data Type
bucInputPower	BUC / Transmitter input power (if supported)	dBm (float, +/-nn.nn) -99.99 to +99.99
bucAtt	BUC / Transmitter attenuation setting	dB (float, nn.nn) 00.00 to 99.99
bucTemp	BUC / Transceiver Temperature	degrees Celcius (float, +/-nnn.nn) -999.99 to 999.99
bucFanSpeed	BUC / Transceiver Fan Speed	Revolutions per minute (integer nnnnnn) 0 to 999999
lnbState	This should include any faults or conditions that are present with the LNB	list {string} ({status-1,status-2, … status-n}) Defined options: {ok, externalReferenceError, voltageFault, toneFault, overCurrentFault, internalFault, overTemperatureFault, noConnection} or custom string
lnbLatchedfault	Latched faults within the LNB	list {string} ({fault-1,fault-2, … fault-n}) Defined options: {externalReferenceError, voltageFault, toneFault, overCurrentFault, internalFault, overTemperatureFault, noConnection} or custom string

Table A-5. Transceiver

Parameter	Description	Data Type
lnbLOSetting	LNB Local Oscillator Setting Receive Local Oscillator frequency configuration	MHz (integer, nnnnn) 00000 to 99999
bucLOSetting	BUC Local Oscillator Setting Transmit Local Oscillator frequency configuration	MHz (integer, nnnnn) 00000 to 99999
bucMan	Transceiver Manufacturer The BUC manufacturer	string custom string
bucPN	BUC/Transceiver Part Number The manufacturer part number	string custom string
bucSN	BUC/Transceiver Serial Number The manufacturers SN for the BUC	string custom string
bucID	BUC/Transceiver ID ID / hostname assigned to the BUC	string custom string
bucIFFilter	BUC IF Lowpass Harmonic filter setting get the BUC IF lowpass harmonic filter setting	string Defined options: {lowband, gpio_0, serial_0, tone_1}
bucSW	BUC/Transceiver SW Version get the current software version	string
bucADC	BUC/Transceiver Forward Power ADC Get the ADC reading from the power sensor	string {string, 3 characters, each 0 to F} ASCII representation of hex values from Analog-to-Digital converter 000 to FFF
bucPol	Transceiver Tx Polarization. Where a BUC / transceiver has an integrated transmit polarization switch	String Defined options {L, R, V, H}
lnbPol	Transceiver Rx Polarization. Where a transceiver has an integrated receive polarization switch	String Defined options {L, R, V, H}

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