AISG Extension:
Antenna Line Device Temperature Sensor

Temperature Sensor Extension to the Control Interface for Antenna Line Devices

Extension to AISG version 2.0

Revision History

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1. FOREWORD

The Antenna Interface Standards Group (AISG) published the AISG standard to facilitate the introduction of antenna line products with remote control and monitoring facilities. The purpose of that standard is to ensure basic interoperability of antennas and control infrastructure. The AISG standard covers two basic types of Antenna Line Devices: Actuators capable of altering the electrical downtilt of the antenna and tower mounted amplifiers.

It has become evident that commercial antenna line devices are evolving beyond this set of capabilities. The AISG has decided to publish extensions to the basic standard rather than adding all possible branches to the core specification. For purposes of compliance, users should note that this entire Extension Standard is *optional*. However, once a given Extension Standard is elected for inclusion in a device, the entire option becomes mandatory.

This extension to the AISG standard adds procedures for Antenna Line Devices that implement monitoring and reporting of temperature. These sensors may be placed within an Antenna Line Device to monitor the performance of certain components or to compensate for changes in ambient temperature. By providing the means of assigning temperature thresholds, this specification allows for alarming and reporting temperature characteristics which may negatively impact the performance of an Antenna Line Device.

2. SCOPE

This document contains extensions to layers 2 and 7 of AISG specification, version 2.0 [1], for Antenna Line Devices implementing Antenna Temperature Sensor (ATS).

3. REFERENCES

This AISG standard incorporates provisions from other publications. These are cited in the text and the referenced publications are listed below. Where references are dated, subsequent amendments or revisions of these publications apply only when specifically incorporated by amendment or revision of this AISG extension. For undated references the latest edition of the publication referred to applies.

1 AISG Version 2.0, “Control Interface for Antenna Line Devices”

2 3GPP TS25.460 UTRAN Iuant Interface General Aspects and Principles Release 6

3 3GPP TS25.461 UTRAN Iuant Interface Layer 1, Release 6

4 3GPP TS25.462 UTRAN Iuant Interface Signalling Transport, Release 6

5 [Not used]

6 3GPP TS25.463 UTRAN Iuant Interface: Application Part, Release 6

Note the 3GPP references are to Release 6 unless otherwise indicated. These documents are referred to in AISG Version 2.0, although they may have been superseded.

4. ABBREVIATIONS

Where abbreviations or acronyms are used in this document they have the following meanings:

ATS	Antenna Temperature Sensor
TCP	Time Consuming Procedure

5. TERMINOLOGY AND DEFINITIONS

Where the following terms are used in this document, they have the meanings listed below.

Temperature	Temperature is reported in decimal degrees Celsius, to one decimal place of accuracy, and then multiplied by 10 so that it may be represented by an integer.
Calculated Temperature	A value representing the 'best estimate' of temperature. This value is the result of averaging historical data, or any other means of calculation deemed appropriate by the ATS vendor for producing a consistently accurate result.
Temperature Precision	A value that represents the standard deviation of values from their arithmetic mean in temperature. This value may be used to judge the credibility of calculated temperatures.
Lowest Calculated Temperature	A temperature value that represents the lowest Calculated Temperature since the ATS was last layer-7 reset..
Highest Calculated Temperature	A temperature value that represents the highest Calculated Temperature since the ATS was last layer-7 reset..
Overtemp Alarm Threshold	A value that represents the highest measurement permitted without triggering a temperature alarm condition. An Overtemp Alarm Threshold is given in decimal degrees Celsius to one decimal place of accuracy, and then multiplied by 10 so that it may be represented by an integer.
Undertemp Alarm Threshold	A value that represents the lowest measurement permitted without triggering a temperature alarm condition. An Undertemp Alarm Threshold is given in decimal degrees Celsius to one decimal place of accuracy, and then multiplied by 10 so that it may be represented by an integer.

6. LAYER 1

All definitions and specifications for RET devices in the reference [1], [2] and [3] regarding luant layer 1 apply to ATS devices complying with this Extension Standard unless otherwise stated by requirements in this document.

6.1. DC supply

6.1.1. ATS DC power consumption

Power consumption shall be given by the product data sheet.

6.1.2. ATS Power-up characteristics

Devices complying with this Extension Standard shall have a maximum power-up period of 3 seconds.

After the power-up period, the device shall be fully functional.

6.2. Resumption of operation after interruption of supply

Normal operation shall be resumed after restoration of the power supply after any interruption or arbitrary reduction of the voltage supplied (brown-out) in accordance with [3].

NOTE: Temperature information may not be immediately available.

6.2.1. ATSs

During loss of DC power, antennas with ATSs continue in normal RF operation but will lose temperature monitoring functionality.

The following data shall be retained:

- Upper Temperature Threshold
- Lower Temperature Threshold

7. LAYER 2

All definitions and specifications for RET devices in reference [4] regarding Iuant layer 2 shall be valid for all antenna line devices included in this Extension Standard regardless of whether the device implements RET functionality.

Extended specifications for layer 2 are defined in the following chapter.

7.1. Device Type

For the purposes of reverse compliance with [4], devices implementing this Extension Standard shall report the device type in compliance with provisions in [6].

The following table shows the additional device type for this Extension Standard:

Table 7.1.1: Device type

Device Type	1-octet hexadecimal code
Antenna Line Device Temperature Sensor	0x24

8. LAYER 7

This chapter defines which procedures defined in [1] shall be re-used by ATS devices. This chapter also includes additional procedures which are specific to ATS devices.

8.1. General Aspects

8.1.1. Geometry and Numbering

All ATS devices shall be defined as multiple subunit devices.

NOTE: Devices with single ATS units shall be implemented as multiple subunit devices with the number of subunits equal to 1.

8.1.2. Parallel Procedure Handling for Time Consuming Procedures (TCPs)

The ATS device does not define any TCPs. Parallel procedure handling is not supported by the ATS.

8.2. Return and alarm codes

A table of return and alarm codes is given in [6] and extended in Annex A of this document.

8.3. Elementary Procedures for the ALD Temperature Sensor

To avoid prematurely exhausting the available space in the command table through the proliferation of extensions, certain codes defined for other devices are reused by this extension. This process is called “overloading”.

For device compliant with this extension, the overloaded code shall refer to a member of the ATS procedure set defined herein, and not to the procedure assigned by the original specification.

This section defines those procedures that are defined by overloading existing procedure codes without any significant changes in the procedure initiation message, response message, and/or return code values. For clarity, only differences from the language of the referenced specification are elaborated for these procedures.

Table 8.3.1 Common elementary procedures

ATS Command	Overloads	Code Value	Requirement
ATSAlarmIndication	TMAAlarmIndication [1]	0x76	Mandatory
ATSClearActiveAlarms	TMAClearActiveAlarms [1]	0x77	Mandatory
ATSGetAlarmStatus	TMAGetAlarmStatus [1]	0x78	Mandatory

These commands shall be implemented as specified in the corresponding paragraphs of [1].

8.4. Device-Specific Elementary Procedures for ATS Subunits

This section defines procedures that are defined by overloading existing procedures in [1] that include significant changes in the procedure message initiation, response, and/or return code values or formats. No requirements from the corresponding procedure clauses in [1] shall be inferred unless re-stated in this Extension Standard.

Table 8.4.1 Antenna Line Device Temperature Sensor elementary procedures for all supported functions

The following elementary procedures shall be included by all ATS implementations, regardless of supported functions.

ATS Command	Overloaded command	Code Value	Requirement
ATSGetSupportedFunctions	TMAGetSupportedFunctions [1]	0x7A	Mandatory
ATSGetTemperature		0xA5	Mandatory

Table 8.4.2 ATS Temperature Compare to Threshold function specific elementary procedures

If the Temperature Compare to Threshold function flag is set, the following elementary procedures must be supported.

ATS Command	Overloaded command	Code Value	Requirement
ATSSetTemperatureThresholds		0xA6	Mandatory
ATSGetTemperatureThresholds		0xA7	Mandatory

8.4.1. ATS Get Temperature

Table 8.4.1.1: Elementary procedure ATSGetTemperature

Name: **ATSGetTemperature**				
Code:	Issued by:	Procedure class:	DownloadMode state:	Power mode:
0xA5	**Primary device**	**1**	**No**	**Low**

Table 8.4.1.2: Initiating message parameters and format for ATSGetTemperature

Field	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number

Table 8.4.1.3: Response message parameters and format for ATSGetTemperature

Field	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number
2	1 octet	Return code	Return code: OK
3	2 octets	Signed integer	Calculated temperature
4	2 octets	Unsigned integer	Temperature precision
5	2 octets	Signed integer	Lowest calculated temperature
6	2 octets	Signed integer	Highest calculated temperature

Table 8.4.1.4: Return codes for ATSGetTemperature

OK	FAIL	Comment
	FormatError	See [1]
	HardwareError	
	WorkingSoftwareMissing	
	UnsupportedProcedure	
	OffScale	Temperature is beyond the capability of the sensor.
	NotConfigured	Prerequisite data has not been set. Unable to calculate result and fulfill request.
	NotReady	The ATS has been correctly configured, but the requested measurement is currently unavailable. The ATS is busy collecting the required data or performing calculations on collected data.

8.4.2. ATS Set Temperature Thresholds

On receipt of the initiating message the secondary device shall first set the addressed ATS subunit Major and Minor Overtemp and Major and Minor Undertemp Thresholds to the respective values passed in the message parameters, and then return the response message.

OutOfRange shall be returned for temperature thresholds which are beyond the range of values supported by the subunit, as reported by ATSGetSupportedFunctions.

FormatError shall be returned when MinorATSOvertempAlarm > MajorATSOvertempAlarm or when MinorATSUndertempAlarm < MajorATSUndertempAlarm.

When both Minor and Major thresholds are set to the same value, a Major Alarm shall be returned if an alarm is detected.

NOTE: Care should be taken to prevent excessive alarm state transitions. Mechanisms which require both a minimum timeframe and minimum change in temperature to be met before allowing alarm state transitions are highly recommended.

Table 8.4.2.1: Elementary procedure ATSSetTemperatureThresholds

Name: **ATSSetTemperatureThresholds**				
Code:	Issued by:	Procedure class:	DownloadMode state:	Power mode:
0xA6	**Primary device**	**1**	**No**	**Low**

Table 8.4.2.2: Initiating message parameters and format for ATSSetTemperatureThresholds

Field	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number
2	2 octets	Signed integer	Minor overtemp alarm threshold
3	2 octets	Signed integer	Major overtemp alarm threshold
4	2 octets	Signed integer	Minor undertemp alarm threshold
5	2 octets	Signed integer	Major undertemp alarm threshold

Table 8.4.2.3: Response message parameters and format for ATSSetTemperatureThresholds

Field	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number
2	1 octet	Return code	Return code: OK

Table 8.4.2.4: Return codes for ATSSetTemperatureThresholds

OK	FAIL	Comment
	FormatError HardwareError WorkingSoftwareMissing UnsupportedProcedure OutOfRange	See [1]

8.4.3. ATS Get Temperature Thresholds

Table 8.4.3.1: Elementary procedure ATSGetTemperatureThresholds

Name: **ATSGetTemperatureThresholds**				
Code:	Issued by:	Procedure class:	DownloadMode state:	Power mode:
0xA7	**Primary device**	**1**	**No**	**Low**

Table 8.4.3.2: Initiating message parameters and format for ATSGetTemperatureThresholds

Field	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number

Table 8.4.3.3: Response message parameters and format for ATSGetTemperatureThresholds

Field	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number
2	1 octet	Return code	Return code: OK
3	2 octets	Signed integer	Minor overtemp alarm threshold
4	2 octets	Signed integer	Major overtemp alarm threshold
5	2 octets	Signed integer	Minor undertemp alarm threshold
6	2 octets	Signed integer	Major undertemp alarm threshold

Table 8.4.3.4: Return codes for ATSGetTemperatureThresholds

OK	FAIL	Comment
	FormatError	See [1]
	HardwareError	
	WorkingSoftwareMissing	
	UnsupportedProcedure	
	NotConfigured	Prerequisite data has not been set. Unable to calculate result and fulfill request.

8.4.4. ATS Get Supported Functions

Table 8.4.4.1: Elementary procedure ATSGetSupportedFunctions

Name: **ATSGetSupportedFunctions**				
Code:	Issued by:	Procedure class:	DownloadMode state:	Power mode:
0x7A	**Primary device**	**1**	**No**	**Low**

Table 8.4.4.2: Initiating message parameters and format for ATSGetSupportedFunctions

Field	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number

Table 8.4.4.3: Response message parameters and format for ATSGetSupported Functions

On receipt of the initiating message, the ATS shall respond with the function flags and parameters indicating the supported functionality of the addressed ATS subunit.

The minimum and maximum measureable temperature parameters indicate the range of supported temperatures that will be returned by ATSGetTemperature and accepted by ATSSetTemperatureThresholds. Min > Max is disallowed.

Field	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number
2	1 octet	Return code	Return code: OK
3	1 octet	Unsigned integer	Function Flags
4	2 octets	Signed integer	Minimum measureable temperature
5	2 octets	Signed integer	Maximum measureable temperature

Table 8.4.4.4: Return codes for ATSGetSupportedFunctions

OK	FAIL	Comment
	FormatError HardwareError WorkingSoftwareMissing	See [1]

Table 8.4.4.5: Function Flags for ATSGetSupportedFunctions

Bit	7 to 1	0
Function	Spare	Temperature Compare to Threshold

Bits are numbered from 0…7, bit number 0 set to 1 represents the value 0x01
Bit value 0 represents function is not supported
Bit value 1 represents function is supported
Spare bits shall be set to zero

9. PRODUCT IDENTIFICATION

9.1. Marking of conforming products with extensions

In order to allow users to identify products which conform with the requirements of this extension standard, member companies are encouraged to use the AISG logo on conforming products and on any brochures, advertisements or product literature associated with them. In addition, the legends 'AISG 2.0 (Antenna Line Device Temperature Sensor Extension)' or 'Conforms with interface standard AISG 2.0 with Antenna Line Device Temperature Sensor Extension ' may be used on such products and associated literature.

Annex A: Return Codes for secondary AISG devices (Normative)

Table A.1: Assigned return codes and alarms of the ATS

Code	Meaning	Domain	Alarm
0x33	MinorATSOvertempAlarm	ATS	X
0x34	MajorATSOvertempAlarm	ATS	X
0x35	MinorATSUndertempAlarm	ATS	X
0x36	MajorATSUndertempAlarm	ATS	X
0x37	OffScale	ATS	