AISG Extension: Remote Azimuth Beamwidth

Remote Azimuth Beamwidth Extension to the Control Interface for Antenna Line Devices

Supplementary to AISG Standard No. AISG version 2.0

Revision History

DATE	ISSUE	NOTES
11 Dec 2007	2.1.0	Approved Vienna
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CONTENTS

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 the implementation of this entire Extension Standard is *optional*. However, once it 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 control of the azimuth beamwidth of an antenna.

2. SCOPE

This document contains extensions to layers 2 and 7 of AISG specification, version 2.0 [1], for antennas implementing Remote Azimuth Beamwidth (RAB) control.

3. REFERENCES

This AISG extension 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 3GPP TS25.463 UTRAN Iuant Interface Remote Electrical Tilting (RET), Release 6

6 3GPP TS25.466 UTRAN Iuant Interface: Application Part, Release 7

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:

ALD	Antenna Line Device
RAB	Remote Azimuth Beamwidth
RET	Remote Electrical Tilt
TCP	Time Consuming Procedure

5. TERMINOLOGY AND DEFINITIONS

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

Azimuth beamwidth	The angle, measured in degrees, between the -3dB points on either side of the maximum of the azimuth radiation pattern of an antenna.
Remote Azimuth Beamwidth device (RAB)	Antenna line device provided with means by which its azimuth beamwidth is varied in response to received commands.
Overload(ed)	A procedure code is said to be overloaded when the same code from a referenced document is re-used for another, similar purpose in this Extension Standard. For example, the code 0x74, which is defined as TMASetDeviceData in [1], is to be interpreted as RABSetDeviceData within this Extension Standard.
Subunit	An RAB may comprise more than one RAB subunit combined in a single physical entity. All RAB subunits within one RAB unit have the same layer 2 HDLC address and are separately addressed via layer 7 procedures.

6. LAYER 1

All definitions and specifications for RET devices in references [1], [2] and [3] regarding Iuant Layer 1 apply to Remote Azimuth Beamwidth devices complying with this Extension Standard unless otherwise stated by requirements in this document.

6.1. Normal operation

6.1.1. RAB DC power consumption

During movement of RAB subunits, power consumption shall remain compliant with the same specifications as RET subunits [5].

6.1.2. RAB 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].

Data to be retained shall include data relating to operational settings and user data; it shall not include address or alarm settings (see [3 and 4]).

6.2.1. RABs not requiring continuous DC power

There shall be no loss of the current set azimuth beamwidth, nor shall there be any autonomous movement or operation by the subunit.

These systems may be left un-powered for extended periods and will be expected to resume normal operation as soon as power is applied.

6.3. Unintended or interrupted movement

In the event that the RAB detects unintended movement or fails to complete a commanded movement, then the alarm ActuatorInterference shall be set unless another more appropriate alarm is set. (for example ActuatorJam, NotCalibrated, etc).

7. LAYER 2

All definitions and specifications for antenna line devices (ALDs) in references [1] and [4] regarding Iuant Layer 2 shall be valid for all ALDs included in this Extension Standard regardless of whether the device implements any other functionality.

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

7.1. Device Type

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

Table 7.1-1: Device type

Device Type	**1-octet unsigned integer**
Remote Azimuth Beamwidth	0x21

For the purposes of reverse compliance with [1] and [4], devices implementing this Extension Standard shall report the device type in compliance with provisions in [6].

8. LAYER 7

The application layer includes the common elementary procedures as defined in [1] and [5] and is extended by AISG-specific procedures.

8.1. General Aspects

8.1.1. Geometry and Numbering

All RAB devices shall be defined as multiple subunit devices. Devices with single RAB 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 following table extends the Common Procedure Sets [5] and [7] to include elementary procedures defined within this specification.

Table 8.1.2-1: Definition of TCPs and the execution of procedures in parallel to a TCP

Elementary Procedure	TCP	Execution in parallel to a TCP
RABSetDeviceData	no	disallowed
RABGetDeviceData	no	disallowed
RABAlarmIndication	no	disallowed
RABClearActiveAlarms	no	disallowed
RABGetAlarmStatus	no	mandatory
RABSetAzimuthBeamwidth	yes	disallowed
RABGetAzimuthBeamwidth	no	disallowed
RABSendConfigurationData	no	disallowed
RABCalibrate	yes	disallowed
RABGet SupportedFunctions	no	disallowed
RABGetNumberOfSubunits	no	mandatory
RABGetSupportedNonLinearBeamwidthValues	no	disallowed

8.2. Return and alarm codes

An annotated table of return and alarm codes is given in [5].

8.3. Common Elementary Procedures for Remote Azimuth Beamwidth

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

For all device subunits compliant with this extension, the overloaded code shall refer to a member of the RAB procedure set 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 Elementary procedures specified for multi-antenna device types

Azimuth Command	Overloads	Code Value	Requirement
RABSetDeviceData	TMASetDeviceData [1]	0x74	mandatory
RABGetDeviceData	TMAGetDeviceData [1]	0x75	mandatory
RABAlarmIndication	TMAAlarmIndication [1]	0x76	mandatory
RABClearActiveAlarms	TMAClearActiveAlarms [1]	0x77	mandatory
RABGetAlarmStatus	TMAGetAlarmStatus [1]	0x78	mandatory
RABGetNumberOfSubunits	TMAGetNumberOfSubunits	0x79	mandatory

These commands shall be implemented as specified in the corresponding paragraphs of [1], except that the term “TMA” shall be replaced by “RAB”.

8.4. Device-Specific Elementary Procedures for RAB Subunits

This section defines procedures that are defined by overloading existing procedures in [1] and [5] that include significant changes in the procedure message initiation, response, and/or return code values or formats. For clarity, these procedures are defined completely. No requirements from the overloaded procedure clauses in [1] or [5] shall be inferred unless re-stated in this Extension Standard.

Table 8.4-1 Azimuth Beamwidth specific elementary procedures

Azimuth Command	Overloads	Code Value	Requirement
RABSetAzimuthBeamwidth	AntennaSetTilt [5]	0x81	mandatory
RABGetAzimuthBeamwidth	AntennaGetTilt [5]	0x82	mandatory
RABSendConfigurationData	AntennaSendConfiguration Data [5]	0x89	optional
RABCalibrate	AntennaCalibrate [5]	0x80	optional
RABGetSupported Functions	TMAGetSupportedFunctions [1]	0x7A	mandatory
RABGetSupportedNonLinearBeamwidthValues	TMAGetSupportedNonLinear Gain Values [7]	0x7B	optional

8.4.1. RAB Set Azimuth Beamwidth

The demanded azimuth beamwidth shall be in the range 0 to 359.9 degrees. The format of this parameter is an unsigned integer expressed as azimuth beamwidth value times 10.

The azimuth beamwidth shall be accepted if:

- AZBWmin <= AZBWdemanded <= AZBWmax ,
- For linear-steps, AZBWdemanded = AZBWmin + n*AZBWresolution, where n is an unsigned integer,
- For non-linear steps, AZBWdemanded must be equal to a supported value.

Where AZBWmin and AZBWmax are the minimum and maximum values of azimuth beamwidth, AZBWdemanded is the demanded azimuth beamwidth and AZBWresolution is the control increment.

AZBWmin, AZBWmax, and AZBWresolution are reported by RABGetSupportedFunctions.

For all other values of AZBWdemanded, the subunit shall respond with return code UnsupportedValue [1].

Azimuth beamwidth adjustments shall not affect other configurable parameters.

The response time to this procedure shall be less than 2 minutes.

Note: The use of 0.1 degree increments for data representation, as implied above, is to be consistent with related data items and shall not be taken as a guarantee of that degree of accuracy.

Table 8.4.1-1: Elementary procedure RABSetAzimuthBeamwidth

Name: **Antenna Set Azimuth Beamwidth**				
Code:	Issued by:	Procedure class:	DownloadMode state:	Power mode:
0x81	**Primary device**	**1**	**No**	**High**

Table 8.4.1-2: Initiating message parameters and format for RABSetAzimuthBeamwidth

Number	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number
2	2 octets	Unsigned integer	Azimuth beamwidth

Table 8.4.1-3: Response message parameters and format for RABSetAzimuthBeamwidth

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

Table 8.4.1-4: Return codes for RABSetAzimuthBeamwidth

OK	FAIL	Comment
	FormatError Busy HardwareError WorkingSoftwareMissing MotorJam ActuatorJam NotConfigured NotCalibrated OutOfRange	see [5].

8.4.2. RAB Get Azimuth Beamwidth

The azimuth beamwidth returned shall be in the range 0 to 359.9 degrees. The format of this parameter shall be an unsigned integer expressed as azimuth beamwidth value times 10.

The use of 0.1 degree increments for data representation is to be consistent with related data items and shall not be taken as a guarantee of that degree of accuracy.

Table 8.4.2-1: Elementary procedure RABGetAzimuthBeamwidth

Name: **RAB Get Azimuth Beamwidth**				
Code:	Issued by:	Procedure class:	DownloadMode state:	Power mode:
0x82	**Primary device**	**1**	**No**	**Low**

Table 8.4.2-2: Initiating message parameters and format for RABGetAzimuthBeamwidth

Number	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number

Table 8.4.2-3: Response message parameters and format for RABGetAzimuthBeamwidth

Number	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number
2	1 octet	Return code	Return code: OK
3	2 octets	Unsigned integer	Azimuth beamwidth

Note that response parameter 3 is not required unless the return code = OK

Table 8.4.2-4: Return codes for RABGetAzimuthBeamwidth

OK	FAIL	Comment
	FormatError HardwareError WorkingSoftwareMissing NotConfigured NotCalibrated	see [5].

8.4.3. RAB Send Configuration Data

On receipt of the initiating message the secondary device shall store the provided vendor and antenna specific configuration data for the relationship between the movement of the drive system and the resulting azimuth beamwidth of the antenna.

If the configuration data exceeds (MaxDataReceiveLength–1), the data shall be split into a number of segments of length (MaxDataReceiveLength–1) and one final segment containing the remaining data. The primary device transmits the segments in order. The layer 2 sequence numbers guarantee that no segment will be lost or received out of order.

Table 8.4.3-1: Elementary procedure RABSendConfigurationData

Name: **Antenna Send Configuration Data**				
Code:	Issued by:	Procedure class:	DownloadMode state:	Power mode:
0x89	**Primary device**	**1**	**No**	**Low**

Table 8.4.3-2: Initiating message parameters and format for RABSendConfigurationData

Number	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number
2	Less than, or equal to (MaxDataReceive-Length–1)	Vendor specific	Configuration data

Table 8.4.3-3: Response message parameters and format for RABSendConfigurationData

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

Table 8.4.3-4: Return codes for RABSendConfigurationData

OK	FAIL	Comment
	FormatError Busy HardwareError WorkingSoftwareMissing ChecksumError InvalidFileContent UnsupportedProcedure	see [5].

8.4.4. RAB Calibrate

On receipt of the initiating message the RAB shall perform a calibration of the RAB addressed by the subunit number. During calibration the azimuth beamwidth may be driven through the whole azimuth beamwidth range.

The response time to this procedure shall be less than 4 minutes.

Table 8.4.4-1: Elementary procedure RABCalibrate

Name: **RABCalibrate**				
Code:	Issued by:	Procedure class:	DownloadMode state:	Power mode:
0x80	**Primary device**	**1**	**No**	**High**

Table 8.4.4-2: Initiating message parameters and format for RABCalibrate

Number	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number

Table 8.4.4-3: Response message parameters and format for RABCalibrate

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

Table 8.4.4-4: Return codes for RABCalibrate

OK	FAIL	Comment
	FormatError Busy HardwareError WorkingSoftwareMissing MotorJam ActuatorJam NotConfigured UnsupportedProcedure	see [5]

8.4.5. RAB Get Supported Functions

On receipt of the initiating message, the secondary device shall respond with the function flags and parameters indicating the supported functionality of the addressed azimuth beamwidth actuator.

Function flags are numbered as described in [1].

If the device only supports a number of fixed values for azimuth beamwidth (called Non-linear Beamwidth Values), it shall report an azimuth resolution value of “0”. The fixed values can be queried by RABGetSupportedNonLinearBeamwidthValues.

Table 8.4.5-1: Elementary procedure RABGetSupportedFunctions

Name: **RAB Get Supported Functions**				
Code:	Issued by:	Procedure class:	DownloadMode state:	Power mode:
0x7A	**Primary device**	**1**	**No**	**Low**

Table 8.4.5-2: Initiating message parameters and format for RABGetSupportedFunctions

Number	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number

Table 8.4.5-3: Response message parameters and format for RABGetSupportedFunctions

Number	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	Unsigned integer	Minimum azimuth beamwidth (RABmin) expressed in beamwidth values times 10
5	2 octets	Unsigned integer	Maximum azimuth beamwidth (RABmax) expressed in beamwidth values times 10
6	2 octets	Unsigned integer	Azimuth beamwidth resolution [degree] expressed in beamwidth values times 10, or 0, if the device only supports non linear beamwidth values.

Table 8.4.5-4: Return codes for RABGetSupportedFunctions

OK	FAIL	Comment
	FormatError Busy WorkingSoftwareMissing	see [5]

Table 8.4.5-5: Function Flags for RABGetSupportedFunctions

Number	Description
0	Set to 1 if subunit supports RABSendConfigurationData procedure, 0 otherwise.
1	Set to 1 if subunit supports RABCalibrate procedure, 0 otherwise.
2	Unused
3	Unused
4	Unused
5	Unused
6	Unused
7	Unused

8.4.6. RAB Get Supported Non-Linear Beamwidth Values

In response to the command RABGetSupportedNonLinearBeamwidthValues, the secondary device shall respond with a message containing a list of supported values in numerically ascending order, preceded by the number (N) of such values contained in the list.

Table 8.4.6-1: Elementary procedure RABGetSupportedNonLinearBeamwidthValues

Name: **RABGetSupportedNonLinearBeamwidthValues**				
Code:	Issued by:	Procedure class:	DownloadMode state:	Power mode:
0x7B	**Primary device**	**1**	**No**	**n/a**

Table 8.4.6-2: Initiating message parameters and format for RABGetSupportedNonLinearBeamwidthValues

Number	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number

Table 8.4.6-3: Response message parameters and format for RABGetSupportedNonLinearBeamwidthValues

Number	Length	Type	Description
1	1 octet	Unsigned integer	Number of non linear beamwidth values supported (N)
i+1	2 octets	Unsigned integer	Non linear beamwidth supported value number i (expressed in beamwidth value times 10)

I = 1..N

Table 8.4.6-4: Return codes RABGetSupportedNonLinearBeamwidthValues

OK	FAIL	Comment
	FormatError Busy WorkingSoftwareMissing UnsupportedProcedure	See [5]

9. VERSION MANAGEMENT

This chapter is not used in this Extension Standard

10. ADDITIONAL RECOMMENDATIONS

This chapter is not used in this Extension Standard

11. PRODUCT IDENTIFICATION

11.1. Marking of conforming products with extensions

In order to allow users to identify products which conform with the requirements of this 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 (Extension Azimuth beamwidth)' or 'Conforms with interface standard AISG 2.0 with Azimuth Beamwidth Extension ' may be used on such products and associated literature.

Annex A: Return Codes for Secondary AISG Devices (Normative)

The return codes listed in [5] annex A shall be used by secondary AISG devices.

Annex B: Re-Use of Assigned Fields for Additional Data (Normative)

The following fields defined in [5] Annex B, and [1] Annex C, are to be supported as described for information related to devices compliant with this Extension Standard. The following standard fields have no operational impact and are used by the procedures RABSetDeviceData and RABGetDeviceData.

Table B.1: Assigned fields for additional data

Field No.	Length (octets)	Format	Description	Additional Recommendations
0x01	15	ASCII	Antenna Model Number	
0x02	17	ASCII	Antenna Serial Number	
0x03	2	16-bit unsigned	Antenna Operating Bands	
0x04	8	4x16-bit unsigned	Beamwidth for each operating band in band order in degrees	
0x05	4	4x8-bit unsigned	Gain for each operating band in band order in tenths of dBi	
0x06	2	16-bit unsigned	Maximum supported azimuth beamwidth	Overloaded. Azimuth beamwidth [degree], expressed as beamwidth value times 10.
0x07	2	16-bit unsigned	Minimum supported azimuth beamwidth	Overloaded. Azimuth beamwidth [degree], expressed as beamwidth value times 10.
0x21	6	ASCII	Installation date	
0x22	5	ASCII	Installer's ID	
0x23	32	ASCII	Base station ID	
0x24	32	ASCII	Sector ID	
0x25	2	16-bit unsigned	Antenna bearing (degrees)	
0x26	2	16-bit signed	Installed mechanical tilt	(degrees times 10)