



Antenna Database
AISG-ST-ADB
vADB3.1.5.3

Revision History

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31 st January 2022	vADB3.1.5.3	Fourth public release
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1. FOREWORD (Informative)

This standard has been produced by the Antenna Interface Standards Group (AISG) to introduce and define new features and enhancement of the management system for antenna line devices (ALDs) with remote control and monitoring facilities. AISG v3.0 base standard describes the common behaviour of antenna line devices with AISG interfaces and type-specific functionality is defined in subunit type standards. This subunit type standard covers the antenna line devices capable of storing the antenna information.

This standard is independent of previous 3GPP specifications.

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2. SCOPE (Informative)

AISG v3.0 specifies the standard data interface between a primary, typically a base station, and antenna line devices (ALDs) which are manageable units, usually associated with base station antennas.

The standard is divided into the base standard and several subunit type standards. This subunit type standard document describes the specific behaviour of the Antenna Database (ADB) subunit.

This standard defines the functional behaviour of ADB subunits.

2.1 Interpretation (Normative)

The text of the standard defines explicitly what is required or permitted. Anything that is not explicitly allowed is not permitted.

All statements in this document are normative, unless indicated as informative or example.

For purposes of compliance and AISG interoperability, users should note that the implementation of this subunit type standard is optional. However, once it is selected for inclusion in a product, the entire standard becomes mandatory.

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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 listed with a specific version or release, subsequent amendments or revisions of these publications apply only when specifically incorporated by amendment or revision of this AISG standard. For references listed without a version or release, the latest edition of the publication referred to applies.

- 1 AISG v3.0: "Base Standard AISG v3.0"
- 2 AISG v3.0 STCM: "Subunit Type Compliance Matrix"
- 3 AISG APCC: "Antenna port colour coding standard"
- 4 170217 NGMN P-BASTA Whitepaper v10.0: "Recommendation on Base Station Antenna Standards"

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4. VERSION COMPLIANCE (Informative)

The compliance of this standard with different version of AISG v3 baseline standard is defined in [2].

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5. ABBREVIATIONS (Informative)

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

ADB	Antenna Database
ALD	Antenna Line Device
ID	Identifier
LHC	Left Hand Circular (Polarisation)
MALD	Multi-primary ALD
NGMN	Next Generation Mobile Networks
RET	Remote Electrical Tilt
RF	Radio Frequency
RHC	Right Hand Circular (Polarisation)
SALD	Single-primary ALD
TCC	Time-Consuming Command
Xpol+	Cross Polarisation, slant +45 degrees
Xpol-	Cross Polarisation, slant -45 degrees
3GPP	3 rd Generation Partnership Project



6. TERMINOLOGY

Where the following terms are used in this document, they have the following meanings:

Antenna port	RF port of the antenna with direction towards the base station.
Array observation direction reference	The direction from which the antenna is viewed to define its polarisation. Possible values are front and back. (Some vendors determine the polarisation by looking at the antenna from the front and others by looking at the antenna from the back, see Annex A).
Array polarisation sense reference	The sense in which the 45 degrees polarisation angle is specified. Vertical axis is used as starting point. Possible values are clockwise or counter-clockwise. This assumes that the antenna is installed in its intended orientation.
Mechanical bearing	The direction orthogonal to the axis of the antenna assembly, expressed in degrees East of True North (ETN).
Mechanical tilt	Tilt angle of the antenna in the vertical plane. Tilt at an angle below straight and level shall be represented by a positive number (down-tilt), while tilt at an angle above straight and level shall be represented by a negative number. Tilt is reported in decimal degrees, to one decimal place of accuracy, and then multiplied by 10 so that it may be represented by an integer.
Polarisation	Orientation of the electric field vector of the radio wave emitted by a array element of an antenna.

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7. DEFINITIONS

```
CONSTANT uint16_t NrOfSubunitAlarms ← 0 // Number of subunit alarm types for this  
subunit type
```



8. GENERAL ASPECTS

8.1. General

An Antenna DataBase (ADB) subunit stores data about the antenna, its contained arrays, installation and site mapping. Any antenna enclosure shall contain one and only one ADB subunit.

It is not allowed to implement an ADB subunit outside an antenna enclosure.

8.2. Subunit relationship

An ADB subunit has logical relationship with all ports of the ALD having antenna.

8.3. Array element and array ID

An array element is a basic building block of an antenna, defined in [1]. Array elements are differentiated by a array element number. This numbering scheme is vendor specific, but shall not include number 0.

Array ID, defined in [3], may contain several array elements, and it is not used in this subunit type standard. It is used in a label close to an antenna port to help installers to cable the site correctly.

8.4. Return codes

This subunit type standard extends the following subunit type specific return codes.

```
Enumeration ReturnCode_t : uint16_t {  
    ADBNotAntennaPort ← 0x0300 // e.g. a RET-port  
}
```

8.5. Resumption of operation

The following data shall be retained after reset:

- Antenna installation data
- RFPATHID and RFPATHIDAlias data

8.6. Replaceable submodule (Informative)

The behaviour of the antenna model number and antenna serial number fields are vendor specific and it is possible that if a replaceable submodule is exchanged on site, info in these fields changes or is lost. The user may have to maintain this information manually during submodule replacement as it is not mandatory for the vendor to provide a mechanism for reading this information to the new submodule from the antenna.

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9. LAYER 1

All definitions and specifications for ALDs in [1] regarding layer 1 shall be valid for ALDs which contain ADB subunits.

9.1. DC power consumption

This subunit type standard does not define the power consumption of an ADB. ADB is not able to switch the ALD to HighPowerMode.

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10. LAYER 2

All definitions and specifications for ALDs in [1] regarding layer 2 shall be valid for ALDs which contain ADB subunits.

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11. LAYER 7

An ALD which contains an ADB subunit shall support the command set which is defined in [1] in addition to those commands specified in this standard.

11.1. Subunit type

Subunit type	1-octet unsigned integer code
ADB	0x03

Table 11.1-1: Subunit type code

11.2. Overview of commands for ADB subunits

The table below shows an overview of all commands used in this ADB subunit type standard.

The following abbreviations are used in the Table 11.2-1: “Command set for ADB subunits”.

- M Mandatory
- O Optional
- Not applicable

	Code	Initiator	Subunit	Timeout	TCC	Mandatory for:			Changes the ConnectionState	Changes to HighPowerMode	Minimum required authority
						Primary	SALD	MALD			
ADB commands											
ADB Get Antenna Info	0x0300	Primary	>0	1 s	no	M	M	M	no	no	RO
ADB Get Antenna Port Info	0x0301	Primary	>0	1 s	no	M	M	M	no	no	RO
ADB Get Antenna Array Element Info	0x0302	Primary	>0	1 s	no	M	M	M	no	no	RO
ADB Set Antenna Installation Info	0x0303	Primary	>0	1 s	no	M	M	M	no	no	RW
ADB Get Antenna Installation Info	0x0304	Primary	>0	1 s	no	M	M	M	no	no	RO
Site mapping commands for ADB											
ADB Set RF Path ID To Array Element	0x0305	Primary	>0	1 s	no	O	M	M	no	no	RW
ADB Get RF Path ID From Array Element	0x0306	Primary	>0	1 s	no	O	M	M	no	no	RO

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Table 11.2-1: Command set for ADB subunits

11.3. Bearing representation

The bearing range supported is from 0.0° to +359.9° East of True North. The bearing value is expressed in 0.1° units with a range of 0 to +3599.

11.4. Mechanical tilt representation

The mechanical tilt range supported is -90.0 – +90.0. The mechanical tilt is expressed in 0.1° units with a range of -900 – +900.

11.5 Polarisation representation

Vendors define the polarisation value of an array as either negative or positive slant linear polarisation. [Value: Xpol+ or Xpol-]. This way of defining polarisation is not comparable between different vendors due to the differences in the polarisation references they use.

This standard defines a way to compose a vendor independent and compatible slant polarisation description by introducing two references that indicate the way that a vendor is defining polarisation. By combining the polarisation value and these two references, i.e. array observation direction reference and array polarisation sense reference, all specified by the manufacturer during ALD production and available through the ADB commands, vendor independent and comparable cross polarisation information can be derived. This method is only used for slant linear polarisation.

Array observation direction reference: Array polarisation is defined looking at the antenna from the front or from the back [Value: Front or Back].

Array polarisation sense reference: Array slant polarisation is defined referring to vertical. +45 degree polarisation may be defined as being oriented 45 degrees clockwise from vertical or 45 degrees counter-clockwise from vertical. [Value: CW or CCW].

Conversion from vendor specific polarisation to comparable polarisation is done using the table 11.5-1.

Polarisation Value	Array Observation Direction Reference	Array Polarisation Sense Reference	Comparable Polarisation ID
Xpol+	Front	CW	A
Xpol-	Front	CW	B
Xpol+	Back	CW	B
Xpol-	Back	CW	A
Xpol+	Front	CCW	B
Xpol-	Front	CCW	A
Xpol+	Back	CCW	A
Xpol-	Back	CCW	B

Table 11.5-1: Polarisation conversion

For examples of this method see Annex A.

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11.6. ADB commands

11.6.1. ADB Get Antenna Info

Description (Informative):

This command returns antenna information.

Message format:

```
PrimaryCommand ADBGetAntennaInfoCommand {
    CommandCode_t      Command ← 0x0300
    CommandSequence_t  PrimaryCommandSequence
    Subunit_t          Subunit
    DataLength_t       DataLength ← 0
}

ALDResponse ADBGetAntennaInfoResponse {
    CommandCode_t      Command ← 0x0300
    CommandSequence_t  PrimaryCommandSequence
    ReturnCode_t       ReturnCode
    DataLength_t       DataLength
    if (ReturnCode == OK) {
        uint8_t         LengthOfAntennaModelNumber // max 32 octets
        UTF8String_t    AntennaModelNumber
        Provenance_t    AntModelNumberProvenance
        uint8_t         LengthOfAntennaSerialNumber // max 32 octets
        UTF8String_t    AntennaSerialNumber
        Provenance_t    AntSerialNumberProvenance
        uint8_t         NrOfArrayElements
        Provenance_t    NrOfArrayElementsProvenance
    }
    else {
        ALDState_t      ALDState
        ConnectionState_t  ConnectionState
    }
}

Enumeration ReturnCode_t {
    OK
    FormatError
    UnknownCommand
    Busy
    InvalidSubunitNumber
    InvalidSubunitType
    NotAuthorised
    IncorrectState
}
```

Primary pseudocode (Normative):

(This section is intentionally left blank)

ALD pseudocode (Normative):

```
IF ALDType = MALD
    AND ActiveAuth[CurrentPort].Authority[Cmd.Subunit] = NoAccess THEN
    RETURN NotAuthorised
    EXIT
ENDIF
```


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```
result ← IsCommandAllowed( LIST{ OperatingConnectionState,
                               RestrictedConnectionState},
                               Cmd.Command, CurrentPort)
```

```
UNLESS result.allowed THEN
    RETURN result.code
    EXIT
ENDIF
```

```
RETURN OK, «AntennaModelNumber, AntennaSerialNumber, NrOfArrayElements and the
corresponding lengths and provenances»
CommandExit(Cmd.Command, CurrentPort)
EXIT
```

11.6.2. ADB Get Antenna Port Info

Description (Informative):

This command returns antenna port information, specifically a list of logical arrays connected to an antenna port.

Message format (Normative):

```
PrimaryCommand ADBGetAntennaPortInfoCommand {
    CommandCode_t      Command ← 0x0301
    CommandSequence_t  PrimaryCommandSequence
    Subunit_t          Subunit
    DataLength_t       DataLength ← 2
    uint16_t           PortNumber
}

ALDResponse ADBGetAntennaPortInfoResponse {
    CommandCode_t      Command ← 0x0301
    CommandSequence_t  PrimaryCommandSequence
    ReturnCode_t       ReturnCode
    DataLength_t       DataLength
    if (ReturnCode == OK) {
        uint8_t         NrOfArrayElementssConnectedToThePort
        uint16_t        ArrayElementsConnectedToThePort [NrOfArrayElementssConnectedToThePort]
        Provenance_t    ArrayElementssConnectedToThePortProvenance
    }
    else {
        ALDState_t      ALDState
        ConnectionState_t  ConnectionState
    }
}
```

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```
Enumeration ReturnCode_t {
    OK
    FormatError
    UnknownCommand
    Busy
    InvalidSubunitNumber
    InvalidSubunitType
    NotAuthorised
    IncorrectState
    InvalidPortNumber
    ADBNotAntennaPort
}
```

Primary pseudocode:

(This section is intentionally left blank)

ALD pseudocode:

```
IF Cmd.PortNumber < 1 OR Cmd.PortNumber > MaxPort THEN
    RETURN InvalidPortNumber
    EXIT
ENDIF

IF ALDType = MALD
    AND ActiveAuth[CurrentPort].Authority[Cmd.Subunit] = NoAccess THEN
    RETURN NotAuthorised
    EXIT
ENDIF

IF (PortProperties[Cmd.PortNumber] bitwise AND RF) ≠ RF OR
    (PortProperties[Cmd.PortNumber] bitwise AND Direction) ≠ TowardsBasestation)
    THEN
    RETURN ADBNotAntennaPort
    EXIT
ENDIF

result ← IsCommandAllowed( LIST{      OperatingConnectionState,
                                   RestrictedConnectionState},
                           Cmd.Command, CurrentPort)

UNLESS result.allowed THEN
    RETURN result.code
    EXIT

RETURN OK, «number of array elementss connected to the port, their array element
numbers and the corresponding provenance»
CommandExit(Cmd.Command, CurrentPort)
EXIT
```

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11.6.3. ADB Get Antenna Array Element Info

Description (Informative):

This command returns the properties of the array elements contained within an antenna. The frequency ranges in the response reflect the capabilities of the antenna; not the current usage by the primary.

Message format:

```
Bitfield ArrayPolarisation_t : uint8_t {
    Xpol+      : Bit 0
    Xpol-      : Bit 1
    Vertical    : Bit 2
    Horizontal  : Bit 3
    RHC        : Bit 4
    LHC        : Bit 5
}

Enumeration ArrayObservationReference_t : uint8_t {
    Front ← 0      // Polarisation is observed by looking at the
                  // antenna from the front for Xpol+ or Xpol-
    Back ← 1       // Polarisation is observed by looking at the
                  // antenna from the back for Xpol+ or Xpol-
    NotApplicable ← 2 // This reference is not applicable to LHC, RHC
                  // Vertical and Horizontal polarisation
}

Enumeration ArrayPolarisationSenseReference_t : uint8_t {
    CW ← 0        // Sense is 45 degrees clockwise from vertical
                  // for Xpol+ and Xpol-
    CCW ← 1       // Sense is 45 degrees counter-clockwise from vertical
                  // for Xpol+ and Xpol-
    NotApplicable ← 2 // This reference is not applicable to LHC, RHC
                  // Vertical and Horizontal polarisations
}

PrimaryCommand ADBGetAntennaArrayElementInfoCommand {
    CommandCode_t      Command ← 0x0302
    CommandSequence_t  PrimaryCommandSequence
    Subunit_t          Subunit
    DataLength_t       DataLength ← 2
    uint16_t           ArrayElementNumber
}
```

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```
ALDResponse ADBGetAntennaArrayElementInfoResponse {
    CommandCode_t          Command ← 0x0302
    CommandSequence_t      PrimaryCommandSequence
    ReturnCode_t           ReturnCode
    DataLength_t           DataLength
    if (ReturnCode == OK) {
        uint16_t            AzimuthBeamwidth3dB // see [4]
                                                // paragraph 3.2.5
        Provenance_t        AzimuthBeamwidth3dBProvenance
        uint16_t            Gain // max value in dBi
        Provenance_t        GainProvenance
        uint8_t             NrOfFrequencies
        FrequencyRange_t    ArrayFrequencies[1..NrOfFrequencies]
        Provenance_t        ArrayFrequenciesProvenance
        ArrayPolarisation_t ArrayPolarisation
        Provenance_t        ArrayPolarisationProvenance
        ArrayObservationReference_t ArrayObservationReference
        Provenance_t        ArrayObservationReferenceProvenance
        PolarisationSenseReference_t ArrayPolarisationSenseReference
        Provenance_t        ArrayPolarisationSenseReferenceProvenance
    }
    else {
        ALDState_t          ALDState
        ConnectionState_t    ConnectionState
    }
}

Enumeration ReturnCode_t {
    OK
    FormatError
    UnknownCommand
    Busy
    InvalidSubunitNumber
    InvalidSubunitType
    NotAuthorised
    IncorrectState
    InvalidArrayElementNumber
}
```

Primary pseudocode:

(This section is intentionally left blank)

ALD pseudocode:

```
IF Cmd. ArrayElementNumber < 1 OR Cmd. ArrayElementNumber > MaxLogicalArray THEN
    RETURN InvalidArrayElementNumber
EXIT
ENDIF

IF ALDType = MALD
    AND ActiveAuth[CurrentPort].Authority[Cmd.Subunit] = NoAccess THEN
        RETURN NotAuthorised
    EXIT
ENDIF

result ← IsCommandAllowed( LIST{ OperatingConnectionState,
                                RestrictedConnectionState},
                          Cmd.Command, CurrentPort)
```

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```
UNLESS result.allowed THEN
    RETURN result.code
    EXIT
ENDIF
```

```
RETURN OK, «Array element information and the corresponding provenances»
CommandExit(Cmd.Command, CurrentPort)
EXIT
```

11.6.4. ADB Set Antenna Installation Info

Description (Informative):

This command stores installation data and corresponding provenances in non-volatile memory.

Only if an automated tool is used to generate the information to be written and automatically transfer it to the primary, the primary shall set the provenance to Automatic. Otherwise the primary shall set the provenance to Manual.

The bitfield InstallationDataToBeStored controls which data fields are stored. The same bit in the bitfield controls the storage of the length of the data (where applicable), the data itself and its provenance as follows:

Bit value 1: Corresponding data is stored together with length (where applicable) and provenance. Existing data is overwritten.

Bit value 0: No data is written to the non-volatile memory and existing data is preserved. The corresponding data in the message is ignored. It is recommended that such data shall be zeroed.

Message format:

```
Bitfield DataToBeStored_t : uint8_t {
    SectorID           : Bit 0
    InstallationNotes  : Bit 1
    MechanicalBearing  : Bit 2
    MechanicalTilt     : Bit 3
}
```

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```
PrimaryCommand ADBSetAntennaInstallationInfoCommand {
    CommandCode_t      Command ← 0x0303
    CommandSequence_t  PrimaryCommandSequence
    Subunit_t          Subunit
    DataLength_t       DataLength
    DataToBeStored_t  InstallationDataToBeStored
    uint8_t            LengthOfSectorID           // max 32 octet
    TextString_t       SectorID
    Provenance_t       SectorIDProvenance
    uint8_t            LengthOfInstallationNotes  // max 140 octet
    UTF8String_t       InstallationNotes
    Provenance_t       InstallationNotesProvenance
    uint16_t           MechanicalBearing
    Provenance_t       MechanicalBearingProvenance
    int16_t            MechanicalTilt             // Mechanical
                                                    // tilt in
                                                    // degrees
    Provenance_t       MechanicalTiltProvenance
}

ALDResponse ADBSetAntennaInstallationInfoResponse {
    CommandCode_t      Command ← 0x0303
    CommandSequence_t  PrimaryCommandSequence
    ReturnCode_t       ReturnCode
    DataLength_t       DataLength
    if (ReturnCode == OK) {
    }
    else {
        ALDState_t      ALDState
        ConnectionState_t  ConnectionState
        uint8_t         ParameterNumber
    }
}

Enumeration ReturnCode_t {
    OK
    FormatError
    UnknownCommand
    Busy
    InvalidSubunitNumber
    InvalidSubunitType
    NotAuthorised
    IncorrectState
    OutOfRange
    InvalidProvenance
    GeneralError
}
```

NOTE: The InstallationNotes field can be used to record any notes that the user/installer considers useful.

Primary pseudocode:

(This section is intentionally left blank)

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ALD pseudocode:

```
IF ALDType = MALD
    AND ActiveAuth[CurrentPort].Authority[Cmd.Subunit] ≠ ReadWrite THEN
    RETURN NotAuthorised
    EXIT
ENDIF

result ← IsCommandAllowed( LIST{      OperatingConnectionState,
                                   RestrictedConnectionState},
                           Cmd.Command, CurrentPort)

UNLESS result.allowed THEN
    RETURN result.code
    EXIT
ENDIF

IF (Cmd.InstallationDataToBeStored.SectorID) THEN
    IF Cmd.LengthOfSectorID > 32 THEN
        Response.ParameterNumber ← 2
        RETURN OutOfRange
        CommandExit(Cmd.Command, CurrentPort)
        EXIT
    ELSEIF Cmd.SectorIDProvenance NOT IN (Manual, Automatic) THEN
        Response.ParameterNumber ← 2
        RETURN InvalidProvenance
        CommandExit(Cmd.Command, CurrentPort)
        EXIT
    ELSE
        «Store the LengthOfSectorID, SectorID and SectorIDProvenance to non-volatile
        memory»
    ENDIF
ENDIF

IF (Cmd.InstallationDataToBeStored.LengthOfInstallationNotes) THEN
    IF Cmd.LengthOfInstallationNotes > 140 THEN
        Response.ParameterNumber ← 3
        RETURN OutOfRange
        CommandExit(Cmd.Command, CurrentPort)
        EXIT
    ELSEIF Cmd.InstallationNotesProvenance NOT IN (Manual, Automatic) THEN
        Response.ParameterNumber ← 3
        RETURN InvalidProvenance
        CommandExit(Cmd.Command, CurrentPort)
        EXIT
    ELSE
        «Store the LengthOfInstallationNotes, InstallationNotes and
        InstallationNotesProvenance to non-volatile memory»
    ENDIF
ENDIF
```

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```
IF (Cmd.InstallationDataToBeStored.MechanicalBearing) THEN
  IF Cmd.MechanicalBearing > 3599 THEN
    Response.ParameterNumber ← 4
    RETURN OutOfRange
    CommandExit(Cmd.Command, CurrentPort)
    EXIT
  ELSEIF Cmd.MechanicalBearingProvenance NOT IN (Manual, Automatic) THEN
    Response.ParameterNumber ← 4
    RETURN InvalidProvenance
    CommandExit(Cmd.Command, CurrentPort)
    EXIT
  ELSE
    «Store the MechanicalBearing and MechanicalBearingProvenance to non-volatile
    memory»
  ENDIF
ENDIF
ENDIF

IF (Cmd.InstallationDataToBeStored.MechanicalTilt) THEN
  IF Cmd.MechanicalTilt > 900 OR Cmd.MechanicalTilt < -900 THEN
    Response.ParameterNumber ← 5
    RETURN OutOfRange
    CommandExit(Cmd.Command, CurrentPort)
    EXIT
  ELSEIF Cmd.MechanicalTiltProvenance NOT IN (Manual, Automatic) THEN
    Response.ParameterNumber ← 5
    RETURN InvalidProvenance
    CommandExit(Cmd.Command, CurrentPort)
    EXIT
  ELSE
    «Store the MechanicalTilt and MechanicalTiltProvenance to non-volatile
    memory»
  ENDIF
ENDIF
ENDIF

IF «the ALD detects a hardware error» THEN
  RAISE AlarmGeneralError SEVERITY Major ON Cmd.Subunit, "Hardware error"
  RETURN GeneralError // Replace "Hardware error" with descriptive text
  // to be read using GetDiagnosticInformation
ELSE
  RETURN OK
ENDIF
ENDIF

CommandExit(Cmd.Command, CurrentPort)
EXIT
```

11.6.5. ADB Get Antenna Installation Info

Description (Informative):

This command returns the installation data from the non-volatile memory.

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Message format:

```
PrimaryCommand ADBGetAntennaInstallationInfoCommand {
    CommandCode_t      Command ← 0x0304
    CommandSequence_t  PrimaryCommandSequence
    Subunit_t          Subunit
    DataLength_t       DataLength ← 0
}

ALDResponse ADBGetAntennaInstallationInfoResponse {
    CommandCode_t      Command ← 0x0304
    CommandSequence_t  PrimaryCommandSequence
    ReturnCode_t       ReturnCode
    DataLength_t       DataLength
    if (ReturnCode == OK) {
        uint8_t         LengthOfSectorID           // max 32 octet
        TextString_t    SectorID
        Provenance_t    SectorIDProvenance
        uint8_t         LengthOfInstallationNotes   // max 140 octet
        UTF8String_t    InstallationNotes
        Provenance_t    InstallationNotesProvenance
        uint16_t        MechanicalBearing
        Provenance_t    MechanicalBearingProvenance
        uint16_t        MechanicalTilt             // Mechanical
                                                    // tilt in
                                                    // degrees
        Provenance_t    MechanicalTiltProvenance
    }
    else {
        ALDState_t      ALDState
        ConnectionState_t  ConnectionState
    }
}

Enumeration ReturnCode_t {
    OK
    FormatError
    UnknownCommand
    Busy
    InvalidSubunitNumber
    InvalidSubunitType
    IncorrectState
    NotAuthorised
}
```

NOTE: The InstallationNotes field can be used to record any notes that the user/installer considers useful.

Primary pseudocode:

(This section is intentionally left blank)

ALD pseudocode:

```
IF ALDType = MALD
    AND ActiveAuth[CurrentPort].Authority[Cmd.Subunit] = NoAccess THEN
    RETURN NotAuthorised
    EXIT
ENDIF
```

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```
result ← IsCommandAllowed( LIST{ OperatingConnectionState
                                RestrictedConnectionState,
                                MALDSetupConnectionState},
                                Cmd.Command, CurrentPort)
```

```
UNLESS result.allowed THEN
    RETURN result.code
    EXIT
ENDIF
```

```
RETURN OK, «SectorID, InstallationNotes, MechanicalBearing, MechanicalTilt and the
corresponding lengths and provenances»
CommandExit(Cmd.Command, CurrentPort)
EXIT
```

11.6.6. ADB Set RF Path ID To Array Element

Description (Informative):

This command assigns the list of RF Path IDs and provenances, associated with the requesting primary, to the specified array element.

Message format:

After any antenna line configuration change, the mapping of the RF Path ID must be revalidated and possibly regenerated.

```
PrimaryCommand ADBSetRFPathIDToArrayElementCommand {
    CommandCode_t      Command ← 0x0305
    CommandSequence_t  PrimaryCommandSequence
    Subunit_t          Subunit
    DataLength_t       DataLength
    uint16_t           ArrayElementNumber
    Provenance_t       ArrayElementNumberProvenance
    uint8_t            NrOfRFPathIDs
    uint16_t           RFPathID[NrOfRFPathIDs]
}

ALDResponse ADBSetRFPathIDToArrayElementResponse {
    CommandCode_t      Command ← 0x0305
    CommandSequence_t  PrimaryCommandSequence
    ReturnCode_t       ReturnCode
    DataLength_t       DataLength
    if (ReturnCode == OK) {
    }
    else {
        ALDState_t      ALDState
        ConnectionState_t  ConnectionState
    }
}
```

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```
Enumeration ReturnCode_t {
    OK
    FormatError
    UnknownCommand
    Busy
    InvalidSubunitNumber
    InvalidSubunitType
    NotAuthorised
    IncorrectState
    InvalidArrayElementNumber
    TooManyArguments
    InvalidProvenance
    GeneralError
}
```

Primary pseudocode:

(This section is intentionally left blank)

ALD pseudocode:

```
IF ALDType = MALD
    AND ActiveAuth[CurrentPort].Authority[Cmd.Subunit] ≠ ReadWrite THEN
        RETURN NotAuthorised
    EXIT
ENDIF

IF Cmd.ArrayElementNumber < 1 OR Cmd.ArrayElementNumber > MaxArrayElement THEN
    RETURN InvalidArrayElementNumber
    EXIT
ENDIF

IF Cmd.NrOfRFPATHIDs > 6 THEN
    RETURN TooManyArguments
    EXIT
ENDIF

IF Cmd.Provenance NOT IN (Manual, Automatic) THEN
    RETURN InvalidProvenance
    EXIT
ENDIF

result ← IsCommandAllowed( LIST{ OperatingConnectionState},
                           Cmd.Command, CurrentPort)

UNLESS result.allowed THEN
    RETURN result.code
    EXIT
ENDIF
```

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«Store the RF path IDs and provenance for the supplied ArrayElementNumber and Cmd.PortNumber to non-volatile memory»

```
IF «the ALD detects a hardware error» THEN
    RAISE AlarmGeneralError SEVERITY Major ON Cmd.Subunit, "Hardware error"
    RETURN GeneralError          // Replace "Hardware Error" with descriptive text
                                // to be read using GetDiagnosticInformation
ELSE
    RETURN OK
ENDIF
CommandExit(Cmd.Command, CurrentPort)
EXIT
```

11.6.7. ADB Get RF Path ID Of Array Element

Description (Informative):

This command returns the RFPATHID list for the requested array element number, specific to the requesting primary.

Message format:

```
PrimaryCommand ADBGetRFPATHIDofArrayElementCommand {
    CommandCode_t      Command ← 0x0306
    CommandSequence_t  PrimaryCommandSequence
    Subunit_t          Subunit
    DataLength_t       DataLength ← 2
    uint16_t           ArrayElementNumber
}

ALDResponse ADBGetRFPATHIDofArrayElementResponse {
    CommandCode_t      Command ← 0x0306
    CommandSequence_t  PrimaryCommandSequence
    ReturnCode_t       ReturnCode
    DataLength_t       DataLength
    if (ReturnCode == OK) {
        uint8_t         NrOfRFPATHIDs
        uint16_t        RFPATHID[NrOfRFPATHIDs]
        Provenance_t    RFPATHIDProvenance
    }
    else {
        ALDState_t      ALDState
        ConnectionState_t  ConnectionState
    }
}

Enumeration ReturnCode_t {
    OK
    FormatError
    UnknownCommand
    Busy
    InvalidSubunitNumber
    InvalidSubunitType
    IncorrectState
    NotAuthorised
    InvalidArrayElementNumber
}
```

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Primary pseudocode:

(This section is intentionally left blank)

ALD pseudocode:

```
IF ALDType = MALD
    AND ActiveAuth[CurrentPort].Authority[Cmd.Subunit] = NoAccess THEN
    RETURN NotAuthorised
    EXIT
ENDIF

IF Cmd.ArrayElementNumber < 1 OR Cmd.ArrayElementNumber > MaxArrayElement THEN
    RETURN InvalidArrayElementNumber
    EXIT
ENDIF

result ← IsCommandAllowed( LIST{      OperatingConnectionState
                                   RestrictedConnectionState,
                                   MALDSetupConnectionState},
                           Cmd.Command, CurrentPort)

UNLESS result.allowed THEN
    RETURN result.code
    EXIT
ENDIF

RETURN OK, «number of stored RF path IDs and the list of RF path IDs of the requested
array element and its provenance and Cmd.PortNumber»
CommandExit(Cmd.Command, CurrentPort)
EXIT
```



ANNEX A: Direction definitions for polarisation

This annex shows how the directions from which the antenna is viewed to define its polarisation are defined.

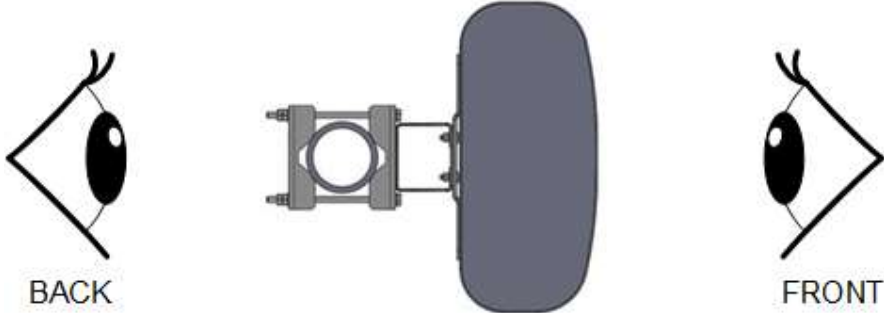


Figure A-1: Array observation reference directions (Back or Front)

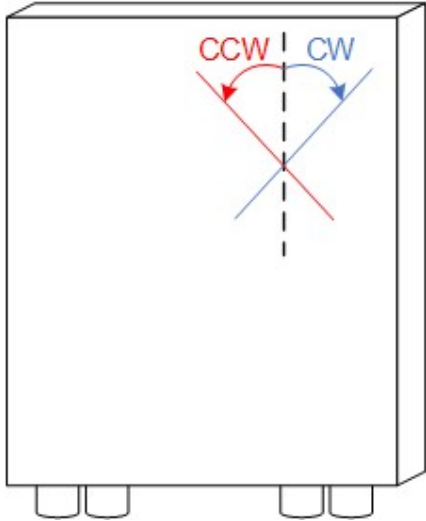


Figure A-2: Array polarisation sense reference (CW (Clockwise) and CCW (Counterclockwise))

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ANNEX B: Polarisation comparison example

Vendor X defines slant linear polarisation by looking the antenna from the back and uses clockwise array polarisation sense reference.

Vendor Y defines slant linear polarisation by looking the antenna from the front and uses clockwise array polarisation sense reference.

Vendor X has indicated that Array 1 polarisation is Xpol+. ADB Get Antenna Array Info reports that the vendor uses array observation direction reference "Back" and array polarisation sense reference "CW".

Vendor Y has indicated that Array 1 polarisation is Xpol-. ADB Get Antenna Array Info reports that the vendor uses array observation direction reference "Front" and array polarisation sense reference "CW".

Conversion using table 11.5-1:

Vendor X comparable polarisation is B.

Vendor Y comparable polarisation is B.