

ETSI TS 137 466 V16.0.0 (2020-09)



**Universal Mobile Telecommunications System (UMTS);  
LTE;  
5G;  
Luant interface: Application part  
(3GPP TS 37.466 version 16.0.0 Release 16)**



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**Reference**

RTS/TSGR-0337466vg00

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**Keywords**

5G,LTE,UMTS

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# Foreword

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# 1 Scope

The present document is an introduction to the 3GPP TS 37.46x series of Technical Specifications that define the Iuant Interface. The Iuant interface is applicable for UTRAN, E-UTRAN and NG-RAN. In this specification UTRAN, E-UTRAN and NG-RAN are denoted as "RAN", whereas the corresponding network entities Node B, eNB, en-gNB and NG-RAN node are denoted as "RAN Node". The logical Iuant interface is an interface internal to the RAN Node and defined to reside between the implementation specific O&M function and the RET antennas together with the TMAs control unit function of the RAN Node.

The present document is applicable for UTRAN, E-UTRAN and NG-RAN and specifies the *Remote Electrical Tilting Application Part (RETAP)* and the *Tower Mounted Amplifier Application Part (TMAAP)*. In this specification UTRAN, E-UTRAN and NG-RAN are denoted as "RAN", whereas the corresponding network entities Node B, eNB, en-gNB and NG-RAN node are denoted as "RAN Node". RETAP supports the functions of the Iuant interface between the implementation specific O&M transport function and the RET Antenna Control unit function, TMAAP supports the functions of the Iuant interface between the implementation specific O&M transport function and the TMA control function.

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# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

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- [1] Void
- [2] Void
- [3] 3GPP TS 37.462: "Iuant Interface: Signalling Transport".
- [4] 3GPP TS 37.461: "Iuant Interface: Layer 1".

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# 3 Definitions and abbreviations

## 3.1 Definitions

For the purposes of the present document, the following terms and definitions apply.

**Active alarm:** An alarm which has an alarm state that has been raised, but not cleared

**Alarm:** Persistent indication of a fault

**Alarm code:** A code that identifies a specific alarm. The alarm code set is a subset of the return code set. The alarm codes are listed in annex A of this TS

**Alarm state:** A condition or state in the existence of an alarm. Alarm states are raised and cleared

**ASCII character:** A character forming part of the International Reference Version of the 7-bit character set defined in ISO/IEC 646:1991

**Calibrate:** Exercise the antenna drive unit over its entire range of travel to ensure fault-free operation and synchronise the measured and actual beam tilt of the antenna

**Configuration data:** A stored table or function defining the relationship between the physical position of the drive and electrical beam tilt

**Data type:** A definition determining the value range and interpretation of a series of octets. The following specified data types are used in this TS:

Name:	Definition:
AlarmCode	1 octet unsigned enumerated code All AlarmCode values are listed in annex A of this TS
FieldNumber	1 octet unsigned enumerated code All field number values are listed in annex B of this TS
ProcedureCode	1 octet unsigned enumerated code
ReturnCode	1 octet unsigned enumerated code All ReturnCode values are listed in annex A of this TS
TextString	Octets with integer values in the range of 32 to 126 to be interpreted as ASCII characters

**Elementary procedure:** The RETAP and TMAAP protocol consists of elementary procedures (EPs). An elementary procedure is a unit of interaction between the primary device (RAN Node) and the secondary devices (RET or TMAs devices)

An EP consists of an initiating message and possibly a response message.

Two kinds of EPs are used:

- **Class 1:** Elementary procedures with response (success or failure).
- **Class 2:** Elementary procedures without response.

For **Class 1** EPs, the types of responses can be as follows:

Successful

- A signalling message explicitly indicates that the elementary procedure has been successfully completed with the receipt of the response.

Unsuccessful

- A signalling message explicitly indicates that the EP failed.

**Class 2** EPs are considered always successful.

**Error:** Deviation of a system from normal operation

**Fault:** Lasting error condition

**Little endian:** The order of transmission in which the least-significant octets of a multi-octet representation of a number are transmitted first. Little endian only applies to binary integer representations

**MaxDataReceiveLength:** SecondaryPayloadReceiveLength minus 3 octets (see subclause 4.8.1 in TS 37.462 [3])

**MaxDataTransmitLength:** SecondaryPayloadTransmitLength minus 3 octets (see subclause 4.8.1 in TS 37.462 [3])

**Procedure code:** A code identifying an elementary procedure

**Reset:** A process by which the device is put in the state it reaches after a completed power-up

**Return code:** A code which defines information about the outcome of an elementary procedure execution

**Tilt (also downtilt, tilt angle, beamtilt):** The elevation angle between the direction orthogonal to the antenna element axis and the maximum of its main beam in the elevation plane. A positive electrical tilt angle means that the antenna beam is directed below the direction orthogonal to the antenna axis. An antenna has separate values for electrical and mechanical tilt. The mechanical tilt is fixed by the geometry of the installation. In this TS the tilt referred to is always the electrical tilt unless otherwise stated

**Tilt value:** A signed integer used in elementary procedures to define the electrical tilt setting of the antenna. The tilt value is 10 times the antenna electrical tilt angle in degrees.



**TMA:** A TMA comprises a low noise amplifier together with its control and monitoring electronics and optional antenna modem.

**TMA subunit:** A TMA may comprise more than one TMA subunit. All TMA subunits within one TMA have the same HDLC address and are addressable by an index via the application layer procedures.

## 3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

EP	Elementary Procedure
HDLC	High-Level Data Link Control
RET	Remote Electrical Tilting
TMA	Tower Mounted Amplifier
RETAP	Remote Electrical Tilting Application Part
TMAAP	Tower Mounted Amplifier Application Part
TCP	Time-Consuming Procedure

---

## 4 General

### 4.1 Procedure specification principles

The principle for specifying the procedure logic is to specify the functional behaviour of the RET antenna control unit and TMA Subunits exactly and completely. The RAN Node functional behaviour is left unspecified.

The following specification principles have been applied for the procedure text in clause 6:

- The procedure text discriminates between:

- 1) Functionality which "shall" be executed

The procedure text indicates that the receiving node "shall" perform a certain function Y under a certain condition. If the receiving node supports procedure X but cannot perform functionality Y requested in the REQUEST message of a Class 1 EP, the receiving node shall respond with the message used to report unsuccessful outcome for this procedure, containing an appropriate cause value.

- 2) Functionality which "shall, if supported" be executed

The procedure text indicates that the receiving node "shall, if supported," perform a certain function Y under a certain condition. If the receiving node supports procedure X, but does not support functionality Y, the receiving node shall proceed with the execution of the EP, possibly informing the requesting node about the not supported functionality.

### 4.2 Forwards and backwards compatibility

The forwards and backwards compatibility of all versions of the protocol shall be assured by a mechanism in which all current and further messages will not be changed in the future. These parts can always be decoded regardless of the standard version.

New functionalities are added into the specification by introducing new procedures and thus the existing messages are not changed in the future.

### 4.3 Multi-antenna units

The RETAP elementary procedures are split into a single-antenna oriented part, a multi-antenna oriented part and a common part for both device types in order to support RET units controlling single- or multi-antenna devices. The RET unit responds, upon request, the number of antennas it controls. All multi-antenna oriented elementary procedures include a parameter stating which antenna the elementary procedure addresses. Antennas are numbered 1 and upwards.

## 4.4 Integer representation

Multi-octet integer values are transmitted in little endian order. Signed integers are represented as 2-complement values.

## 4.5 TMA Subunits

TMA subunits shall be numbered starting with 1 and proceeding upwards. The error message format for TMA procedures follows that of multiple RET devices.

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# 5 Services expected from signalling transport

RETAP and TMAAP requires an assured in-sequence delivery service from the signalling transport and notification if the assured in-sequence delivery service is no longer available.

## 5.1 Elementary procedure format

Layer 2 provides a full-duplex link for the transmission of RETAP and TMAAP messages.

There are two types of RETAP and TMAAP elementary procedures:

**Class 1:** Initiating messages are sent either from the primary to a secondary device, or from a secondary to the primary device, in order to initiate some action within the receiving device. The other device sends a response message completing the procedure.

**Class 2:** Initiating messages are sent either from the primary to a secondary device, or from a secondary to the primary device. No response message is expected.

All RETAP and TMAAP messages use the same basic format:

**Table 5.1.1: Basic format for all RETAP and TMAAP messages**

Elementary procedure	Number of data octets	Data
1 octet	2 octets	MaxDataReceiveLength or MaxDataTransmitLength.

NOTE: Response messages have the same basic format as initiating messages. The elementary procedure code shall be the same in the response message as in the associated initiating message.

### 5.1.1 Initiating message

The data part of an initiating message may contain parameters as specified in clause 6 of this TS.

### 5.1.2 Response message

Elementary procedures shall, unless otherwise specified, provide a response message within 1 second. The response time is measured from the time the message frame was received by the transport layer to the time the response message is ready for transfer by the transport layer.

If the class1 elementary procedure requested by the initiating message was successfully executed, the response message data part from a single-antenna device shall contain return code <OK>. Additional information may follow in the data part. The response message data part from a multi-antenna device starts with the antenna number followed by return code <OK> and optional additional information.

If the elementary procedure requested by the initiating message was not successfully executed, the response message data part from a single-antenna device shall contain return code <FAIL>.

The following octet shall contain a second return code which describes why the execution of the requested procedure failed. The response message data part from a multi-antenna device starts with the antenna number followed by return code <FAIL> and a second return code which describes why the execution of the requested procedure failed.

In some situations an initiating message can cause a change of operating conditions, for instance a SetTilt procedure might cause a RET device to discover that an adjuster is jammed or that a previously jammed adjuster works normally again. In these cases an alarm procedure reporting the change of operating conditions shall be used in addition to the regular <OK> or <FAIL> return codes in response message.

A complete annotated table of all return codes with their corresponding hexadecimal numbers is provided in annex A of this TS.

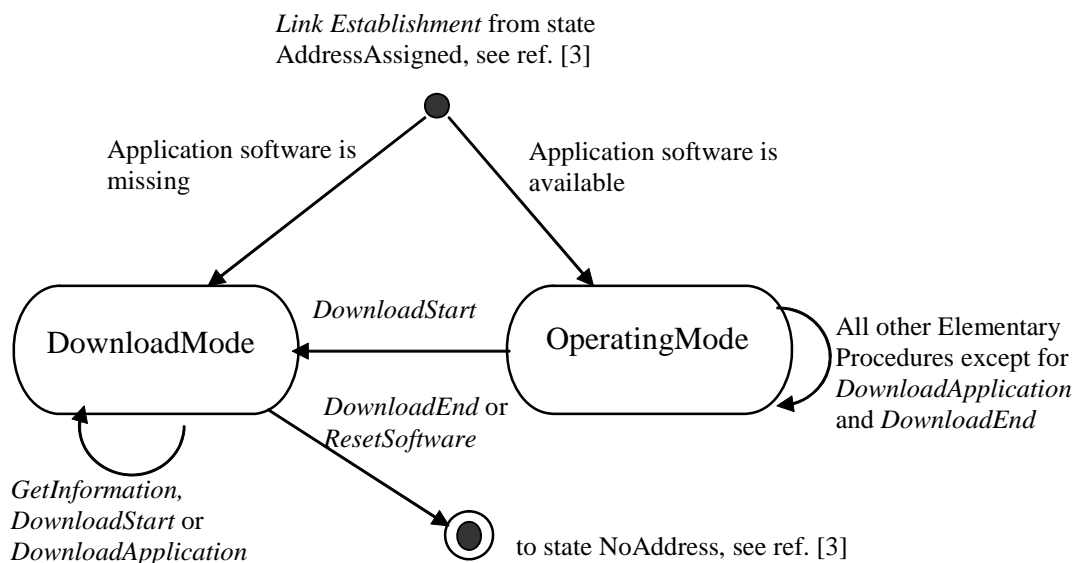
Return codes marked with an X in the Alarm column of annex A in this TS are used to report operating conditions in alarm procedures (see subclauses 6.6.5 and 6.7.6 for details).

## 6 Control elementary procedures

### 6.1 State model

The state model describing the secondary device is shown in figure 6.1 with procedures written in *italic*.

The relation to the connection state model for layer 2 can be found in TS 37.462 [3].



**Figure 6.1: State model for the Secondary device**

If an application software is not missing the secondary device enters the state **OperatingMode**.

If an application software is missing, the secondary device enters the state **DownloadMode**. In this state only software download functionality is supported in order to restore the application software.

The primary device will be notified that the secondary device has entered the state **DownloadMode** when a procedure which only is supported in the state **OperatingMode** fails with the return code *WorkingSoftwareMissing*.

If no software download functionality is supported, then only the state **OperatingMode** for the secondary device is supported.

## 6.2 General procedure handling

### 6.2.1 Alarms

When a fault is detected, the corresponding alarm state shall be changed to state *raised* by the secondary device. When the fault no longer exists, the corresponding alarm state shall be changed to state *cleared* by the secondary device. Alarm changes are reported through the AlarmIndication or AntennaAlarmIndication elementary procedures. Whenever an AlarmIndication or AntennaAlarmIndication elementary procedure message is transmitted, it shall contain all the alarm states changed that have not yet been reported as described in subclauses 6.6.5 and 6.7.6.

All alarm states shall be cleared by any type of reset.

### 6.2.2 Procedure message interpretation

The following message interpretation rules shall apply to a secondary device in the order mentioned:

- Any message shorter than 3 octets shall be disregarded. In case of Multi-Antenna-Procedures or TMA-Procedures, which uses a subunit field, any messages shorter than 4 octets shall be disregarded;
- If a message has a length inconsistent with its "Number of data octets" field value it shall be responded with a failure message stating "FormatError" as the cause of failure. The response message shall be to the initiating message identified by the procedure code;
- If a secondary device in the OperatingMode state receives a procedure message which is undefined for this device type, it shall respond with "Unknown Procedure";
- If a secondary device in the OperatingMode state is receiving a procedure message of an optional procedure not supported, it shall respond with a failure message stating "UnsupportedProcedure" as the cause of failure;
- If a secondary device receives a procedure message, part of the software download procedure sequence described in Annex C, without having received the previous procedure messages in that sequence it shall respond with a failure message stating "InvalidProcedureSequence" as the cause of failure;
- If a secondary device in the DownloadMode state is receiving a procedure message not supported in that state it shall respond with a failure message stating "WorkingSoftwareMissing" as the cause of failure;
- If a message has a length inconsistent with the defined message length in the procedure definition it shall be responded with a failure message stating "FormatError" as the cause of failure. The response message shall be to the initiating message identified by the procedure code;
- If a secondary device in the OperatingMode state is receiving a procedure message which addressed device subunit does not exist "FormatError" shall be returned.

### 6.2.3 Parallel procedure handling

The secondary device shall support parallel execution of in maximum one additional EP only in parallel to one of the Time-Consuming Procedures defined in table 6.2.3.1:

**Table 6.2.3.1: Definition of TCPs and the execution of procedures in parallel to a TCP**

Elementary Procedure	TCP	Execution in parallel to a TCP
<b>Common Procedure Set</b>		
(Reserved)		
Reset Software	No	mandatory
Get Alarm Status	No	mandatory
Get Information	No	mandatory
Clear Active Alarms	No	disallowed
Read User Data	No	optional
Write User Data	No	optional
Alarm Subscribe	No	optional
Self Test	Yes	disallowed
Download Start	No	disallowed
Download Application	No	disallowed
Download End	No	disallowed
Vendor specific procedure	vendor specific	optional
<b>Single-Antenna Procedure Set</b>		
Set Device Data	No	optional
Get Device Data	No	optional
Calibrate	Yes	disallowed
Send Configuration Data	No	disallowed
Set Tilt	Yes	disallowed
Get Tilt	No	optional
Alarm Indication	No	optional
<b>Multi-Antenna Procedure Set</b>		
Antenna Calibrate	Yes	optional
Antenna Send Configuration Data	No	disallowed
Antenna Set Tilt	Yes	optional
Antenna Get Tilt	No	optional
Antenna Set Device Data	No	optional
Antenna Get Device Data	No	optional
Antenna Alarm Indication	No	optional
Antenna Clear Active Alarms	No	disallowed
Antenna Get Alarm Status	No	mandatory
Antenna Get Number of Antennas	No	mandatory

"yes" in the "TCP" column indicates that the procedure is a TCP, "no" in the "TCP" column indicates that the procedure is not a TCP. "mandatory" in the "Execution in parallel to a TCP" column indicates that the procedure shall be executed in parallel to an ongoing TCP. "optional" in this column indicates, that the support of the execution of the procedure in parallel to an ongoing TCP is optional and "disallowed" indicates that the procedure shall not be executed in parallel to a TCP.

If a secondary device receives an initiating message for an EP which cannot be executed due to the ongoing execution of other EPs, the secondary device shall respond with a failure message stating "Busy" as the cause of failure.

Parallel execution of one TCP marked "optional" in the "Execution in parallel to a TCP" column in table 6.2.3.1 may be supported for each antenna by the secondary device. The EPs AntennaSetTilt and AntennaCalibrate shall be executed in parallel only for different antenna numbers. If more than one TCP is executed, ResetSoftware shall be executed anyway and never be responded with "Busy".

If the EPs Get Tilt and Antenna GetTilt are executed in parallel with a TCP, their response message shall deliver a tilt value sampled during their execution.

TMAAP doesn't define any TCPs. Therefore parallel procedure handling is not supported by TMAAP.

## 6.3 Overview of elementary procedures

The set of elementary procedures for RET antennas and TMAs control provides procedure-oriented instructions. An overview of the procedures is given in annex D. Table 6.3.1 lists all common elementary procedures described in subclause 6.5. Table 6.3.2 lists all RETAP elementary procedures specific for single-antenna device types described in subclause 6.6. Table 6.3.3 lists all RETAP elementary procedures specific for multi-antenna device types described in

subclause 6.7. Table 6.3.4 lists all TMAAP elementary procedures specific for TMA device types described in subclause 6.8. Subclause 6.4 describes how to interpret the elementary procedure definitions in subclauses 6.5 to 6.8.

Some elementary procedures shall be performed in sequence as described in Annex C for the software download.

**Table 6.3.1: Common elementary procedure set for all device types**

Elementary procedure	Requirement	Comment
Reset Software	Mandatory	
Get Alarm Status	Mandatory	
Get Information	Mandatory	
Clear Active Alarms	Mandatory	
Alarm Subscribe	Mandatory	
Read User Data	Mandatory	
Write User Data	Mandatory	
Self Test	Mandatory	
Download Start	Optional	This procedure is mandatory if the software download feature is supported
Download Application	Optional	This procedure is mandatory if the software download feature is supported
Download End	Optional	This procedure is mandatory if the software download feature is supported
Vendor specific procedure	Optional	

**Table 6.3.2: RETAP Elementary procedure set for single-antenna device type**

Elementary procedure	Requirement	Comment
Calibrate	Mandatory	
Send Configuration Data	Mandatory	
Set Tilt	Mandatory	
Get Tilt	Mandatory	
Alarm Indication	Mandatory	
Set Device Data	Mandatory	
Get Device Data	Mandatory	

**Table 6.3.3: RETAP Elementary procedure set for multi-antenna device type**

Elementary procedure	Requirement	Comment
Antenna Calibrate	Mandatory	
Antenna Send Configuration Data	Mandatory	
Antenna Set Tilt	Mandatory	
Antenna Get Tilt	Mandatory	
Antenna Set Device Data	Mandatory	
Antenna Get Device Data	Mandatory	
Antenna Alarm Indication	Mandatory	
Antenna Clear Active Alarms	Mandatory	
Antenna Get Alarm Status	Mandatory	
Antenna Get Number Of Antennas	Mandatory	

**Table 6.3.4: TMAAP elementary procedure set for TMA devices**

Elementary procedure	Requirement	Comment
TMASetMode	Optional	Shall only be supported if the TMA subunit supports bypass mode
TMAGetMode	Mandatory	
TMAGetSupportedFunctions	Mandatory	
TMASetGain	Optional	Shall only be supported if the TMA subunit supports variable gain
TMAGetGain	Mandatory	
TMASetDeviceData	Mandatory	
TMAGetDeviceData	Mandatory	
TMAAlarmIndication	Mandatory	
TMAClearActiveAlarms	Mandatory	
TMAGetAlarmStatus	Mandatory	
TMAGetNumberOfSubunits	Mandatory	
TMAGetSupportedNonLinearGainValues	Optional	Shall only be supported if the TMA subunit supports variable gain with non-linear steps

## 6.4 Description of elementary procedures

**Table 6.4.1: Description of elementary procedures**

<b>Name:</b> The name used to refer to the elementary procedure				
<b>Code:</b> The code is defined here. All other code references are informative	<b>Issued by:</b> Primary device or secondary device	<b>Procedure class:</b> Class 1 or Class 2	<b>DownloadMode state:</b> Defines whether the procedure shall be supported in the DownloadMode state.	<b>Power mode:</b> Defines the secondary device power consumption as described in TS 37.461 [4] during the execution of the elementary procedure.

**Table 6.4.2: Initiating and response message parameters and format**

Number	Length	Type	Description
The enumerated order in which the parameter occurs in the data field of the message. The first number is 1.	The length of the parameter, in number of octets, if defined.	The data type used in the parameter.	Description of the parameter.

**Table 6.4.3: Response message parameters and format for common class 1 elementary procedures upon error**

Number	Length	Type	Description
1	1 octet	ReturnCode	Return code FAIL
2	1 octet	ReturnCode	Reason for failure

**Table 6.4.4: Response message parameters and format for single-antenna class 1 elementary procedures upon error**

Number	Length	Type	Description
1	1 octet	ReturnCode	Return code FAIL
2	1 octet	ReturnCode	Reason for failure

**Table 6.4.5: Response message parameters and format for multi-antenna class 1 and TMA subunit class 1 elementary procedures upon error**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Antenna number or TMA subunit number
2	1 octet	ReturnCode	Return code FAIL
3	1 octet	ReturnCode	Reason for failure

NOTE 1: The response message in the elementary procedure AntennaGetAntennaNumber, has the format given in table 6.4.4, although it is defined as a multi-antenna class 1 elementary procedure.

NOTE 2: The response message in the elementary procedure TMAGetNumberOfSubunits has the format given in table 6.4.4 as class 1 elementary procedure.

**Table 6.4.6: Return codes**

OK	FAIL	Comment
All return codes applicable in a response message to a successful procedure, except "OK", are listed here. The return codes are listed by name as defined in annex A.	All return codes applicable in a response message to a failing procedure, except "FAIL" are listed here. The return codes are listed by name as defined in annex A.	Any comment needed for clarification.

## 6.5 Common elementary procedures

### 6.5.1 Reset Software

**Table 6.5.1.1: Elementary procedure Reset Software**

Name: ResetSoftware				
Code: 0x03	Issued by: Primary device	Procedure class: 1	DownloadMode state: Yes	Power mode: Low

**Table 6.5.1.2: Initiating message parameters and format for Reset Software**

Number	Length	Type	Description
None	0 octets	None	No data carried

**Table 6.5.1.3: Response message parameters and format for Reset Software**

Number	Length	Type	Description
1	1 octet	ReturnCode	Return code OK

#### Description:

On the receipt of the initiating message the secondary device shall reset the application. All alarm states shall be cleared.

If the initiating message is received in the OperatingMode state, the transport layer shall remain unaffected.

If the initiating message is received in the DownloadMode state, the ResetSoftware procedure shall reset the entire device without activating any new application software downloaded since entering the DownloadMode state.

The device shall not execute the reset procedure before transport layer acknowledgement through sequence number update is received for the response.



Table 6.5.1.4: Return codes for Reset Software

OK	FAIL	Comment
	FormatError	In case of format error, the procedure code validity is not secured.

## 6.5.2 Get Alarm Status

Table 6.5.2.1: Elementary procedure Get Alarm Status

Name: <b>GetAlarmStatus</b>				
Code: <b>0x04</b>	Issued by: <b>Primary device</b>	Procedure class: <b>1</b>	DownloadMode state: <b>No</b>	Power mode: <b>Low</b>

Table 6.5.2.2: Initiating message parameters and format for Get Alarm Status

Number	Length	Type	Description
None	0 octets	None	No data carried

Table 6.5.2.3: Response message parameters and format for Get Alarm Status

Number	Length	Type	Description
1	1 octet	ReturnCode	Return code OK
i + 1	1 octet	AlarmCode	Active alarm number i

i = 1 ... N

### Description:

On receipt of the initiating message the secondary device reports the alarm codes of the active alarms.

Table 6.5.2.4: Return codes for Get Alarm Status

OK	FAIL	Comment
All return codes marked as used for alarms in Annex A.	FormatError WorkingSoftwareMissing	

## 6.5.3 Get Information

Table 6.5.3.1: Elementary procedure Get Information

Name: <b>GetInformation</b>				
Code: <b>0x05</b>	Issued by: <b>Primary device</b>	Procedure class: <b>1</b>	DownloadMode state: <b>Yes</b>	Power mode: <b>Low</b>

Table 6.5.3.2: Initiating message parameters and format for Get Information

Number	Length	Type	Description
None	0 octets	None	No data carried

**Table 6.5.3.3: Response message parameters and format for Get Information**

Number	Length	Type	Description
1	1 octet	ReturnCode	Return code OK
2	1 octet	Unsigned integer	Length of parameter 3 in number of octets
3		TextString	Product number
4	1 octet	Unsigned integer	Length of parameter 5 in number of octets
5		TextString	Serial number
6	1 octet	Unsigned integer	Length of parameter 7 in number of octets
7		TextString	Hardware Version
8	1 octet	Unsigned integer	Length of parameter 9 in number of octets
9		TextString	Software Version

**Description:**

On receipt of the initiating message the secondary device shall return the product number ProdNr and the serial number SerNr of the secondary device. If known, also the hardware version and the software version may be returned. The software version should indicate the version number of the currently executed software.

The parameters HWVersion and SWVersion in the response message refer to the version designators of the hardware and installed software of the secondary device. If the application is missing or no HW or SW version number is found, then an empty string shall be returned as the HW or SW version number. The empty string is represented as a length field equals 0 and no octets in the TextString field.

The response message length shall be less than or equal to the minimum SecondaryPayloadTransmitLength as given in subclause 4.8.1 in TS 37.462 [3].

**Table 6.5.3.4: Return codes for Get Information**

OK	FAIL	Comment
	FormatError	

**6.5.4 Clear Active Alarms****Table 6.5.4.1: Elementary procedure Clear Active Alarms**

Name: <b>ClearActiveAlarms</b>				
Code: <b>0x06</b>	Issued by: <b>Primary device</b>	Procedure class: <b>1</b>	DownloadMode state: <b>No</b>	Power mode: <b>Low</b>

**Table 6.5.4.2: Initiating message parameters and format for Clear Active Alarms**

Number	Length	Type	Description
None	0 octets	None	No data carried

**Table 6.5.4.3: Response message parameters and format for Clear Active Alarms**

Number	Length	Type	Description
1	1 octet	ReturnCode	Return code OK

**Description:**

On receipt of the initiating message the secondary device shall first clear all stored alarm information and then return a procedure response message.

**Table 6.5.4.4: Return codes for Clear Active Alarms**

OK	FAIL	Comment
	FormatError Busy WorkingSoftwareMissing	

## 6.5.5 Alarm Subscribe

**Table 6.5.5.1: Elementary procedure Alarm Subscribe**

Name: <b>AlarmSubscribe</b>				
Code: <b>0x12</b>	Issued by: <b>Primary device</b>	Procedure class: <b>1</b>	DownloadMode state: <b>No</b>	Power mode: <b>Low</b>

**Table 6.5.5.2: Initiating message parameters and format for Alarm Subscribe**

Number	Length	Type	Description
None	0 octets	None	No data carried

**Table 6.5.5.3: Response message parameters and format for Alarm Subscribe**

Number	Length	Type	Description
1	1 octet	ReturnCode	Return code OK

### Description:

On receipt of the initiating message the secondary device shall start reporting alarms to the primary device.

**Table 6.5.5.4: Return codes for Alarm Subscribe**

OK	FAIL	Comment
	FormatError Busy WorkingSoftwareMissing	

## 6.5.6 Self Test

**Table 6.5.6.1: Elementary procedure Self Test**

Name: <b>SelfTest</b>				
Code: <b>0x0A</b>	Issued by: <b>Primary device</b>	Procedure class: <b>1</b>	DownloadMode state: <b>No</b>	Power mode: <b>High</b>

**Table 6.5.6.2: Initiating message parameters and format for Self Test**

Number	Length	Type	Description
None	0 octets	None	No data carried

**Table 6.5.6.3: Response message parameters and format for Self Test**

Number	Length	Type	Description
1	1 octet	ReturnCode	Return code OK
i + 1	1 octet	AlarmCode	Alarm code for alarm i detected during self test.

i = 1 ... N

**Description:**

On receipt of the initiating message the secondary device shall execute a test procedure which may include a check of physical and processor functions. The specific tests to be performed are implementation specific, and may include the movement of the adjuster, which shall not exceed  $\pm 5\%$  of total available tilting range starting from the current adjuster position.

The response message of the secondary device on the procedure provides information on detected faults or, if no fault is detected, with confidence that the operation of the device is normal in all respects.

During the test the operational parameters of the device shall not change beyond operationally acceptable limits and on completion all parameters shall be returned to their initial values.

In the normal response message, after the self test was executed successfully, the return codes are set to report possible detected faults during the self test. If no faults are detected, this shall be signalled by no return codes following the return code <OK>.

In the case of a failure response message, the self test could not be executed successfully and the reported return code relates to the inability of the device to perform the requested self-test operation.

**Table 6.5.6.4: Return codes for Self Test**

OK	FAIL	Comment
All return codes marked as alarms in annex A.	FormatError Busy WorkingSoftwareMissing NotCalibrated NotScaled	

6.5.7 Void

6.5.8 Void

6.5.9 Read User Data

**Table 6.5.9.1: Elementary procedure Read User Data**

Name: <b>ReadUserData</b>				
Code: <b>0x10</b>	Issued by: <b>Primary device</b>	Procedure class: <b>1</b>	DownloadMode state: <b>No</b>	Power mode: <b>Low</b>

**Table 6.5.9.2: Initiating message parameters and format for Read User Data**

Number	Length	Type	Description
1	2 octets	Unsigned integer	Memory offset
2	1 octet	Unsigned integer	Number of octets to read

NOTE: Number of octets to read shall be less than, or equal to MaxDataTransmit Length minus 1.

**Table 6.5.9.3: Response message parameters and format for Read User Data**

Number	Length	Type	Description
1	1 octet	ReturnCode	Return code OK
2	Number of octets given by parameter 2 of the initiating message	User specific	User data

**Description:**

On receipt of the initiating message the secondary device shall send back user specific data stored in a user data area to the primary device.

The user data area is intended for storage of user defined data, e.g. inventory information.

**Table 6.5.9.4: Return codes for Read User Data**

OK	FAIL	Comment
	FormatError WorkingSoftwareMissing OutOfRange	The return code OutOfRange is used, if the given memory address range is outside the valid address space.

**6.5.10 Write User Data****Table 6.5.10.1: Elementary procedure Write User Data**

Name: <b>WriteUserData</b>				
Code: <b>0x11</b>	Issued by: <b>Primary device</b>	Procedure class: <b>1</b>	DownloadMode state: No	Power mode: <b>Low</b>

**Table 6.5.10.2: Initiating message parameters and format for Write User Data**

Number	Length	Type	Description
1	2 octets	Unsigned integer	Memory offset
2	1 octet	Unsigned integer	Number of octets to write
3	Message specific, given by parameter 2	User specific	Data to write

NOTE: Number of octets to write shall be less than, or equal to MaxDataReceiveLength minus 3.

**Table 6.5.10.3: Response message parameters and format for Write User Data**

Number	Length	Type	Description
1	1 octet	ReturnCode	Return code OK

**Description:**

On receipt of the initiating message the secondary device shall store user data in non-volatile memory. The user data is stored in the user data area using the relative memory address offset given in the initiating message and starting with zero.

The user data area is intended for storage of user defined data, e.g. inventory information.

**Table 6.5.10.4: Return codes for Write User Data**

OK	FAIL	Comment
	FormatError Busy WorkingSoftwareMissing HardwareError OutOfRange	The return code OutOfRange is used if the given memory address range is outside the valid address space.

## 6.5.11 Download Start

**Table 6.5.11.1: Elementary procedure Download Start**

Name: <b>DownloadStart</b>				
Code: <b>0x40</b>	Issued by: <b>Primary device</b>	Procedure class: <b>1</b>	DownloadMode state: <b>Yes</b>	Power mode: <b>Low</b>

**Table 6.5.11.2: Initiating message parameters and format for Download Start**

Number	Length	Type	Description
None	0 octets	None	No data carried

**Table 6.5.11.3: Response message parameters and format for Download Start**

Number	Length	Type	Description
1	1 octet	ReturnCode	Return code OK

### Description:

On receipt of this initiating message the software download process shall be initiated. Following transition to the DownloadMode state, the secondary device sends return code <OK>. Previous subscription of alarms by use of the AlarmSubscribe procedure is cancelled.

**Table 6.5.11.4: Return codes for Download Start**

OK	FAIL	Comment
	FormatError Busy UnsupportedProcedure	

## 6.5.12 Download Application

**Table 6.5.12.1: Elementary procedure Download Application**

Name: <b>DownloadApplication</b>				
Code: <b>0x41</b>	Issued by: <b>Primary device</b>	Procedure class: <b>1</b>	DownloadMode state: <b>Yes</b>	Power mode: <b>Low</b>

**Table 6.5.12.2: Initiating message parameters and format for Download Application**

Number	Length	Type	Description
1	Less than, or equal to MaxDataReceiveLength	Vendor specific	Software data

**Table 6.5.12.3: Response message parameters and format for Download Application**

Number	Length	Type	Description
1	1 octet	ReturnCode	Return code OK

**Description:**

This elementary procedure is used once or several times to transfer software data from the primary device to the secondary device.

**Table 6.5.12.4: Return codes for Download Application**

OK	FAIL	Comment
	FormatError Busy HardwareError InvalidFileContent InvalidProcedureSequence	

**6.5.13 Download End****Table 6.5.13.1: Elementary procedure Download End**

Name: <b>DownloadEnd</b>				
Code: <b>0x42</b>	Issued by: <b>Primary device</b>	Procedure class: <b>1</b>	DownloadMode state: <b>Yes</b>	Power mode: <b>Low</b>

**Table 6.5.13.2: Initiating message parameters and format for Download End**

Number	Length	Type	Description
None	0 octets	None	No data carried

**Table 6.5.13.3: Response message parameters and format for Download End**

Number	Length	Type	Description
1	1 octet	ReturnCode	Return code OK

**Description:**

This elementary procedure signals the end of a multi-message data transfer to the secondary device. The secondary device shall respond after verifying the received data. The secondary device shall reset autonomously after completion of the layer 2 response and activate the new application software.

**Table 6.5.13.4: Return codes for Download End**

OK	FAIL	Comment
	FormatError Busy HardwareError ChecksumError InvalidFileContent InvalidProcedureSequence	

## 6.5.14 Vendor specific procedure

**Table 6.5.14.1: Elementary procedure Vendor Specific Procedure**

Name: <b>VendorSpecificProcedure</b>				
Code: <b>0x90</b>	Issued by: <b>Vendor specific</b>	Procedure class: <b>Vendor specific</b>	DownloadMode state: <b>Vendor specific</b>	Power mode: <b>Vendor specific</b>

**Table 6.5.14.2: Initiating message parameters and format for Vendor Specific Procedure**

Number	Length	Type	Description
1	2 octets	ASCII	Vendor code
1 + i	Vendor specific	Vendor specific	

$i = 1 \dots N$

**Table 6.5.14.3: Response message parameters and format for Vendor Specific Procedure**

Number	Length	Type	Description
1	Vendor specific	Vendor specific	Vendor specific

$i = 1 \dots N$

### Description:

The vendor specific procedure is intended for vendor specific purposes like e.g. testing.

**Table 6.5.14.4: Return codes for vendor specific procedure**

OK	FAIL	Comment
	FormatError UnsupportedProcedure	If the Vendor code in the initiating message does not match that of the RET device, UnsupportedProcedure shall be returned.

## 6.6 Single-antenna elementary procedures

### 6.6.1 Calibrate

**Table 6.6.1.1: Elementary procedure Calibrate**

Name: <b>Calibrate</b>				
Code: <b>0x31</b>	Issued by: <b>Primary Device</b>	Procedure class: <b>1</b>	DownloadMode state: <b>No</b>	Power mode: <b>High</b>

**Table 6.6.1.2: Initiating message parameters and format for Calibrate**

Number	Length	Type	Description
None	0 octets	None	No data carried



**Table 6.6.1.3: Response message parameters and format for Calibrate**

Number	Length	Type	Description
1	1 octet	ReturnCode	Return code OK

**Description:**

On receipt of the initiating message the secondary device shall perform a calibration of the RET antenna where the actuator is driven through its whole tilt range.

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

**Table 6.6.1.4: Return codes for Calibrate**

OK	FAIL	Comment
	FormatError Busy HardwareError WorkingSoftwareMissing MotorJam ActuatorJam NotConfigured UnsupportedProcedure	

## 6.6.2 Send Configuration Data

**Table 6.6.2.1: Elementary procedure Send Configuration Data**

Name: <b>SendConfigurationData</b>				
Code: <b>0x32</b>	Issued by: <b>Primary device</b>	Procedure class: <b>1</b>	DownloadMode state: <b>No</b>	Power mode: <b>Low</b>

**Table 6.6.2.2: Initiating message parameters and format for Send Configuration Data**

Number	Length	Type	Description
1	Less than, or equal to MaxDataReceiveLength	Vendor specific	Configuration data

**Table 6.6.2.3: Response message parameters and format for Send Configuration Data**

Number	Length	Type	Description
1	1 octet	ReturnCode	Return code OK

**Description:**

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 beam tilt position of the antenna.

If the configuration data exceeds MaxDataReceiveLength, the data shall be split into a number of MaxDataReceiveLength segments and one final segment with whatever is left. 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 6.6.2.4: Return codes for Send Configuration Data**

OK	FAIL	Comment
	FormatError Busy HardwareError WorkingSoftwareMissing ChecksumError InvalidFileContent UnsupportedProcedure	

### 6.6.3 Set Tilt

**Table 6.6.3.1: Elementary procedure Set Tilt**

Name: <b>SetTilt</b>				
Code: <b>0x33</b>	Issued by: <b>Primary device</b>	Procedure class: <b>1</b>	DownloadMode state: <b>No</b>	Power mode: <b>High</b>

**Table 6.6.3.2: Initiating message parameters and format for Set Tilt**

Number	Length	Type	Description
1	2 octets	Signed integer	Tilt value

**Table 6.6.3.3: Response message parameters and format for Set Tilt**

Number	Length	Type	Description
1	1 octet	ReturnCode	Return code OK

**Description:**

On receipt of the initiating message the secondary device shall set the electrical tilt in increments of 0.1°.

The secondary device shall respond to the initiating message in less than 2 minutes.

The tilt value corresponding to the actual tilt angle shall not go outside of the range between the tilt value corresponding to the current tilt angle and the tilt value corresponding to the requested tilt angle by more than 5 during this operation.

The format of the value of parameter 1 is given in subclause 3.1.

**Table 6.6.3.4: Return codes for Set Tilt**

OK	FAIL	Comment
	FormatError Busy HardwareError WorkingSoftwareMissing MotorJam ActuatorJam NotConfigured NotCalibrated OutOfRange UnsupportedProcedure	

## 6.6.4 Get Tilt

**Table 6.6.4.1: Elementary procedure Get Tilt**

Name: <b>GetTilt</b>				
Code: <b>0x34</b>	Issued by: <b>Primary device</b>	Procedure class: <b>1</b>	DownloadMode state: <b>No</b>	Power mode: <b>Low</b>

**Table 6.6.4.2: Initiating message parameters and format for Get Tilt**

Number	Length	Type	Description
None	0 octets	None	No data carried

**Table 6.6.4.3: Response message parameters and format for Get Tilt**

Number	Length	Type	Description
1	1 octet	ReturnCode	Return code OK
2	2 octets	Signed integer	Tilt value

### Description:

On receipt of the initiating message the secondary device shall return the current tilt value.

The returned tilt value is given in the format specified in subclause 3.1.

**Table 6.6.4.4: Return codes for Get Tilt**

OK	FAIL	Comment
	FormatError Busy HardwareError WorkingSoftwareMissing NotCalibrated NotConfigured UnsupportedProcedure	HardwareError shall only be used, if error is detected in tilt detector.

## 6.6.5 Alarm Indication

**Table 6.6.5.1: Elementary procedure Alarm Indication**

Name: <b>AlarmIndication</b>				
Code: <b>0x07</b>	Issued by: <b>Secondary device</b>	Procedure class: <b>2</b>	DownloadMode state: <b>No</b>	Power mode: <b>Low</b>

**Table 6.6.5.2: Initiating message parameters and format for Alarm Indication**

Number	Length	Type	Description
2 i – 1	1 octet	Unsigned integer	Return code i; see annex A
2 i	1 octet	Unsigned integer	State flag i

$i = 1 \dots N$

### Description:

The secondary device uses this procedure to report alarm state changes to the primary device. This procedure shall only be performed if the secondary has performed an AlarmSubscribe procedure since its latest reset.

For each alarm, the current alarm state and alarm code shall be reported if and only if any change in its state has occurred during the period of time since the last reported state. An AlarmIndication procedure shall be performed if at least one alarm shall be reported. The first AlarmIndication procedure after the AlarmSubscribe procedure shall report the active alarms.

Alarm state changes are considered as reported at the time the message is passed to the transport layer.

State flag = 0 represents alarm state *cleared*.

State flag = 1 represents alarm state *raised*.

## 6.6.6 Set Device Data

**Table 6.6.6.1: Elementary procedure Set Device Data**

Name: <b>SetDeviceData</b>				
Code: <b>0x0E</b>	Issued by: <b>Primary device</b>	Procedure class: <b>1</b>	DownloadMode state: <b>No</b>	Power mode: <b>Low</b>

**Table 6.6.6.2: Initiating message parameters and format for Set Device Data**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Field number, see annex B
2	See annex B	See annex B	Data to write

**Table 6.6.6.3: Response message parameters and format for Set Device Data**

Number	Length	Type	Description
1	1 octet	ReturnCode	Return code OK

### Description:

On receipt of the initiating message the secondary device shall write the data given in the parameters of the initiating message into the fields optionally provided for configuration data and listed in annex B of this TS. If an attempt is made to write to fields which are designated as read only, the return code *ReadOnly* is returned and the data for those fields is ignored. If an attempt is made to write to fields which are not supported by the device the return code *UnknownParameter* is returned and the data for those fields is ignored.

**Table 6.6.6.4: Return codes for Set Device Data**

OK	FAIL	Comment
	FormatError Busy WorkingSoftwareMissing HardwareError ReadOnly UnknownParameter	

## 6.6.7 Get Device Data

**Table 6.6.7.1: Elementary procedure Get Device Data**

Name: <b>GetDeviceData</b>				
Code: <b>0x0F</b>	Issued by: <b>Primary device</b>	Procedure class: <b>1</b>	DownloadMode state: <b>No</b>	Power mode: <b>Low</b>

**Table 6.6.7.2: Initiating message parameters and format for Get Device Data**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Field number; see annex B

**Table 6.6.7.3: Response message parameters and format for Get Device Data**

Number	Length	Type	Description
1	1 octet	ReturnCode	Return code OK
2	See annex B	See annex B	Field value

**Description:**

In this procedure the secondary device shall return the data stored in the field for configuration data specified by the field number in the procedure and listed in annex B of this TS.

**Table 6.6.7.4: Return codes for Get Device Data**

OK	FAIL	Comment
	FormatError Busy WorkingSoftwareMissing UnknownParameter	

## 6.7 Multi-antenna elementary procedures

### 6.7.1 Antenna Calibrate

**Table 6.7.1.1: Elementary procedure Antenna Calibrate**

Name: <b>AntennaCalibrate</b>				
Code: <b>0x80</b>	Issued by: <b>Primary device</b>	Procedure class: <b>1</b>	DownloadMode state: <b>No</b>	Power mode: <b>High</b>

**Table 6.7.1.2: Initiating message parameters and format for Antenna Calibrate**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Antenna number

**Table 6.7.1.3: Response message parameters and format for Antenna Calibrate**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Antenna number
2	1 octet	ReturnCode	Return code OK

**Description:**

On receipt of the initiating message the secondary device shall perform a calibration of the antenna addressed by the antenna number. During calibration the actuator is driven through the whole tilt range of the antenna.

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

**Table 6.7.1.4: Return codes for Antenna Calibrate**

OK	FAIL	Comment
	FormatError Busy HardwareError WorkingSoftwareMissing MotorJam ActuatorJam NotConfigured UnsupportedProcedure	If the addressed antenna is not existing, FormatError is returned.

## 6.7.2 Antenna Set Tilt

**Table 6.7.2.1: Elementary procedure Antenna Set Tilt**

Name: <b>AntennaSetTilt</b>				
Code: <b>0x81</b>	Issued by: <b>Primary device</b>	Procedure class: <b>1</b>	DownloadMode state: <b>No</b>	Power mode: <b>High</b>

**Table 6.7.2.2: Initiating message parameters and format for Antenna Set Tilt**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Antenna number
2	2 octets	Signed integer	Tilt value

**Table 6.7.2.3: Response message parameters and format for Antenna Set Tilt**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Antenna number
2	1 octet	ReturnCode	Return code OK

### Description:

On receipt of the initiating message the secondary device shall set the electrical tilt of the antenna addressed by the antenna number in increments of 0.1°.

The secondary device shall respond to the initiating message in less than 2 minutes.

The tilt value corresponding to the actual tilt angle shall not go outside of the range between the tilt value corresponding to the current tilt angle and the tilt value corresponding to the requested tilt angle by more than 5 during this operation.

The format of the value of parameter 2 is given in subclause 3.1.

**Table 6.7.2.4: Return codes for Antenna Set Tilt**

OK	FAIL	Comment
	FormatError Busy HardwareError WorkingSoftwareMissing MotorJam ActuatorJam NotConfigured NotCalibrated OutOfRange UnsupportedProcedure	If the addressed antenna is not existing, FormatError is returned.

### 6.7.3 Antenna Get Tilt

**Table 6.7.3.1: Elementary procedure Antenna Get Tilt**

Name: <b>AntennaGetTilt</b>				
Code: <b>0x82</b>	Issued by: <b>Primary device</b>	Procedure class: <b>1</b>	DownloadMode state: <b>No</b>	Power mode: <b>Low</b>

**Table 6.7.3.2: Initiating message parameters and format for Antenna Get Tilt**

Number	Length	Type	Description
1	1 octet	Unsigned interger	Antenna number

**Table 6.7.3.3: Response message parameters and format for Antenna Get Tilt**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Antenna number
2	1 octet	ReturnCode	Return code OK
3	2 octets	Signed integer	Tilt value

#### Description:

On receipt of the initiating message the secondary device shall return the current tilt value of the antenna addressed by the antenna number.

The returned tilt value is in the format specified in subclause 3.1.

**Table 6.7.3.4: Return codes for Antenna Get Tilt**

OK	FAIL	Comment
	FormatError Busy HardwareError WorkingSoftwareMissing NotConfigured NotCalibrated UnsupportedProcedure	If the addressed antenna is not existing, FormatError is returned. HardwareError shall only be used, if an error is detected in tilt detector.

### 6.7.4 Antenna Set Device Data

**Table 6.7.4.1: Elementary procedure Antenna Set Device Data**

Name: <b>AntennaSetDeviceData</b>				
Code: <b>0x83</b>	Issued by: <b>Primary device</b>	Procedure class: <b>1</b>	DownloadMode state: <b>No</b>	Power mode: <b>Low</b>

**Table 6.7.4.2: Initiating message parameters and format for Antenna Set Device Data**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Antenna number
2	1 octet	Unsigned integer	Field number; see annex B
3	See annex B	See annex B	Data to write

**Table 6.7.4.3: Response message parameters and format for Antenna Set Device Data**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Antenna number
2	1 octet	ReturnCode	Return code OK

**Description:**

On receipt of the initiating message the secondary device shall write the provided data for the antenna addressed by the antenna number into the fields optionally provided for configuration data and listed in annex B of this TS. If an attempt is made to write to fields which are designated as read only for the addressed antenna the return code ReadOnly is returned and the data for those fields is ignored. If an attempt is made to write to fields which are not supported for the addressed antenna the return code UnknownParameter is returned and the data for those fields is ignored.

**Table 6.7.4.4: Return codes for Antenna Set Device Data**

OK	FAIL	Comment
	FormatError Busy HardwareError WorkingSoftwareMissing ReadOnly UnknownParameter UnsupportedProcedure	If the addressed antenna is not existing, FormatError is returned.

**6.7.5 Antenna Get Device Data****Table 6.7.5.1: Elementary procedure Antenna Get Device Data**

Name: <b>AntennaGetDeviceData</b>				
Code: <b>0x84</b>	Issued by: <b>Primary device</b>	Procedure class: <b>1</b>	DownloadMode state: <b>No</b>	Power mode: <b>Low</b>

**Table 6.7.5.2: Initiating message parameters and format for Antenna Get Device Data**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Antenna number
2	1 octet	Unsigned integer	Field number to read; see annex B

**Table 6.7.5.3: Response message parameters and format for Antenna Get Device Data**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Antenna number
2	1 octet	ReturnCode	Return code OK
3	See annex B	See annex B	Field value

**Description:**

On receipt of the initiating message the secondary device shall return the data stored for the addressed antenna in the field for configuration data specified by the field number in the initiating message and listed in annex B of this TS.



Table 6.7.5.4: Return codes for Antenna Get Device Data

OK	FAIL	Comment
	FormatError Busy WorkingSoftwareMissing UnsupportedProcedure UnknownParameter	If the addressed antenna is not existing, FormatError is returned.

## 6.7.6 Antenna Alarm Indication

Table 6.7.6.1: Elementary procedure Antenna Alarm Indication

Name: <b>AntennaAlarmIndication</b>				
Code: <b>0x85</b>	Issued by: <b>Secondary device</b>	Procedure class: <b>2</b>	DownloadMode state: <b>No</b>	Power mode: <b>Low</b>

Table 6.7.6.2: Initiating message parameters and format for Antenna Alarm Indication

Number	Length	Type	Description
1	1 octet	Unsigned integer	Antenna number
2 i	1 octet	Unsigned integer	Return code i; see annex A
2 i + 1	1 octet	Unsigned integer	State flag i

$i = 1 \dots N$

### Description:

The multi-antenna secondary device uses this procedure to report antenna alarm state changes to the primary device. This procedure shall only be performed if the secondary has performed an AlarmSubscribe procedure since its latest reset. Multi-antenna devices shall use this AntennaAlarmIndication procedure only for multi-antenna specific alarms and the AlarmIndication procedure in subclause 6.6.5 for the other alarms.

For each alarm, the current alarm state and alarm code shall be reported if and only if any change in its state has occurred during the period of time since the last reported state. An AntennaAlarmIndication procedure shall be performed if at least one multi-antenna specific alarm shall be reported. The first AntennaAlarmIndication procedure after the AlarmSubscribe procedure shall report the active alarms.

Alarm state changes are considered as reported at the time the message is passed to the transport layer.

State flag = 0 represents alarm state *cleared*.

State flag = 1 represents alarm state *raised*.

## 6.7.7 Antenna Clear Active Alarms

Table 6.7.7.1: Elementary procedure Antenna Clear Active Alarms

Name: <b>AntennaClearActiveAlarms</b>				
Code: <b>0x86</b>	Issued by: <b>Secondary device</b>	Procedure class: <b>1</b>	DownloadMode state: <b>No</b>	Power mode: <b>Low</b>

Table 6.7.7.2: Initiating message parameters and format for Antenna Clear Active Alarms

Number	Length	Type	Description
1	1 octet	Unsigned integer	Antenna number

**Table 6.7.7.3: Response message parameters and format for Antenna Clear Active Alarms**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Antenna number
2	1 octet	ReturnCode	Return code OK

**Description:**

On receipt of the initiating message the secondary device shall first clear all stored alarm information for the addressed antenna and then return a procedure response message.

**Table 6.7.7.4: Return codes for Antenna Clear Active Alarms**

OK	FAIL	Comment
	FormatError Busy WorkingSoftwareMissing UnsupportedProcedure	If the addressed antenna is not existing, FormatError is returned.

**6.7.8 Antenna Get Alarm Status****Table 6.7.8.1: Elementary procedure Antenna Get Alarm Status**

Name: <b>AntennaGetAlarmStatus</b>				
Code: <b>0x87</b>	Issued by: <b>Primary device</b>	Procedure class: <b>1</b>	DownloadMode state: <b>No</b>	Power mode: <b>Low</b>

**Table 6.7.8.2: Initiating message parameters and format for Antenna Get Alarm Status**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Antenna number

**Table 6.7.8.3: Response message parameters and format for Antenna Get Alarm Status**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Antenna number
2	1 octet	ReturnCode	Return code OK
i + 2	1 octet	AlarmCode	Active alarm number i

i = 1 ... N

**Description:**

On receipt of the initiating message the secondary device shall report the alarm codes of the active alarms for the addressed antenna.

**Table 6.7.8.4: Return codes for Antenna Get Alarm Status**

OK	FAIL	Comment
All return codes marked as used for alarms in Annex A	FormatError WorkingSoftwareMissing UnsupportedProcedure	If the addressed antenna is not existing, FormatError is returned.

## 6.7.9 Antenna Get Number Of Antennas

**Table 6.7.9.1: Elementary procedure Antenna Get Number Of Antennas**

Name: <b>AntennaGetNumberOfAntennas</b>				
Code: <b>0x88</b>	Issued by: <b>Primary device</b>	Procedure class: <b>1</b>	DownloadMode state: <b>No</b>	Power mode: <b>Low</b>

**Table 6.7.9.2: Initiating message parameters and format for Antenna Get Number Of Antennas**

Number	Length	Type	Description
None	0 octets	None	No data carried

**Table 6.7.9.3: Response message parameters and format for Antenna Get Number Of Antennas**

Number	Length	Type	Description
1	1 octet	ReturnCode	Return code OK
2	1 octet	Unsigned integer	Number of antennas

### Description:

On receipt of the initiating message the secondary device shall return the number of antennas it controls.

**Table 6.7.9.4: Return codes for Antenna Get Number Of Antennas**

OK	FAIL	Comment
	FormatError WorkingSoftwareMissing UnsupportedProcedure	

## 6.7.10 Antenna Send Configuration Data

**Table 6.7.10.1: Elementary procedure Antenna Send Configuration Data**

Name: <b>AntennaSendConfigurationData</b>				
Code: <b>0x89</b>	Issued by: <b>Primary device</b>	Procedure class: <b>1</b>	DownloadMode state: <b>No</b>	Power mode: <b>Low</b>

**Table 6.7.10.2: Initiating message parameters and format for Antenna Send Configuration Data**

Number	Length	Type	Description
1	1 octet	Unsigned Integer	Antenna number
2	Less than, or equal to MaxDataReceiveLength minus 1	Vendor specific	Configuration data

**Table 6.7.10.3: Response message parameters and format for Antenna Send Configuration Data**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Antenna number
2	1 octet	ReturnCode	Return code OK

### Description:

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 beam tilt position of the addressed antenna.

If the configuration data exceeds MaxDataReceiveLength minus 1, the data shall be split into a number of MaxDataReceiveLength minus 1 segments and one final segment with whatever is left. 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 6.7.10.4: Return codes for Antenna Send Configuration Data**

OK	FAIL	Comment
	FormatError Busy HardwareError WorkingSoftwareMissing ChecksumError InvalidFileContent UnsupportedProcedure	If the addressed antenna is not existing, FormatError is returned.

## 6.8 TMAAP Elementary procedures for TMA

### 6.8.1 TMA Set Mode

The TMA Set Mode procedure shall only be supported if the TMA subunit can be set in bypass mode. On receipt of the initiating message, the secondary device shall first set the TMA subunit in the appropriate mode as indicated by the mode state flag, and then return a response message. If a TMA subunit in bypass mode receives the elementary procedure TMASetMode to Bypass, the TMA subunit shall remain in the Bypass mode and the response OK shall be returned.

Mode state flag = 0 represents *Normal mode*.

Mode state flag = 1 represents *Bypass mode*.

**Table 6.8.1.1: Elementary procedure TMA Set Mode**

Name: TMA Set Mode				
Code:	Issued by:	Procedure class:	DownloadMode state:	Power mode:
0x70	Primary device	1	No	n/a

**Table 6.8.1.2: Initiating message parameters and format TMA Set Mode**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number
2	1 octet	Unsigned integer	Mode state flag

**Table 6.8.1.3: Response message parameters and format for TMA Set Mode**

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

**Table 6.8.1.4: Return codes for TMA Set Mode**

OK	FAIL	Comment
	FormatError	
	Busy	
	HardwareError	HardwareError shall refer to a detected inability to switch mode.
	WorkingSoftwareMissing	
	UnsupportedProcedure	UnsupportedProcedure shall be returned if set mode is not supported by the TMA subunit.
	OutOfRange	OutOfRange shall be returned if the mode state flag has another value than those listed in the procedure description.
	MajorTMAFault	MajorTMAFault shall be returned if the TMA subunit is in bypass mode due to a major TMA fault and TMASetMode to Normal is received and not possible to set.
	MinorTMAFault	MinorTMAFault shall be returned if the TMA subunit is in bypass mode due to a minor TMA fault and TMASetMode to Normal is received and not possible to set.

## 6.8.2 TMA Get Mode

On receipt of the initiating message, the secondary device shall respond with the mode state flag indicating whether the TMA subunit is in normal mode or in bypass mode. TMA subunits which do not support bypass mode shall return Normal mode.

Mode state flag = 0x00 represents *Normal mode*.

Mode state flag = 0x01 represents *Bypass mode*.

**Table 6.8.2.1: Elementary procedure TMA Get Mode**

Name: TMA Get Mode				
Code:	Issued by:	Procedure class:	DownloadMode state:	Power mode:
0x71	Primary device	1	No	n/a

**Table 6.8.2.2: Initiating message parameters and format for TMA Get Mode**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number

**Table 6.8.2.3: Response message parameters and format for TMA Get Mode**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number
2	1 octet	ReturnCode	Return code OK
3	1 octet	Unsigned integer	Mode state flag

**Table 6.8.2.4: Return codes TMA Get Mode**

OK	FAIL	Comment
	FormatError Busy WorkingSoftwareMissing	

## 6.8.3 TMA 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 TMA subunit.

**Table 6.8.3.1: Elementary procedure TMAGetSupportedFunctions**

Name: TMA Get Supported Functions				
Code:	Issued by:	Procedure class:	DownloadMode state:	Power mode:
0x7A	Primary device	1	No	n/a

**Table 6.8.3.2: Initiating message parameters and format for TMAGetSupportedFunctions**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number

**Table 6.8.3.3: Response message parameters and format for TMAGetSupportedFunctions**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number
2	1 octet	ReturnCode	Return code OK
3	1 octet	Unsigned integer	Function flags
4	1 octet	Unsigned integer	Min Gain capability (expressed in dB/4)
5	1 octet	Unsigned integer	Max Gain capability (expressed in dB/4)
6	1 octet	Unsigned integer	Resolution capability (expressed in dB/4)

**Description:**

1. A fixed gain TMA subunit shall have min and max gain as the same value.
2. If the resolution is zero, then non linear gain steps are supported (e.g. 3dB and 6dB and 12dB).

NOTE: These parameters represent absolute fixed physical data. Any change of the corresponding parameter in the additional data will not have any operational impact on the TMA.

**Table 6.8.3.4: Return codes TMAGetSupportedFunctions**

OK	FAIL	Comment
	FormatError Busy WorkingSoftwareMissing	

Function flags:

Bit	7 to 1	0
Function	Spare	Bypass Mode

- 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 0

## 6.8.4 TMA Set Gain

The procedure TMASetGain shall only be supported if the TMA subunit gain can be adjusted. On receipt of the initiating message, the secondary device shall first set the addressed TMA subunit to the gain determined by the TMA

gain figure parameter, and then return the response message. The TMA gain figure parameter is calculated as 4 times the required gain expressed in dB. (This method of specification allows the gain to be set with a resolution of 0.25 dB while using an integer parameter.)

If the TMA subunit is set in bypass mode by TMASetMode, and TMASetGain is received, then the procedure shall be performed and bypass mode shall be retained.

If any alarm state flag is set than the status has to be validated and the result has to be responded.

Gain shall be accepted if  $G_{min} \leq G_{demanded} \leq G_{max}$

For linear steps:  $G_{demanded} = (G_{min} + n * G_{resolution})$  where n is a non-negative integer

For non-linear steps:  $G_{demanded}$  must be equal to a supported value.

$G_{min}$ ,  $G_{max}$  and  $G_{resolution}$  are reported by TMAGetSupportedFunctions. The supported values for non-linear steps are reported by TMAGetSupportedNonLinearGainValues.

For all other values of  $G_{demanded}$ , the TMA subunit shall respond UnsupportedValue.

**Table 6.8.4.1: Elementary procedure TMA Set Gain**

Name: TMA Set Gain				
Code:	Issued by:	Procedure class:	DownloadMode state:	Power mode:
0x72	Primary device	1	No	n/a

**Table 6.8.4.2: Initiating message parameters and format TMA Set Gain**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number
2	1 octet	Unsigned integer	TMA gain figure

**Table 6.8.4.3: Response message parameters and format for TMA Set Gain**

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

**Table 6.8.4.4: Return codes for TMA Set Gain**

OK	FAIL	Comment
	FormatError	
	Busy	
	HardwareError	HardwareError shall refer to the detected inability to set the gain according to the instruction, although it is within the TMA gain adjustment range.
	WorkingSoftwareMissing	
	UnsupportedProcedure	UnsupportedProcedure shall be returned if gain adjustment is not supported by the TMA subunit.
	UnsupportedValue	The requested value is not supported.
	MajorTMAFault	
	MinorTMAFault	

## 6.8.5 TMA Get Gain

On receipt of the initiating message, the secondary device shall return the set gain of the TMA subunit. Fixed gain TMA subunits shall return their fixed gain value. The TMA gain figure is calculated as 4 times the set gain expressed in dB.

**Table 6.8.5.1: Elementary procedure TMA Get Gain**

Name: TMA Get Gain				
Code:	Issued by:	Procedure class:	DownloadMode state:	Power mode:
0x73	Primary device	1	No	n/a

**Table 6.8.5.2: Initiating message parameters and format TMA Get Gain**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number

**Table 6.8.5.3: Response message parameters and format for TMA Get Gain**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number
2	1 octet	Return Code	Return code OK
3	1 octet	Unsigned integer	TMA gain figure

**Table 6.8.5.4: Return codes for TMA Get Gain**

OK	FAIL	Comment
	FormatError	
	Busy	
	WorkingSoftwareMissing	
	MajorTMAFault	
	MinorTMAFault	
	BypassMode	BypassMode shall be returned if the TMA subunit is in bypass mode due to a TMASetMode procedure.

## 6.8.6 TMA Set Device Data

On receipt of the initiating message the secondary device shall first write the provided data for the TMA subunit addressed by the subunit number into the fields provided for device data (and listed in Annex C of this document) and then return the response message. If an attempt is made to write to a field which is implemented as read only for the addressed TMA subunit, the return code *ReadOnly* is returned and the data for that field is ignored. If an attempt is made to write to a field which is not supported for the addressed TMA subunit the return code *UnknownParameter* is returned and the data for that field is ignored.

**Table 6.8.6.1: Elementary procedure TMA Set Device Data**

Name: TMASetDeviceData				
Code:	Issued by:	Procedure class:	DownloadMode state:	Power mode:
0x74	Primary device	1	No	n/a

**Table 6.8.6.2: Initiating message parameters and format for TMA Set Device Data**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number
2	1 octet	Unsigned integer	Field number; see annex C
3	See annex C	See annex C	Data to write



**Table 6.8.6.3: Response message parameters and format for TMA Set Device Data**

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

**Table 6.8.6.4: Return codes for TMA Set Device Data**

OK	FAIL	Comment
	FormatError Busy HardwareError WorkingSoftwareMissing ReadOnly UnknownParameter	

## 6.8.7 TMA Get Device Data

On receipt of the initiating message the secondary device shall return the data stored for the addressed TMA subunit in the field for additional device data specified by the field number in the initiating message and listed in Annex C of this document.

**Table 6.8.7.1: Elementary procedure TMA Get Device Data**

Name: TMAGetDeviceData				
Code:	Issued by:	Procedure class:	DownloadMode state:	Power mode:
0x75	Primary device	1	No	n/a

**Table 6.8.7.2: Initiating message parameters and format for TMA Get Device Data**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number
2	1 octet	Unsigned integer	Field number to be read; see Annex C

**Table 6.8.7.3: Response message parameters and format for TMA Get Device Data**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number
2	1 octet	Return Code	Return code OK
3	See Annex C	See Annex C	Field value

**Table 6.8.7.4: Return codes for TMA Get Device Data**

OK	FAIL	Comment
	FormatError Busy WorkingSoftwareMissing UnknownParameter	

## 6.8.8 TMA Alarm Indication

TMA uses this procedure to report TMA alarm state changes to the primary device. This procedure shall only be performed if the TMA has performed an AlarmSubscribe procedure since its latest reset.

**Table 6.8.8.1: Elementary procedure TMA Alarm Indication**

Name: TMAAlarmIndication				
Code:	Issued by:	Procedure class:	DownloadMode state:	Power mode:
0x76	Secondary device	2	No	n/a

**Table 6.8.8.2: Initiating message parameters and format for TMA Alarm Indication**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number
2* i	1 octet	Unsigned integer	Return code i; see Annex A
2*i +1	1 octet	Unsigned integer	State flag i

$i = 1 \dots N$

### 6.8.8.1 Further requirements

For each alarm, the current alarm state and alarm code shall be reported if and only if any change in its state has occurred since the last reported state.

A TMA Alarm Indication procedure shall be performed if at least one TMA alarm shall be reported for the TMA subunit. The first TMA Alarm Indication procedure after the Alarm Subscribe procedure shall report the active alarms.

Alarm state changes are considered as reported at the time the message is passed to the transport layer.

State flag = 0x00 represents alarm state *cleared*.

State flag = 0x01 represents alarm state *raised*.

### 6.8.9 TMA Clear Active Alarms

On receipt of the initiating message the secondary device shall first clear all stored alarm information for the addressed TMA subunit and then return a procedure response message. In the event that the cause of the alarm persists the alarm shall be re-raised and a new TMA Alarm Indication procedure shall be performed.

**Table 6.8.9.1: Elementary procedure TMA Clear Active Alarms**

Name: TMAClearActiveAlarms				
Code:	Issued by	Procedure class:	DownloadMode state:	Power mode:
0x77	Primary device	1	No	n/a

**Table 6.8.9.2: Initiating message parameters and format for TMA Clear Active Alarms**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number

**Table 6.8.9.3: Response message parameters and format for TMA Clear Active Alarms**

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

**Table 6.8.9.4: Return codes for TMA Clear Active Alarms**

OK	FAIL	Comment
	FormatError Busy WorkingSoftwareMissing	

## 6.8.10 TMA Get Alarm Status

On receipt of the initiating message the secondary device shall report the alarm codes of the active alarms for the addressed TMA subunit.

**Table 6.8.10.1: Elementary procedure TMA Get Alarm Status**

Name: TMAGetAlarmStatus				
Code:	Issued by:	Procedure class:	DownloadMode state:	Power mode:
0x78	Primary device	1	No	n/a

**Table 6.8.10.2: Initiating message parameters and format for TMA Get Alarm Status**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number

**Table 6.8.10.3: Response message parameters and format for TMA Get Alarm Status**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number
2	1 octet	ReturnCode	Return code OK
2 + i	1 octet	AlarmCode	Alarm code for alarm number i

$i = 1 \dots N$

**Table 6.8.10.4: Return codes for TMA Get Alarm Status**

OK	FAIL	Comment
All return codes marked as used for alarms in Annex A	FormatError Busy WorkingSoftwareMissing	

## 6.8.11 TMA Get Number of Subunits

On receipt of the initiating message the secondary device shall return the number of subunits it controls.

**Table 6.8.11.1: Elementary procedure TMAGetNumberOfSubunits**

Name: TMAGetNumberOfSubunits				
Code:	Issued by:	Procedure class:	DownloadMode state:	Power mode:
0x79	Primary device	1	No	n/a

**Table 6.8.11.2: Initiating message parameters and format for TMAGetNumberOfSubunits**

Number	Length	Type	Description
None	0 octets	None	No data carried

**Table 6.8.11.3: Response message parameters and format for TMAGetNumberOfSubunits**

Number	Length	Type	Description
1	1 octet	ReturnCode	Return code OK
2	1 octet	Unsigned integer	Number of subunits

**Table 6.8.11.4: Return codes for TMAGetNumberOfSubunits**

OK	FAIL	Comment
	FormatError Busy WorkingSoftwareMissing	

## 6.8.12 3GPP Clear Active Alarms and Get Alarm Status

When an TMA receives ClearActiveAlarms, it shall perform the procedure for all subunits of the TMA and then return a single procedure response message.

When an TMA receives GetAlarmStatus, it shall in a single procedure response message report the union of the alarm codes of all active alarms for all subunits, i.e. the same alarm codes shall be reported only once.

## 6.8.13 TMA Get Supported Non-Linear Gain Values

On receipt of the initiating message, the secondary device shall respond with a message containing a list of supported values in numerical order, preceded by the number (N) of such values contained in the list.

**Table 6.8.13.1: Elementary procedure TMAGetSupportedNonLinearGainValues**

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

**Table 6.8.13.2: Initiating message parameters and format for TMAGetSupportedNonLinearGainValues**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number

**Table 6.8.13.3: Response message parameters and format for TMAGetSupportedNonLinearGainValues**

Number	Length	Type	Description
1	1 octet	Unsigned integer	Subunit number
2	1 octet	ReturnCode	Return code OK
3	1 octet	Unsigned integer	Number of non linear gain values supported (N)
3 + i	1 octet	Unsigned integer	Non linear gain supported value number i (expressed in dB/4)

i=1 .. N

**Table 6.8.13.4: Return codes TMAGetSupportedNonLinearGainValues**

<b>OK</b>	<b>FAIL</b>	<b>Comment</b>
	FormatError	
	Busy	
	WorkingSoftwareMissing	
	UnsupportedProcedure	UnsupportedProcedure shall be returned if the TMA does not support non-linear gain steps

---

## 7 Unknown elementary procedures

Void.

## Annex A (normative): Return codes for secondary devices

**Table A.1: Return Codes for Secondary Devices**

Code	Name	Comment	Alarm	DownloadMode state
0x00	OK	Normal response		X
0x02	Motor Jam	Motor cannot move	X	
0x03	ActuatorJam	Actuator jam has been detected. No movement of the actuator, but movement of the motor was detected	X	
0x05	Busy	The device is busy and cannot execute the procedure until an ongoing activity is completed		
0x06	ChecksumError	Checksum incorrect for otherwise valid data..		
0x0B	FAIL	Abnormal response. Indicates that a procedure has not been executed successfully		X
0x0E	NotCalibrated	The device has not completed a calibration operation, or calibration has been lost	X	
0x0F	NotConfigured	Actuator configuration data is missing	X	
0x11	HardwareError	Any hardware error which cannot be classified. May not be reported as an alarm until the fault is likely to be persistent	X	X
0x13	OutOfRange	A parameter given by an operator (e.g. tilt value or memory offset) is out of range		
0x19	UnknownProcedure	Received procedure code is not defined		X
0x1D	ReadOnly	Invalid device data parameter usage		X
0x1E	UnknownParameter	Specified parameter is not supported for the used procedure		X
0x21	WorkingSoftwareMissing	The unit is inDownloadMode state. Returned upon unsupported procedure when in DownloadMode state		X
0x22	InvalidFileContent	The data being downloaded is detected to be of wrong format or size		X
0x24	FormatError	Procedure message is inconsistent or if an addressed field or antenna is invalid or the data parameter field length is inconsistent with the corresponding field length parameter		X
0x25	UnsupportedProcedure	The procedure is optional and not supported or the procedure does not apply to this device type		
0x26	InvalidProcedureSequence	Procedure sequence as described in annex C is expected but not experienced by the secondary device		
0x27	ActuatorInterference	An actuator movement outside the control of the RET unit has been detected. Probable cause is manual interference	X	
0x1A	MinorTMAFault	A fault in the TMA subunit is detected which reduces the gain performance but maintains its function.	x	
0x1B	MajorTMAFault	A fault in the TMA subunit is detected. The fault prevents the function of the TMA subunit.	x	
0x1C	UnsupportedValue	The requested value is not supported.		
0x1F	BypassMode	The TMA subunit is in bypass mode and cannot report a correct gain value.	x	

NOTE: A TMA subunit with a fault which is causing it to switch to bypass mode will report both the fault and the BypassMode alarm.

## Annex B (normative): Assigned fields for additional data

The following standard fields have no operational impact and are used by the procedures SetDeviceData, GetDeviceData, AntennaSetDeviceData and AntennaGetDeviceData. Little endian order is used for storage of multiple-octet numbers. Where ASCII variables are shorter than the assigned field lengths the characters are right aligned and leading blanks are filled with null characters (0x00). Unused or not initialized parameter shall return the value 0x00 for the GetDeviceData, AntennaGetDeviceData and TMAGetDeviceData procedure.

**Table B.1: Assigned fields for additional data of RETAP**

Field No.	Length (octets)	Format	Description
0x01	15	ASCII	Antenna model number
0x02	17	ASCII	Antenna serial number
0x03	2	16-bit unsigned	Antenna operating band(s): Not supported in this release
0x08	2	16-bit unsigned	Antenna operating band(s): Not supported in this release
0x09	2	16-bit unsigned	Antenna operating band(s): Not supported in this release
0x0A	2	16-bit unsigned	Antenna operating band(s): Not supported in this release
0x0B	2	16-bit unsigned	Antenna operating band(s): Not supported in this release
0x04	8	4 x 16-bit unsigned	Beamwidth for each operating band in band order (deg), beginning with lowest band. The lowest band is transmitted within the first 16-bit value. Not supported in this release
0x05	4	4 x 8-bit unsigned	Gain [dBi] for each operating band in band order, expressed in gain value times 10, beginning with the lowest band. The lowest band is transmitted within the first 8-bit value Not supported in this release
0x06	2	16-bit signed	Maximum supported electrical tilt [degree], expressed in tilt value times 10, format as in subclause 3.1
0x07	2	16-bit signed	Minimum supported electrical tilt [degree], expressed in tilt value times 10, format as in subclause 3.1
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 [degree], in the range of 0 – 359,9 degree, expressed as bearing value times 10
0x26	2	16-bit signed	Installed mechanical tilt [degree], expressed in tilt value times 10, format as in subclause 3.1

**Table B.2: Void**

**Table B.2-1: Void**

**Table B.2-2: Void**

**Table B.2-3: Void**

**Table B.2-4: Void**

The operating bands are defined in subclause 4.3.7 in TS 37.461 [4], an example of operating bands coding is provided in Annex F.

**Table B.3: Assigned fields for additional data of TMAAP**

Field No.	Length (octets)	Format	Description
0x01	15	ASCII	Antenna model number
0x02	17	ASCII	Antenna serial number
0x03	2	16-bit unsigned	Antenna operating band(s): Not supported in this release
0x08	2	16-bit unsigned	Antenna operating band(s): Not supported in this release
0x09	2	16-bit unsigned	Antenna operating band(s): Not supported in this release
0x0A	2	16-bit unsigned	Antenna operating band(s): Not supported in this release
0x0B	2	16-bit unsigned	Antenna operating band(s): Not supported in this release
0x04	8	4 x 16-bit unsigned	Beamwidth for each operating band in band order (deg) beginning with lowest band. The lowest band is transmitted within the first 16-bit value. Not supported in this release
0x05	4	4 x 8-bit unsigned	Gain [dBi] for each operating band in band order, expressed in gain value times 10, beginning with the lowest band. The lowest band is transmitted within the first 8-bit value Not supported in this release
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
0x26	2	16-bit signed	Installed mechanical tilt (degrees * 10)
0x13	1	8-bit unsigned	TMA subunit type (see table B.4)
0x14	4	2x16-bit unsigned integer	TMA subunit receive frequency band (see Table B.5)
0x15	4	2x16-bit unsigned integer	TMA subunit transmit frequency band (see Table B.5)
0x16	1	Unsigned integer	Maximum supported gain given as gain figure expressed in dB/4
0x17	1	Unsigned integer	Minimum supported gain given as gain figure expressed in dB/4
0x18	1	Unsigned integer	Gain resolution given as the gain resolution figure expressed in dB/4

**Table B.4: Field 0x13 interpretation**

Bit number	7... 2	1	0
TMA subunit type	Spare	Reserved for AISG use	Bypass

Bits are numbered from 0...7, bit numbered 0 set to 1 represents the value 0x01.

Bit value 0 represents TMA subunit type is not supported.

Bit value 1 represents TMA subunit type is supported.

Spare bits and Bit 1 shall be set to 0.



Example: 0000 0001 = Bypass

**Table B.5: Field 0x14 and 0x15 interpretation**

Octet number	Description
0	fmin low octet
1	fmin high octet
2	fmax low octet
3	fmax high octet

fmin and fmax are expressed in 100kHz steps from 0kHz.

Example: For 850MHz, low octet = 0x34, high octet = 0x21.

# Annex C (normative): Procedure sequence for download of software to a secondary device

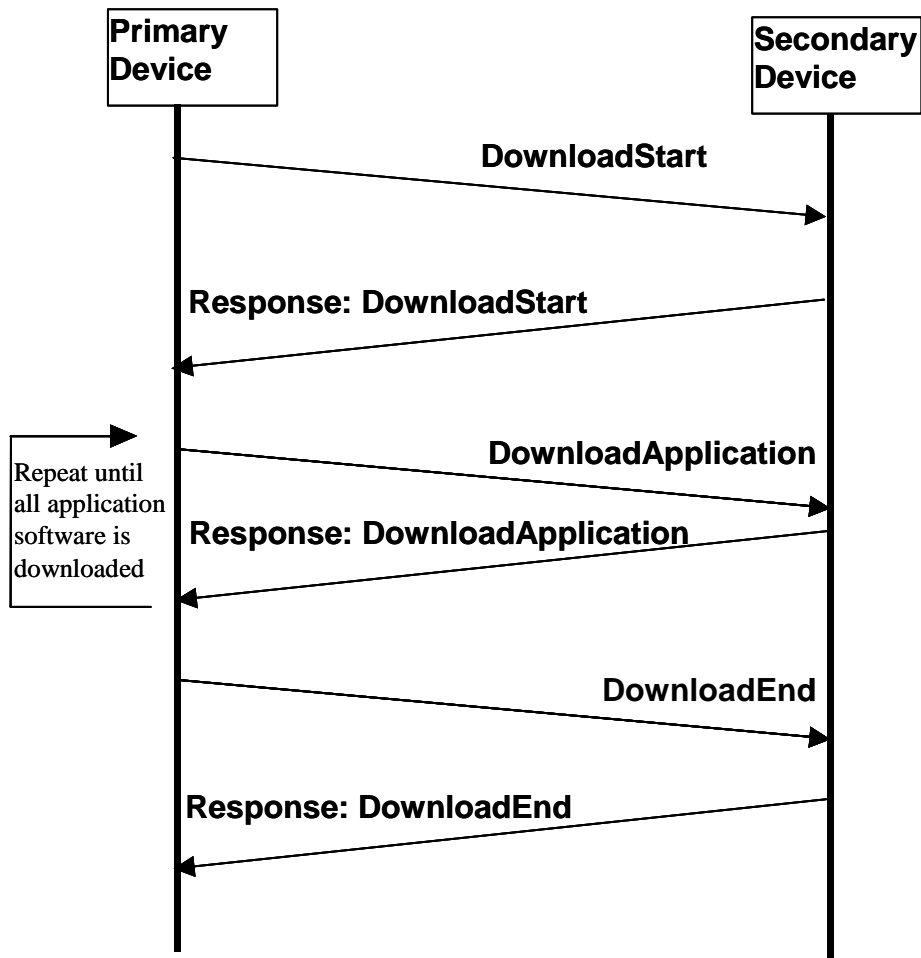


Figure C.1: Procedure sequence for Software Download

The erasure of the secondary device application software shall not be done before the reception of the Download Application message. The data content of the Download Application message is implementation specific but it is recommended to support an application software validity feature that shall minimise the risk of downloading faulty or invalid application software.

## Annex D (informative): Overview of elementary procedures

**Table D.1: Elementary Procedures and Procedure Codes**

Elementary Procedure	Procedure Code	Issued by	DownloadMode state
<u>Common Procedure Set</u>			
(Reserved)	0x01		
Reset Software	0x03	primary device	Yes
Get Alarm Status	0x04	primary device	No
Get Information	0x05	primary device	Yes
Clear Active Alarms	0x06	primary device	No
Read User Data	0x10	primary device	No
Write User Data	0x11	primary device	No
Alarm Subscribe	0x12	primary device	No
Self Test	0x0A	primary device	No
Download Start	0x40	primary device	Yes
Download Application	0x41	primary device	Yes
Download End	0x42	primary device	Yes
Vendor Specific Procedure	0x90	primary device	Vendor specific
<u>RETAP Single-Antenna Procedure Set</u>			
Set Device Data	0x0E	primary device	No
Get Device Data	0x0F	primary device	No
Calibrate	0x31	primary device	No
Send Configuration Data	0x32	primary device	No
Set Tilt	0x33	primary device	No
Get Tilt	0x34	primary device	No
Alarm Indication	0x07	secondary device	No
<u>RETAP Multi-Antenna Procedure Set</u>			
Antenna Calibrate	0x80	primary device	No
Antenna Send Configuration Data	0x89	primary device	No
Antenna Set Tilt	0x81	primary device	No
Antenna Get Tilt	0x82	primary device	No
Antenna Set Device Data	0x83	primary device	No
Antenna Get Device Data	0x84	primary device	No
Antenna Alarm Indication	0x85	secondary device	No
Antenna Clear Active Alarms	0x86	primary device	No
Antenna Get Alarm Status	0x87	primary device	No
Antenna Get Number of Antennas	0x88	primary device	No
<u>TMAAP Procedure Set for multi and single TMA</u>			
TMASetMode	0x70	primary device	No
TMAGetMode	0x71	primary device	No
TMAGetSupportedFunctions	0x7A	primary device	No
TMASetGain	0x72	primary device	No
TMAGetGain	0x73	primary device	No
TMASetDeviceData	0x74	primary device	No
TMAGetDeviceData	0x75	primary device	No
TMAAlarmIndication	0x76	secondary device	No
TMAClearActiveAlarms	0x77	primary device	No
TMAGetAlarmStatus	0x78	primary device	No
TMAGetNumberOfSubunits	0x79	primary device	No
TMAGetSupportedNonLinearGainValues	0x7B	primary device	No

NOTE: The notion "yes" in the DownloadMode state column indicates that the listed procedures are mandatory if the DownloadMode state can be entered by the secondary device.

## Annex E (informative): I-frame and INFO-field format

The I-frame and INFO-field formats for both primary and secondary stations are illustrated. To transfer elementary procedures, the INFO-field of the I-frame is used.

**Table E.1: HDLC-Frame:**

Flag 1 octet	ADR 1 octet	Control 1 octet	INFO N octets	CRC 2 octets		Flag 1 octet
0x7E	Device Address	Control bits	Variable length (must support a maximum length of at least 74 octets)	CRC1 Low Octet	CRC2 high octet	0x7E

Procedure ID	Number of data octets		Data octets
1 octet	low octet	high octet	Variable length (must support a maximum length of at least 71 octets)

### Format of the I-Frame and INFO Field

Devices shall support the following data length:

Mandatory:  $0 \leq \text{data octets} \leq 71$

Optional:  $0 \leq \text{data octets} < 65,536$  octets

## Annex F (Informative): Assigned fields for additional data coding for operating bands

NOTE: This Annex is not updated in Rel-16 and onwards.

**Table F.1: Band related fields for additional data of RETAP**

Field No.	Length (octets)	Format	Description
0x03	2	16-bit unsigned	Antenna operating band(s): see Table F.2 below
0x08	2	16-bit unsigned	Antenna operating band(s): see Table F.2-1 below
0x09	2	16-bit unsigned	Antenna operating band(s): see Table F.2-2 below
0x0A	2	16-bit unsigned	Antenna operating band(s): see Table F.2-3 below
0x0B	2	16-bit unsigned	Antenna operating band(s): see Table F.2-4 below
0x04	8	4 x 16-bit unsigned	Beamwidth for each operating band in band order (deg), beginning with lowest band. The lowest band is transmitted within the first 16-bit value. (example: width for band I, width for band III)
0x05	4	4 x 8-bit unsigned	Gain [dBi] for each operating band in band order, expressed in gain value times 10, beginning with the lowest band. The lowest band is transmitted within the first 8-bit value (example: gain for band I, gain for band III)

**Table F.2: Coding for operating bands in field 0x03**

Bit no	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Operating band UTRA	Ext. 09	Ext. 08	XIV	XIII	XII	XI	X	IX	VIII	VII	I	II	III	IV	V	VI
Operating band E-UTRA	Ext. 09	Ext. 08	14	13	12	11	10	9	8	7	1	2	3	4	5	6

Bit 14 set to "1" indicates that field 0x08 is defined.

Bit 15 set to "1" indicates that field 0x09 is defined.

**Table F.2-1: Coding for operating bands in field 0x08**

Bit no	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Operating band UTRA	-	-	-	-	XXVI	XXV	-	-	XXII	XXI	XX	XIX	XVIII	XVII	Res.	Res.
Operating band E-UTRA	30	29	28	27	26	25	24	23	22	21	20	19	18	17	Res.	Res.

**Table F.2-2: Coding for operating bands in field 0x09**

Bit no	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Operating band UTRA	Ext 0A	-	XXXII	-	-	-	-	-	e	f	d	c	b)36	b)35	a)34	a)33
Operating band E-UTRA	Ext 0A	65	32	31	44	43	42	41	40	39	38	37	36	35	34	33

Bit 15 set to "1" indicates that field 0x0A is defined.

**Table F.2-3: Coding for operating bands in field 0x0A**

Bit no	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Operating band UTRA	Ext 0B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Operating band E-UTRA	Ext 0B	75	74	72	71	49	51	50	48	69	70	46	68	45	67	66

Bit 15 set to "1" indicates that field 0x0B is defined.

**Table F.2-4: Coding for operating bands in field 0x0B**

Bit no	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Operating band UTRA	Res.	Spare	Spare	Spare	Spare	Spare	Spare	Spare	Spare	Spare	Spare	Spare	-	-	-	-
Operating band E-UTRA	Res.	Spare	Spare	Spare	Spare	Spare	Spare	Spare	Spare	Spare	Spare	Spare	85	52	73	76

The operating bands are defined in subclause 4.3.7 in TS 37.461 [4]. In Table F.2-2, the notation a)33 is equivalent to E-UTRA band 33.

Bits are numbered from 0 to 15, bit no 0 set=1 represents the value 0x0001.

Bit set=1 represents operating band is supported.

Bit set=0 represents operating band is not supported.

Spare bits shall be set=0.

Unused Beamwidth and Gain octets shall be set to 0x0000.

Examples of operating bands: 0000 0000 0001 0000 = Operating band II

0000 0000 0011 1000 = Operating band I, II and III

**Table F.3: Band related fields for additional data of TMAAP**

Field No.	Length (octets)	Format	Description
0x03	2	16-bit unsigned	Antenna operating band(s): see Table F.2 above
0x08	2	16-bit unsigned	Antenna operating band(s): see Table F.2-1 above
0x09	2	16-bit unsigned	Antenna operating band(s): see Table F.2-2 above
0x0A	2	16-bit unsigned	Antenna operating band(s): see Table F.2-3 above
0x0B	2	16-bit unsigned	Antenna operating band(s): see Table F.2-4 above
0x04	8	4 x 16-bit unsigned	Beamwidth for each operating band in band order (deg) beginning with lowest band. The lowest band is transmitted within the first 16-bit value.
0x05	4	4 x 8-bit unsigned	Gain [dBi] for each operating band in band order, expressed in gain value times 10, beginning with the lowest band. The lowest band is transmitted within the first 8-bit value (example: gain for band I, gain for band III)

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## Annex G (informative): Change History

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2019-02	R3-103	R3-190103				Text transferred from 25.466 v15.3.0 (changes shown with rev marks)	1.15.0
2019-04	RAN#83	RP-190606				Specification approved by RAN plenary	15.4.0
2019-12	RP-86	RP-192915	0001	5	F	Correction for luant	15.5.0
2020-07	<a href="#">SA#88-e</a>	-	-	-	-	Update to Rel-16 version (MCC)	16.0.0



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# History

<b>Document history</b>		
V16.0.0	September 2020	Publication