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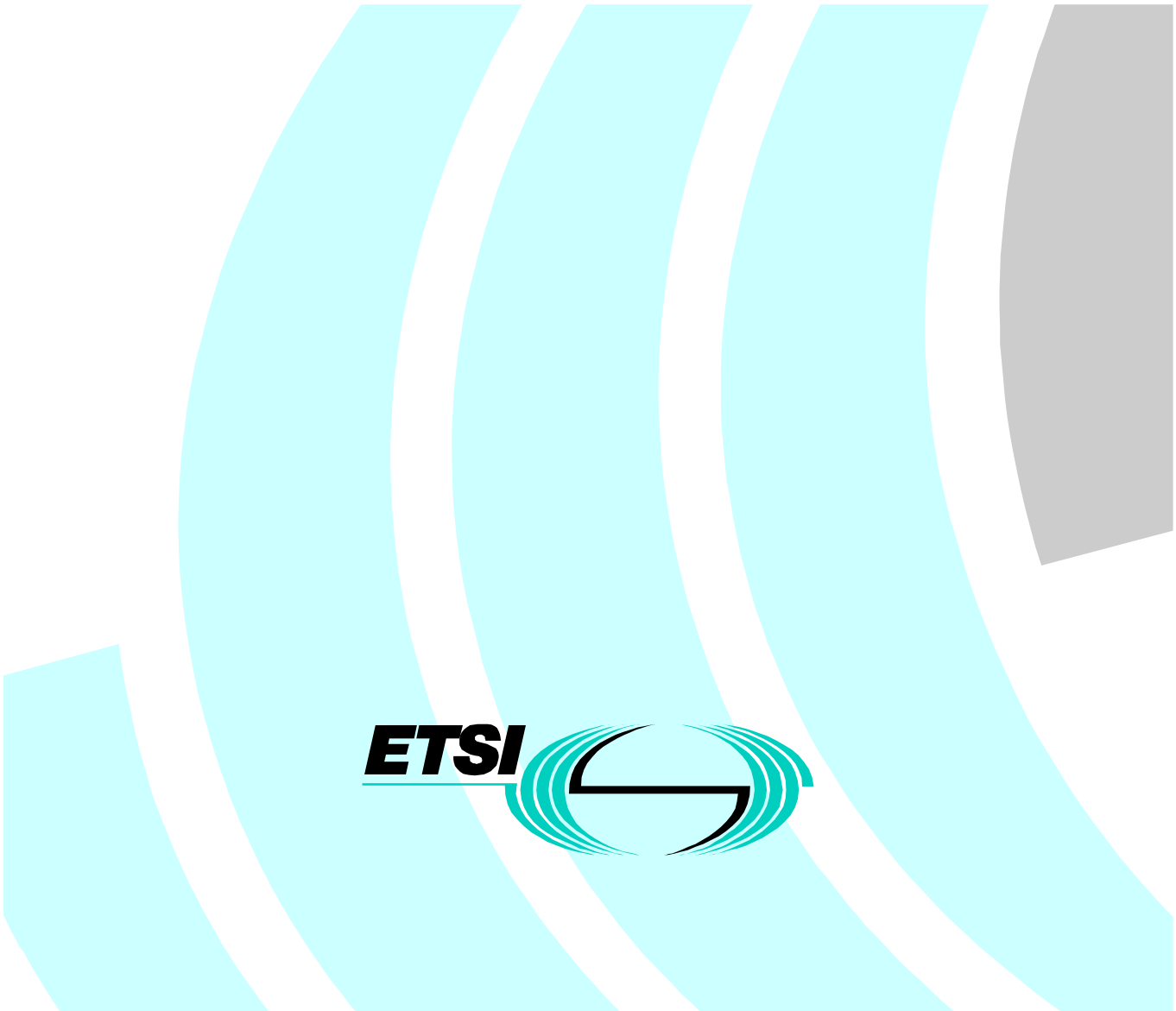
European Standard (Telecommunications series)

Terrestrial Trunked Radio (TETRA); Technical requirements for Direct Mode Operation (DMO); Part 10: Managed Direct Mode Operation (M-DMO)



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ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
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Contents

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Project Terrestrial Trunked Radio (TETRA), and is now submitted for the Public Enquiry phase of the ETSI standards Two-step Approval Procedure.

The present document is part 10 of a multi-part delivrable covering the Technical requirements for Direct Mode Operation (DMO), as identified below:

Part 1: General network design;

Part 2: Radio aspects;

Part 3: Mobile Station to Mobile Station (MS-MS) Air Interface (AI) protocol;

Part 4: Type 1 repeater air interface;

Part 5: Gateway air interface;

Part 6: Security;

Part 7: Type 2 repeater air interface;

Part 8: Protocol Implementation Conformance Statement (PICS) proforma specification;

Part 9: Service and Description Language (SDL) model;

Part 10: Managed Direct Mode Operation (M-DMO).

Proposed national transposition dates	
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1 Scope

ETS/EN 300 396 defines the Terrestrial Trunked Radio (TETRA) Direct Mode Operation (DMO). It specifies the basic air interface, the inter-working between Direct Mode (DM) groups via repeaters, and inter-working with the TETRA Voice plus Data (V+D) system via gateways. It also specifies the security aspects in TETRA DMO, and the intrinsic services that are supported in addition to the basic bearer and teleservices.

The present document defines TETRA Managed Direct Mode Operation (M-DMO).

M-DMO provides a means to restrict the use of Direct Mode Operation (DMO) by requiring prior authorization before a Direct Mode Mobile Station (DM-MS) is permitted to transmit on a radio frequency. This modifies the operation of DM-MSs from that specified in ETS 300 396-3 [3], EN 300 396-4 [4], ETS 300 396-5 [5] and EN 300 396-7 [7].

M-DMO provides a control mechanism by which radio frequencies (M-DMO frequencies) may be given for DMO use for a period of time; those frequencies are considered to be managed frequencies. All M-DMO devices operating on a managed frequency shall comply with the transmit restrictions defined in the present document.

An M-DMO DM-MS (M-DM-MS) may receive the authorization to transmit from a broadcast signal sent on the M-DMO frequency.Or, alternatively, it may obtain the authorization directly on the V+D side from the SwMI or from an M-DMO management station.

The authorizing unit which sends the broadcast signal on the M-DMO frequency is referred to as an M-DM-AUTH. It obtains the authorization to operate as an M-DM-AUTH from the V+D SwMI or from a management station that is authorized to allocate frequencies for M-DMO. An M-DM-AUTH may be a stand-alone unit (performing only the authorization function), or it may perform also the function of a DM-REP, DM-GATE or DM-REP/GATE.

The content of the present document is as follows:

- Clause 4: provides an overview of M-DMO;
- Clause 5: describes the procedures for M-DMO mobile stations;
- Clause 6: describes the procedures for M-DM-AUTHs;
- Clause 7: describes the operation of M-DMO frequencies;
- Clause 8: describes the usage of the authorization presence signal;
- Annex A: lists the timers and constants specific to M-DMO;
- Annexes B through F: describe the differences from ETS 300 396-3 [3], EN 300 396-4 [4], ETS 300 396-5 [5] and EN 300 396-7 [7] arising from M-DMO.

The present document assumes familiarity with operation of TETRA in a network environment as described in EN 300 392, and with operation of TETRA in Direct Mode as described in other parts of ETS/EN 300 396.

The present document does not define the process for deciding which frequencies are allocated to M-DMO use.

2 References

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

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

[1] ETSI ETS 300 396-1: "Terrestrial Trunked Radio (TETRA); Technical Requirements for Direct Mode Operation (DMO); Part 1: General Network Design".

[2] ETSI ETS 300 396-2: "Terrestrial Trunked Radio (TETRA); Technical Requirements for Direct Mode Operation (DMO); Part 2: Radio Aspects".

[3] ETSI ETS 300 396-3: "Terrestrial Trunked Radio (TETRA); Technical Requirements for Direct Mode Operation (DMO); Part 3: Mobile Station to Mobile Station (MS-MS) Air Interface (AI) Protocol".

[4] ETSI EN 300 396-4: "Terrestrial Trunked Radio (TETRA); Technical Requirements for Direct Mode Operation (DMO); Part 4: Type 1 repeater air interface".

[5] ETSI ETS 300 396-5: "Terrestrial Trunked Radio (TETRA); Technical Requirements for Direct Mode Operation (DMO); Part 5: Gateway air interface".

[6] ETSI ETS 300 396-6: "Terrestrial Trunked Radio (TETRA); Direct Mode Operation (DMO); Part 6: Security".

[7] ETSI EN 300 396-7: "Terrestrial Trunked Radio (TETRA); Technical Requirements for Direct Mode Operation (DMO); Part 7: Typeke 2 repeater air interface".

[8] ETSI EN 300 392-2: "Terrestrial Trund Radio (TETRA); Voice plus Data (V+D); Part 2: Air Interface (AI)".

[9] ETSI TR 101 661: "Terrestrial Trunked Radio (TETRA); Technical Requirements Specification; Managed Direct Mode Operation (DMO)".

3 Definitions and abbreviations

3.1 Definitions

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

authorization datum point: geographical point in space from which M-DMO is allowed

authorization presence signal: message that is transmitted by an M-DM-AUTH on an M-DMO RF carrier. It permits M-DM-MSs which receive this message to know that the M-DM-AUTH is within range. It indicates which M-DM-MSs are authorized to transmit on the RF carrier, and the validity time for which those M-DM-MSs are authorized

call: there are two types of call, individual call or group call. An individual call is a complete sequence of related call transactions between two MSs. There are always two participants in an individual call. A group call is a complete sequence of related call transactions involving two or more MSs. The number of participants in a group call is not fixed, but is at least two. Participants may join (late entry) and leave an ongoing call

call transaction: all of the functions associated with a complete unidirectional transmission of information during a call. A call is made up of one or more call transactions. In a simplex call these call transactions are sequential.

changeover: within a call, the process of effecting a transfer of the master role (and hence transmitting MS) at the end of one call transaction so that another can commence

Direct Mode Call Control (DMCC): layer 3 entity responsible for setting up and maintaining a call in DMO

DM channel: specific grouping of timeslots in the DM multiplex structure related to a particular DM RF carrier i.e. DM frequency (or to a pair of duplex-spaced RF carriers for operation with a type 1B or type 2 DM-REP or a type 1B DM-REP/GATE). The grouping may not always be fixed, but in DMO when operating in frequency efficient mode as an example, there are two DM channels, identified by the letters A and B.

Direct Mode Operation (DMO): mode of simplex operation where mobile subscriber radio units may communicate using radio frequencies which may be monitored by, but which are outside the control of, the TETRA V+D network. DM operation is performed without intervention of any base station.

direct mode presence signal: message that is transmitted by a DM-REP, DM-GATE, DM-REP/GATE or M-DM-AUTH in order to indicate its presence on a DM RF carrier. It permits DM-MSs which receive this message to know that the DM-REP, DM-GATE, DM-REP/GATE or M-DM-AUTH is within range.

Direct Mode Mobile Station (DM-MS): physical grouping that contains all of the mobile equipment that is used to obtain TETRA DM services. A DM-MS may have one of three roles:

- **master:** if the DM-MS is either active in a call transaction transmitting traffic or control data, or is reserving the channel by means of channel reservation signalling;
- **slave:** if the DM-MS is receiving traffic and/or signalling in a call; or
- **idle:** if the DM-MS is not in a call.

DUal Mode switchable Mobile Station (DU-MS): MS that is capable of both TETRA DMO and TETRA V+D operation. Only one mode can be selected at any given time and the MS is not capable of monitoring a DM RF carrier while in V+D mode or a V+D channel while in DMO.

Dual Watch Mobile Station (DW-MS): MS that is capable of both TETRA DMO and TETRA V+D operation. The MS is capable of periodically monitoring the V+D control channel while in a DM call, a DM RF carrier while in a V+D call and, when idle, it periodically monitors both the DM RF carrier and the V+D control channel.

Direct Mode GATEway (DM-GATE): device which provides gateway connectivity between DM-MS(s) and the TETRA V+D network. The gateway provides the interface between TETRA DMO and TETRA V+D mode.

Direct Mode REPeater (DM-REP): device that operates in TETRA DMO and provides a repeater function to enable two or more DM-MSs to extend their coverage range. It may be either a type 1 DM-REP, capable of supporting only a single call on the air interface, or a type 2 DM-REP, capable of supporting two calls on the air interface. A type 1 DM-REP may operate on either a single RF carrier (type 1A DM-REP) or a pair of duplex-spaced RF carriers (type 1B DM-REP). A type 2 DM-REP operates on a pair of duplex-spaced RF carriers. In the case of a type 1B or type 2 DM-REP, one of the RF carriers is used as the "uplink" from DM-MSs to the DM-REP and the other is used as the "downlink" from the DM-REP to DM-MSs.

Direct Mode REPeater/GATEway (DM-REP/GATE): device that combines the functions of a Direct Mode repeater and a Direct Mode gateway in a single implementation and is capable of providing both functions simultaneously (so that, during a call transaction initiated by a DM-MS, the DM-REP/GATE provides gateway connectivity to the TETRA V+D network and also provides a repeater function on the DM channel). The repeater part of the combined implementation may be either a type 1A repeater, operating on a single DM RF carrier, or a type 1B repeater, operating on a pair of duplex-spaced DM RF carriers.

frequency efficient mode: mode of operation where two independent DM communications are supported on a single RF carrier (or pair of duplex-spaced RF carriers for operation with a type 2 DM-REP). In frequency efficient mode the two DM channels are identified as channel A and channel B.

gateway: generic term used to describe either a pure DM-GATE or a combined implementation with a repeater (DM-REP/GATE).

Managed Direct Mode Operation (M-DMO): method of operation in which a direct mode terminal is only permitted to transmit when it has received a signal authorizing it to do so.

Managed Direct Mode AUTHorizing unit (M-DM-AUTH): device that transmits an authorization presence signal on a DM RF carrier. An M-DM-AUTH may be a stand-alone unit, performing only the authorization function, or it may perform also the function of a DM-REP, DM-GATE or DM-REP/GATE (in which case it is referred to as an M-DM-REP, M-DM-GATE or M-DM-REP/GATE respectively).

M-DMO management station: station that is accessed via the V+D network and is authorized to allocate frequencies for M-DMO.

Managed Direct Mode Mobile Station (M-DM-MS): DM-MS that is using managed direct mode operation. An M-DM-MS is not permitted to transmit on the DM RF carrier unless it has received a signal containing authorization and the authorized time has not expired. The authorization may have been received from an M-DM-AUTH transmitting on the DM RF carrier. Alternatively the authorization may have been received from the V+D SwMI or an M-DMO management station (in which case the M-DM-MS is referred to as a V+D authorized M-DM-MS).

normal mode: mode of operation where only one DM communication is supported on an RF carrier (or pair of duplex-spaced RF carriers for operation with a type 1B DM-REP or type 1B DM-REP/GATE).

surveillance: process of determining the current state of the DM RF carrier when in idle mode

trunked voice and data network: network which uses the TETRA V+D operation

V+D authorized M-DM-MS: type of M-DM-MS that receives its authorization to transmit on the DM RF carrier directly from the V+D SwMI or from an M-DMO management station via the V+D network

V+D operation: mode of operation where MSs may communicate via the TETRA V+D air interface which is controlled by the TETRA Switching and Management Infrastructure (SwMI)

3.2 Abbreviations

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

DM	Direct Mode
DMO	Direct Mode Operation
DM-MS	Direct Mode Mobile Station
DU-MS	DUal mode (V+D / Direct Mode) switchable Mobile Station
DW-MS	Dual Watch Mobile Station
DM-REP	Direct Mode REPeater
DM-GATE	Direct Mode GATEway
DM-REP/GATE	Direct Mode REPeater/GATEway
DMCC	Direct Mode Call Control entity
DNB	Direct Mode Normal Burst
DSB	Direct Mode Synchronization Burst
ETSI	European Telecommunications Standards Institute
GPS	Global Positioning System
GSSI	Group Short Subscriber Identity
GTSI	Group TETRA Subscriber Identity
ISSI	Individual Short Subscriber Identity
ITSI	Individual TETRA Subscriber Identity
MAC	Medium Access Control
M-DMO	Managed Direct Mode Operation
M-DM-MS	Managed Direct Mode Mobile Station
M-DM-AUTH	Managed Direct Mode AUTHorization unit
M-DM-REP	Managed Direct Mode REPeater
M-DM-GATE	Managed Direct Mode GATEway
M-DM-REP/GATE	Managed Direct Mode REPeater/GATEway
MNI	Mobile Network Identity
MS	Mobile Station
PDU	Protocol Data Unit
RF	Radio Frequency
SDS	Short Data Service
SDS-4	SDS type 4
SDS-TL	SDS Transport Layer
SSI	Short Subscriber Identity
SwMI	Switching and Management Infrastructure
TETRA	TErrestrial Trunked RAdio
TSI	TETRA Subscriber Identity
V+D	Voice plus Data

4 Overview of M-DMO

Managed Direct Mode Operation (M-DMO) enables the use of DMO to be controlled by providing a mechanism by which frequencies may be given for DMO use for a period of time. The objective of M-DMO is to constrain the transmission by the M-DMO terminals such that they will not transmit in a geographical area in which they are not authorized to transmit.

There are two types of M-DMO terminal:

- M-DMO mobile station (M-DM-MS);
- M-DMO authorizing unit (M-DM-AUTH).

An M-DM-MS shall not transmit on an M-DMO RF carrier (i.e. frequency) unless it has received a signal containing authorization and the authorized time has not expired. The M-DM-MS may have received the authorization from an M-DM-AUTH transmitting on the managed RF carrier. Alternatively, an M-DM-MS may be capable of receiving the authorization directly on the V+D side from the SwMI or from an M-DMO management station via the V+D network.

Visual and/or audible indications should be given to the user of the M-DM-MS indicating whether transmission is enabled or inhibited.

NOTE: The term "M-DM-MS" in the present document refers to an MS when it is operating on an RF carrier on which the use of M-DMO is required. It is expected that some MSs will only be permitted to operate as an M-DM-MS. Other MSs may be permitted to use non-managed DMO in some frequency bands (where they may use ETS 300 396-3 [3], EN 300 396-4 [4], ETS 300 396-5 [5] and EN 300 396-7 [7] without amendment), whereas they may be required to operate as an M-DM-MS in other frequency bands.

The M-DM-AUTH receives its authorization to operate on an RF carrier from the V+D SwMI, or from a management station that is authorized to allocate frequencies for M-DMO. An M-DM-AUTH may be a stand-alone unit, performing only the authorization function, or it may perform also the function of a DM-REP, DM-GATE or DM-REP/GATE (in which case it is designated as an M-DM-REP, M-DM-GATE or M-DM-REP/GATE respectively).

The authorization signal broadcast by an M-DM-AUTH is the direct mode presence signal. For an M-DM-REP, M-DM-GATE or M-DM-REP/GATE, this is the DM-REP or gateway presence signal defined in EN 300 396-4 [4] and ETS 300 396-5 [5]. The authorization presence signal for a stand-alone M-DM-AUTH is defined in 8.3.1.

The authorization presence signal is a signalling message transmitted by the M-DM-AUTH on the managed RF carrier. It indicates to any M-DM-MSs monitoring the RF carrier that the M-DM-AUTH is within range. It also indicates which M-DM-MSs are authorized to transmit on the RF carrier, and the validity time for which those M-DM-MSs are authorized. The authorization presence signal authorizes transmission by the indicated M-DM-MSs on the RF carrier on which the signal is sent (except in the case of a two-frequency M-DM-REP or M-DM-REP/GATE (see 7.1)).

The authorization presence signal is not sent during direct MS-MS calls. Therefore, a stand-alone M-DM-AUTH sends the authorization presence signal only when the channel is free. An M-DM-REP, M-DM-GATE or M-DM-REP/GATE sends the authorization presence signal when the channel is free; it also sends the authorization presence signal during calls made through that repeater or gateway, as defined in EN 300 396-4 [4] and ETS 300 396-5 [5].

An example of a scenario in which M-DMO works is shown in figure 1. The example shows direct MS-MS operation authorized by a stand-alone M-DM-AUTH. The M-DM-AUTH has received its authorization to transmit the authorization presence signal on the DM RF carrier from an M-DMO management station, using the V+D Short Data Service Transport Layer (SDS-TL) data transfer service.

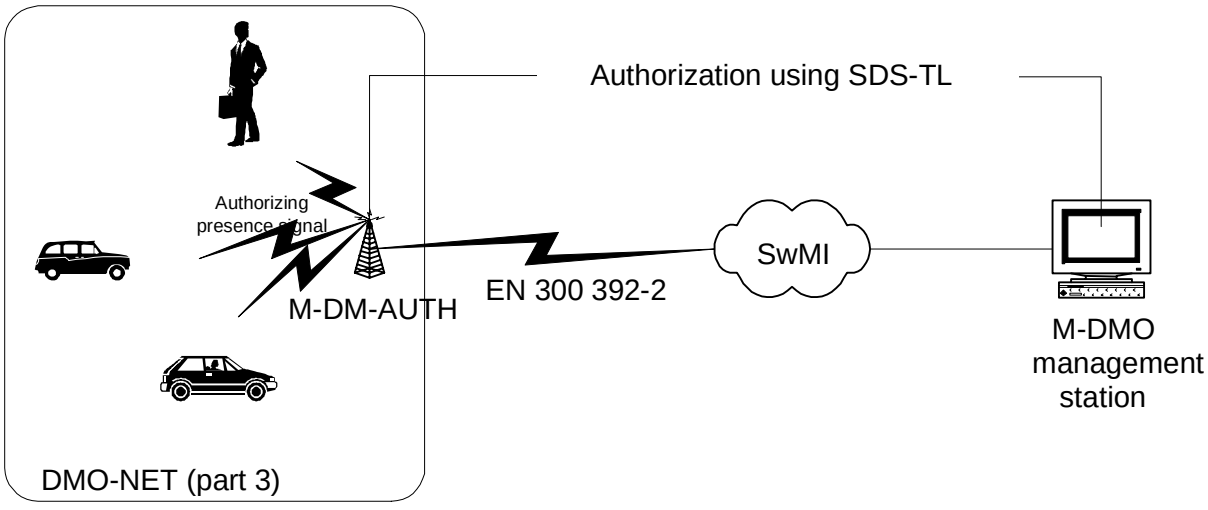

Figure 1: M-DMO Operational scenario

The normal sequence of events for an M-DM-MS authorized by an M-DM-AUTH is as shown in the simplified message sequence chart of figure 2 and described in the following text.

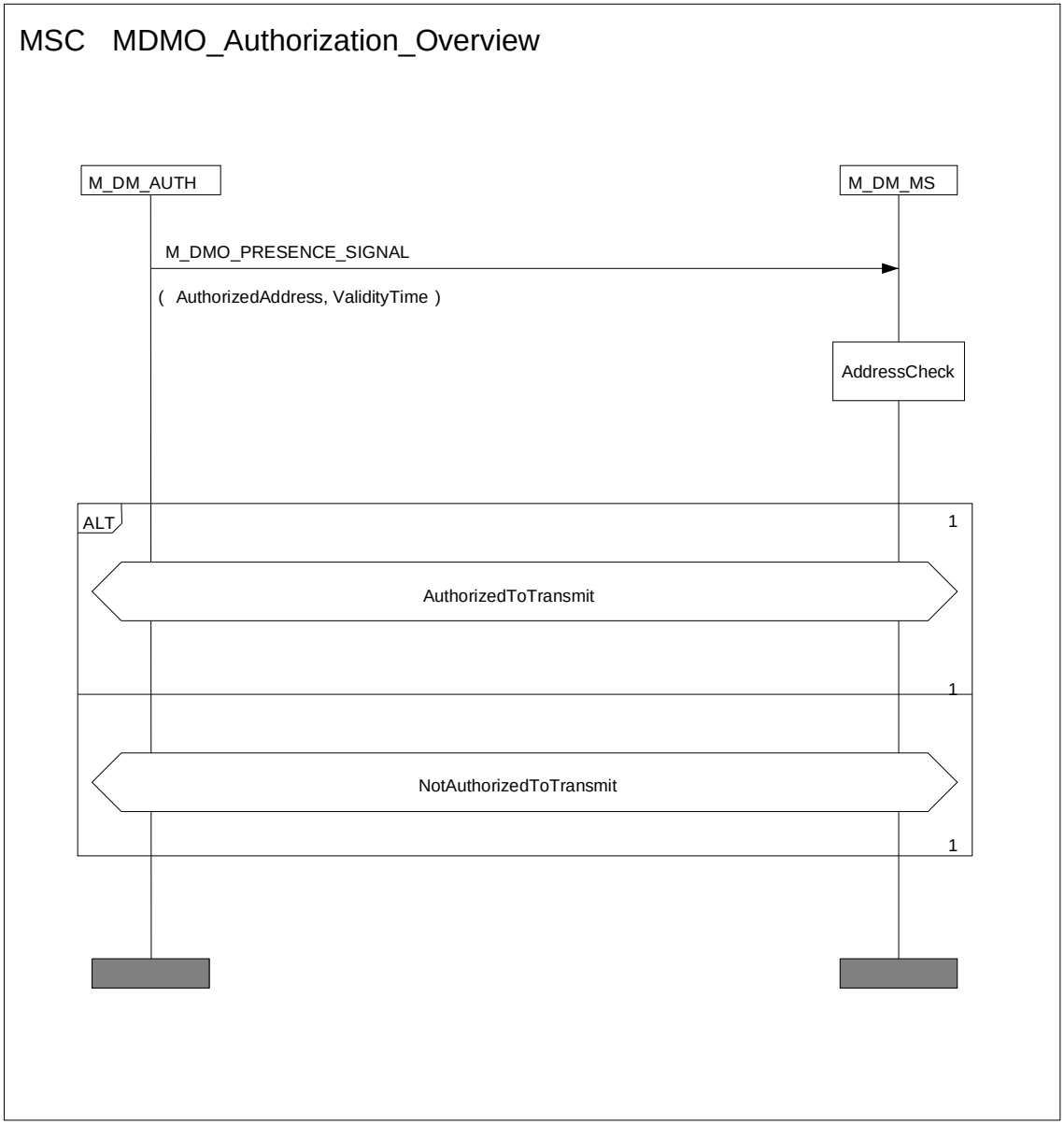

Figure 2: M-DMO authorization sequence chart

1) Power up on M-DMO RF carrier.
2) Inhibit transmission path (including transmission for linearization).
3) Scan RF carrier for activity.
4) If activity is detected, determine whether activity is direct mode presence signal (DPRES-SYNC PDU).
5) If yes, determine whether it is an M-DMO presence signal (i.e. M-DMO flag set to 1).
6) If yes, compare own addresses with authorized addresses (indicated by process box marked "AddressCheck" on figure 2):

- if any address is equal then the transmission path may be enabled on this RF carrier for the indicated validity time (as shown in upper ALT path of figure 2);
- if not equal then the state of the transmission path on this RF carrier shall not be changed (as shown in lower ALT path of figure 2).

7) Return to 3.

5 M-DM-MS

5.1 Operation of M-DM-MS

Mobile stations used for Managed Direct Mode Operation (M-DMO) may be considered as a variant of those used for Direct Mode operation as described in:

- ETS 300 396-3 [3] for direct DM-MS to DM-MS operation;
- EN 300 396-4 [4] for DM-MS to DM-MS operation through a type 1 DM-REP;
- ETS 300 396-5 [5] for DM-MS to/from V+D operation through a gateway; and
- EN 300 396-7 [7] for DM-MS to DM-MS operation through a type 2 DM-REP.

The differences from ETS 300 396-3 [3], EN 300 396-4 [4], ETS 300 396-5 [5] and EN 300 396-7 [7] operation described in the present document relate principally to the permission to transmit - though some other differences also apply.

The addressing methods of DMO described in ETS 300 396-1 [1], clause 6 shall apply to M-DMO.

The radio aspects of DMO described in ETS 300 396-2 [2], EN 300 396-4 [4], ETS 300 396-5 [5] and EN 300 396-7 [7] shall apply to M-DMO.

The security aspects of DMO described in ETS 300 396-6 [6] shall apply to M-DMO.

There are two distinct methods for authorization of an M-DM-MS:

a) the M-DM-MS may receive authorization from an M-DM-AUTH transmitting on the managed RF carrier; or

b) the M-DM-MS may receive authorization directly from an authorizing V+D SwMI or from an M-DMO management station via the V+D network.

These methods are described in clauses 5.2 and 5.3 respectively. An M-DM-MS shall use either the method described in clause 5.2 or the method described in clause 5.3.

5.2 M-DM-MS authorized by M-DM-AUTH

In this type of operation, the M-DM-MS receives authorization from an M-DM-AUTH transmitting on the managed RF carrier. The M-DM-MS shall not transmit on the managed RF carrier unless it has received an authorization presence signal indicating one of its addresses and the validity time has not expired.

The M-DM-MS's authorization to transmit is based only on the validity time from the most recently received presence signal that authorized the M-DM-MS to use the RF carrier. The authorization for that validity time applies even if the M-DM-MS goes out of range of the M-DM-AUTH.

The M-DM-MS's authorization relates to any type of transmission on the RF carrier (e.g. for a circuit mode call, SDS message etc).

Reception is allowed always. Thus, as an option, an M-DM-MS may receive calls while it is not authorized to transmit, though it is not permitted to respond or request to transmit in the call.

The authorization presence signal is described in clause 8.

The protocol differences for the M-DM-MS relative to the specifications provided in ETS 300 396-3 [3], EN 300 396-4 [4], ETS 300 396-5 [5] and EN 300 396-7 [7] are described in annexes B, C, D and E.

NOTE: Methods for selection of the appropriate RF carrier by the M-DM-MS are not defined in the present document.

5.3 V+D authorized M-DM-MS

There is an alternative type of M-DM-MS. This is:

1) a Dual Watch MS; or

2) a Dual Mode MS with a means for determining its geographical location (e.g. a GPS receiver),

that receives its authorization directly from an authorizing SwMI or from an M-DMO management station via the V+D network. This type of M-DM-MS appears to the authorizing SwMI or management station to be similar to an M-DM-AUTH but is restricted to obtaining authorization only for itself. Such an M-DM-MS shall not broadcast an authorization presence signal on any M-DMO RF carrier but may make calls whilst its authorization on the RF carrier is valid. This type of M-DM-MS is referred to in the present document as a V+D authorized M-DM-MS.

In this type of operation, the M-DM-MS's authorization to transmit on the RF carrier is constrained by the authorization duration received from the authorizing SwMI or management station. It is also constrained by the M-DM-MS's location, as described in the following two paragraphs.

In case 1), the Dual Watch MS may transmit on the managed RF carrier while it is in range of the TETRA SwMI and in receipt of signalling from the SwMI and the authorization time has not expired. In some cases this link will be lost due to the variability of RF path conditions. If the link to the SwMI is lost for longer than a time MT201, the MS shall inhibit transmission on the managed RF carrier (see 5.4.2).

In case 2), the Dual Mode MS receives information about the authorized geographical area from the authorizing SwMI or management station when it receives the authorization to use the managed RF carrier; this information is defined in terms of a geographical point (the authorization datum point) and the authorized range relative to that point. The Dual Mode MS shall be able to calculate its geographical location and its distance in metres from its authorization datum point. The MS may transmit on the managed RF carrier while it is within the defined range from the authorization datum point and the authorization time has not expired. Transmission shall be inhibited when the defined range from the authorization datum point is exceeded (see 5.4.2). The MS may re-enable transmission if it returns to a location within the defined range from the authorization datum point (provided that the authorization time has not expired). It is a requirement of this mode that the source of the geographical location data is trusted. The means by which this trust is maintained is outside the scope of the present document.

Reception is allowed always. Thus, as an option, the M-DM-MS may receive calls while it is not authorized to transmit, though it is not permitted to respond or request to transmit in the call.

The protocol differences for a V+D authorized M-DM-MS relative to the specifications provided in ETS 300 396-3 [3], EN 300 396-4 [4], ETS 300 396-5 [5] and EN 300 396-7 [7] are described in annex F.

Unless specified otherwise, the procedures defined for a M-DM-MS in the remainder of the present document apply only to an M-DM-MS that is authorized by an M-DM-AUTH, not to a V+D authorized M-DM-MS.

NOTE: A V+D authorized M-DM-MS receives its authorization to use the managed RF carrier directly from the SwMI or from an M-DMO management station via the V+D network. It does not need to receive an authorization presence signal on the managed RF carrier. I.e. a V+D authorized M-DM-MS does not need an M-DM-AUTH to be present on the managed RF carrier.

5.4 Transmit authorization for M-DM-MS

5.4.1 Transmit authorization for M-DM-MS authorized by M-DM-AUTH

The authorization signal shall be processed by the M-DM-MS in accordance with the simplified state machine illustrated in figure 3 and the following text.

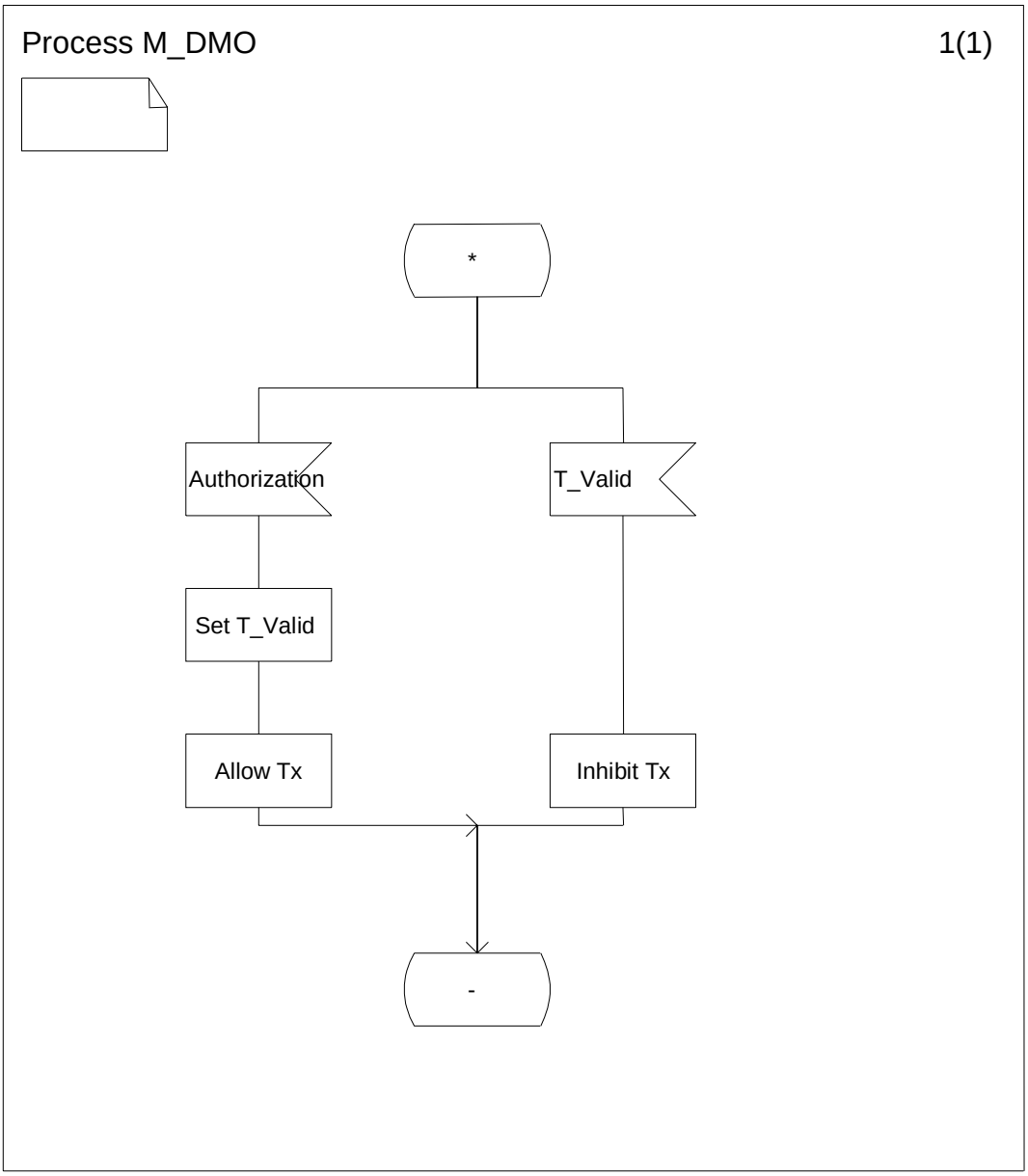

Figure 3: Simplified state machine of M-DMO in an M-DM-MS

The action "Set T_Valid" in figure 3 means that the M-DM-MS shall set timer T_Valid to the validity time contained in the authorizing presence signal.

The state machine of the M-DM-MS shall be implemented such that transmission shall only be allowed when the timer T_Valid has not expired. If T_Valid has expired or does not exist, transmission shall be inhibited.

The following procedures shall apply when timer T_Valid expires:

a) If the M-DM-MS is in the process of transmitting a burst, the transmission of that burst shall be completed before transmission is inhibited.

b) If the M-DM-MS is currently sending a short data message, it may complete the current transmission of the short data message before transmission is inhibited.

c) If the M-DM-MS is currently master during a circuit mode call, the DMCC in the M-DM-MS shall immediately send a DM-RELEASE PDU to the called DM-MS(s), stop timer DT311 (if in occupation), inform the user application with a DMCC-RELEASE indication primitive and return to state IDLE. The DM-MAC shall send the DM-RELEASE message in at least two frames before transmission is inhibited.

d) Otherwise the M-DM-MS shall inhibit transmission immediately.

NOTE: If the M-DM-MS is attempting random access when timer T_Valid expires, the M-DM-MS inhibits transmission immediately - unless it is actually in the process of transmitting a request, in which case it inhibits transmission immediately after the end of the DSB containing that request.

In case c), the DMCC in the M-DM-MS should set the "release cause" element in the DM-RELEASE PDU to "transmit capability lost" (see 5.4.3) and should set the "release cause" parameter in the DMCC-RELEASE indication primitive to a new value "transmit authorization lost".

5.4.2 Transmit authorization for V+D authorized M-DM-MS

The state machine of a V+D authorized M-DM-MS shall be implemented such that transmission shall only be allowed when the authorization time indicated by the authorizing SwMI or management station has not expired and:

- for a Dual Watch M-DM-MS, the link to the SwMI has not been lost (i.e. timer MT201 has not expired); or
- for a Dual Mode M-DM-MS, the MS is within the defined range from the authorization datum point.

For a Dual Watch M-DM-MS, procedures a), b), c) and d) of clause 5.4.1 shall apply when the authorization time or timer MT201 expires.

For a Dual Mode M-DM-MS, procedures a), b), c) and d) of clause 5.4.1 shall apply when the authorization time expires or the defined range from the authorization datum point is exceeded.

5.4.3 Release cause element

The "release cause" element in the DM-RELEASE PDU may take an additional value as shown in table 1.

Table 1: Release cause element

Information element	Length	Value	Remark
Release cause	4	0000_2 to 0110_2	As defined in ETS 300 396-3 [3]
		0111_2	As defined in EN 300 396-4 [4]
		1000_2 to 1100_2	As defined in ETS 300 396-5 [5]
		1101_2	Transmit capability lost
		others	Reserved

6 M-DM-AUTH

6.1 Operation of M-DM-AUTH

The following types of M-DMO authorizing unit (M-DM-AUTH) are standardized:

a) stand-alone M-DM-AUTH, which performs only the authorization function;

b) M-DM-REP, which is a modified DM-REP that provides the authorization function;

c) M-DM-GATE, which is a modified DM-GATE that provides the authorization function;

d) M-DM-REP/GATE, which is a modified DM-REP/GATE that provides the authorization function.

The M-DM-AUTH transmits the authorization presence signal on the managed RF carrier. The M-DM-AUTH sends the authorization presence signal periodically when the channel is free. Also an M-DM-REP, M-DM-GATE or M-DM-REP/GATE shall send the authorization presence signal during calls made through that repeater or gateway, as defined in EN 300 396-4 [4] and ETS 300 396-5 [5].

NOTE 1: The authorization presence signal is not sent during direct MS-MS calls (except that it may be sent in the random access slots if the M-DM-AUTH needs to withdraw authorization from the master MS; see 8.2.1.2).

The authorization presence signal shall contain data to identify the authorized users (by SSI, TSI or MNI), and the time for which those M-DM-MSs are authorized. The time for which the M-DM-MSs are authorized, as transmitted in the authorization presence signal, shall be known as the validity time of the authorization. The validity time transmitted in the authorization presence signal shall not be longer than the remaining time for which the M-DM-AUTH has been authorized to operate on the RF carrier, and it will generally be shorter. In some cases the validity time will be as short as a few seconds but it may be as long as several hours to allow an M-DM-MS to make direct MS-MS calls under conditions where regular contact with the M-DM-AUTH cannot be guaranteed (e.g. for operation underground).

NOTE 2: As defined below, the M-DM-AUTH's authorization to operate on the RF carrier is constrained by the authorization duration received from the authorizing SwMI or management station, and also by the M-DM-AUTH's location. (The M-DM-AUTH either operates only within range of the SwMI or operates only in a specified geographical area.) Since the M-DM-AUTH's location is controlled, the authorization duration may be a long period of time. By contrast, an M-DM-MS's authorization to transmit on the RF carrier is based only on the validity time from the authorizing presence signal. Thus the M-DM-MS's location is restricted only by the need to remain in the area local to the M-DM-AUTH in order to receive a repetition of the authorization presence signal before the validity time expires. Validity times will often be quite short in order to ensure that the M-DM-MS transmits only when it is close to the M-DM-AUTH.

The authorizing network or M-DMO management station shall be involved in M-DMO by indicating to the M-DM-AUTH the RF carrier(s), and addresses, which are to be authorized and for how long. M-DM-AUTH shall register to the authorizing network and may request permission to transmit the authorization presence signal for one or a number of M-DM-MSs.

NOTE 3: The authorizing network or M-DMO management station may provide authorization for addresses where the MNI component of the TSI is different from that of the authorizing network.

An M-DM-AUTH operates in one of two modes:

1) The M-DM-AUTH may be configured to operate on the managed RF carrier for the specified authorization duration but only while it is in contact with the authorizing SwMI. This type of M-DM-AUTH shall be in contact with the authorizing SwMI at all times, with a timer allowing for temporary loss of connection due to RF path conditions (e.g. fading); see 6.2.

2) The M-DM-AUTH may be equipped with a means for determining its geographical location (e.g. a GPS receiver), in which case it may obtain authorization to operate on the managed RF carrier for the specified authorization duration within a specified geographical area. This type of M-DM-AUTH may either:

   - operate out of range of the authorizing SwMI; and/or

   - be a dual mode (V+D / direct mode) switchable equipment, which may receive its authorization via the V+D network and then be switched to operate on a managed direct mode RF carrier.

   See also 6.3.

NOTE 4: Operation of an M-DM-REP in mode 1 as defined above is not supported in this version of the present document.

The M-DM-AUTH shall cease operation on the managed RF carrier when its authorization time has expired. If the M-DM-AUTH is in range of the SwMI (for operation in mode 1) or is within the specified geographical area (for operation in mode 2) when the authorization time expires, it shall send the presence signal with the validity time set to zero and addressed to all M-DM-MSs on the managed RF carrier before it ceases transmission on the RF carrier.

The M-DM-AUTH is also required to withdraw authorization from M-DM-MSs and cease transmission on the managed RF carrier if it loses the link to the SwMI (for operation in mode 1) or if it moves out of the specified geographical area (for operation in mode 2); see clauses 6.2 and 6.3.

6.2 Loss of link to SwMI

If an M-DM-AUTH operating in mode 1 (i.e. if it is not performing managed out-of-range or dual mode operation) then it may transmit the authorization presence signal on the managed RF carrier only when it is in range of the TETRA

SwMI and in receipt of signalling from the SwMI and the authorization time has not expired. In some cases this link will be lost due to the variability of RF path conditions. If the link to the SwMI is lost for longer than a time MT251, the M-DM-AUTH shall send the presence signal with the validity time set to zero and addressed to all M-DM-MSs on the managed RF carrier, and shall then cease transmission on the managed RF carrier.

NOTE: If an M-DM-GATE or M-DM-REP/GATE is master of a circuit mode call when the authorization time or timer MT251 expires, it may send the DM-RELEASE PDU to the called DM-MS(s) before sending the presence signal with the validity time set to zero.

6.3 Managed out-of-range or dual mode operation

A managed out-of-range or dual mode M-DM-AUTH receives information about the authorized geographical area from the authorizing SwMI or management station when it receives the authorization to operate on the managed RF carrier; this information is defined in terms of a geographical point (the authorization datum point) and the authorized range relative to that point. The M-DM-AUTH shall be able to calculate its geographical location and its distance in metres from its authorization datum point. The M-DM-AUTH may transmit the authorization presence signal on the managed RF carrier while it is within the defined range from the authorization datum point and the authorization time has not expired. Authorization shall stop when the defined range from the authorization datum point is exceeded; the M-DM-AUTH shall send the presence signal with the validity time set to zero and addressed to all M-DM-MSs on the managed RF carrier, and shall then cease transmission on the managed RF carrier. The M-DM-AUTH may resume transmission of the authorization presence signal on the managed RF carrier if it returns to a location within the defined range from the authorization datum point (provided that the authorization time has not expired).

It is a requirement of this mode that the source of the geographical location data is trusted. The means by which this trust is maintained is outside the scope of the present document.

6.4 Maintaining link to M-DM-MSs

M-DM-MSs need to receive the authorization presence signal in order to remain authorized to transmit on the managed RF carrier. In some cases the receipt of this signal will be lost due to the variability of RF path conditions. Therefore, when the channel is free, the M-DM-AUTH should transmit the authorization presence signal such that the interval between sequences of transmissions of the authorizing presence signal is not greater than 1/3 of the validity time. If the M-DM-AUTH needs to authorize more than three addresses then the authorization cannot be performed with a single authorization presence signal. Then the interval between sequences of transmissions of the authorizing presence signal containing each address should not be greater than 1/3 of the validity time for that address.

6.5 M-DM-AUTH direct mode procedures

6.5.1 Direct mode procedures for stand-alone M-DM-AUTH

The direct mode procedures for a stand-alone M-DM-AUTH are described in this clause.

NOTE: This clause defines only the procedures specific to the M-DM-AUTH functions. (If the M-DM-AUTH has a handset attached then the equipment is in essence a combined M-DM-AUTH and DM-MS.)

6.5.1.1 General

The principal direct mode function of a stand-alone M-DM-AUTH is to send the authorization presence signal on the managed RF carrier. The methods for the transmission of the authorization presence signal are described in 8.2.1.

As defined in 8.2.1, the M-DM-AUTH shall transmit the presence signal periodically on the managed RF carrier during the time when the RF carrier is perceived by the M-DM-AUTH as being free. In order to do this, the M-DM-AUTH needs to be able to determine when the RF carrier is free. It therefore needs to perform channel surveillance procedures.

6.5.1.2 Basic capabilities of stand-alone M-DM-AUTH's physical layer

The M-DM-AUTH shall be capable of either transmitting or receiving (i.e. simplex mode operation) on a single DM RF carrier.

The M-DM-AUTH shall be capable of switching between DM transmit and receive within one timeslot duration, approximately 14 ms.

The M-DM-AUTH shall be capable of transmitting in all four timeslots of at least two consecutive frames.

In addition, if the M-DM-AUTH is operating in mode 1 as defined in 6.1 (i.e. if it is not performing managed out-of-range or dual mode operation), then it shall be capable of switching between the managed RF carrier and the V+D main carrier within 0,5 of a timeslot duration (approximately 7 ms).

If the M-DM-AUTH is operating in mode 1, then it shall not permit the use of frequency efficient mode on the managed RF carrier unless it is capable of switching between the managed RF carrier and the V+D main carrier between contiguous timeslots (i.e. within the guard + ramping + PA linearization time) or has requested energy economy mode or dual watch operation using EG4, EG5, EG6 or EG7.

NOTE: The above restriction is needed in order that the M-DM-AUTH can receive DSBs on both channel A and channel B. Otherwise, when only one of the DM channels is busy, the M-DM-AUTH could perceive that the RF carrier is free and therefore transmit its presence signal (causing possible interference to the call).

6.5.1.3 State definitions for stand-alone M-DM-AUTH

The states for a stand-alone M-DM-AUTH depend only upon the current state of the channel. They are as follows:

1) Channel free

The M-DM-AUTH is currently operating on a channel which is perceived as free i.e. no DMO activity is detected on the channel (other than possible receipt of presence signals indicating that the channel is free).

2) Channel busy (i.e. occupied or reserved)

a) Channel occupied

The M-DM-AUTH is currently operating on a channel which is perceived as being occupied i.e. signalling or traffic information is detected on the channel.

b) Channel reserved

The M-DM-AUTH is currently operating on a channel which is perceived as being reserved i.e. channel reservation signalling is detected on the channel.

6.5.1.4 Channel surveillance procedures for stand-alone M-DM-AUTH

The M-DM-AUTH shall conduct the following channel surveillance procedures in order to determine the current DM channel state. The M-DM-AUTH needs to know the channel state before sending the presence signal.

The presence signal need not be used as the timing reference when an M-DM-MS makes a call. Therefore, when monitoring the channel, the M-DM-AUTH should be prepared to receive DSBs at any time.

If the M-DM-AUTH is operating in mode 1 as defined in 6.1 (i.e. if it is not performing managed out-of-range or dual mode operation) then it shall use the channel surveillance procedures defined in 6.5.1.4.1 and 6.5.1.4.2. If the M-DM-AUTH is operating in mode 2 (i.e. if it is performing managed out-of-range or dual mode operation) then it shall use the channel surveillance procedures defined either in 6.5.1.4.1 and 6.5.1.4.2 or in 6.5.1.4.3.

6.5.1.4.1 Initial determination of DM channel state by stand-alone M-DM-AUTH

An M-DM-AUTH which has just been switched into direct mode operation or following initial power-up in direct mode shall conduct continuous monitoring of the managed RF carrier in order to detect any DSBs present. The M-DM-AUTH shall conduct the procedure to determine the initial state of the RF carrier over a period of at least 19 frame durations or until DSBs are detected. If DSBs are detected, other than presence signals indicating that the channel is free, then the M-DM-AUTH shall regard the channel as busy (i.e. occupied or reserved as appropriate); see note 1. Otherwise the M-DM-AUTH may regard the channel as free.

Continuous monitoring of the RF carrier means that the M-DM-AUTH shall sample the RF carrier at a sufficient rate so that the presence of a DSB may be determined.

NOTE 1: The M-DM-AUTH is permitted to implement a signal strength threshold where it need not regard the channel as busy as a result of receiving DSBs below that threshold. For example, the signal strength threshold may be set to the receiver sensitivity level.

NOTE 2: If use of frequency efficient mode is permitted by the M-DM-AUTH then the current state of both channel A and channel B should be determined.

6.5.1.4.2 Channel surveillance procedures after initial determination of channel state

Following initial channel determination, the M-DM-AUTH shall conduct channel surveillance on the managed RF carrier at least once every 7 timeslot durations when the carrier is perceived as being free. Channel surveillance shall consist of continuous monitoring of the RF carrier for a period of at least 2 timeslot durations.

If DSBs are detected, other than presence signals indicating that the channel is free, then the M-DM-AUTH shall change the perceived channel state to busy (i.e. occupied or reserved as appropriate); see note 1.

NOTE 1: The M-DM-AUTH is permitted to implement a signal strength threshold where it need not regard the channel as busy as a result of receiving DSBs below that threshold. For example, the signal strength threshold may be set to the receiver sensitivity level.

In the case of an occupied or reserved channel, the M-DM-AUTH shall monitor as follows:

- If the M-DM-AUTH is operating in mode 1 then:
  - it shall monitor at least timeslot 3 of frames 6, 12 and 18 if this does not conflict with V+D requirements;
  - else it shall monitor at least timeslot 1 of frames 6, 12 and 18 if this does not conflict with V+D requirements;
  - else it shall monitor at least timeslot 2 or timeslot 4 of frames 6, 12 and 18. (This case should not occur if the M-DM-AUTH is able to switch between the managed RF carrier and the V+D main carrier between contiguous timeslots).
- If the M-DM-AUTH is operating in mode 2 then it shall monitor at least timeslot 3 of frames 6, 12 and 18.

The M-DM-AUTH shall change the perceived DM channel state if it detects DSB(s) which indicate that the channel state has changed.

NOTE 2: If the M-DM-AUTH detects DSB(s) which indicate that a DM channel is occupied or reserved then it should assume that the DM channel is still occupied or reserved until it receives DSB(s) which indicate that the channel state has changed or until the appropriate timer expires (i.e. inactivity time-out MT257, reservation time remaining or SDS time remaining). See 6.5.1.5.

If use of frequency efficient mode is permitted by the M-DM-AUTH then the current state of both channel A and channel B should be determined (or see next paragraph). When the M-DM-AUTH perceives that one of the DM channels is occupied or reserved, it should conduct channel surveillance on the other DM channel in at least timeslot 3 (or timeslot 1) of frames 6, 12 and 18 of that other DM channel. (The M-DM-AUTH may use the slot numbering from the occupied or reserved channel to deduce the slot numbering of the other DM channel.)This is in addition to monitoring timeslot 3 (or timeslot 1) of frames 6, 12 and 18 on the occupied or reserved channel.

Alternatively, if the M-DM-AUTH is operating in mode 2, it may regard the RF carrier as busy whenever it perceives that either channel A or channel B is busy. The M-DM-AUTH then monitors at least timeslot 3 of frames 6, 12 and 18 of the busy DM channel. When that DM channel becomes free, the M-DM-AUTH shall continuously monitor the RF carrier for a period of at least 19 frame durations before it may assume that the RF carrier is free.

6.5.1.4.3 Channel surveillance only prior to transmission of presence signal

If the M-DM-AUTH is operating in mode 2 then it may perform the procedure in this clause instead of the procedures in 6.5.1.4.1 and 6.5.1.4.2.

Prior to each sequence of transmissions of the free-carrier authorization presence signal, the M-DM-AUTH shall continuously monitor the managed RF carrier for a period of at least 19 frame durations or until DSBs are detected. If no DSBs are detected (other than presence signals indicating that the channel is free) then the M-DM-AUTH may send the sequence of transmissions of the authorization presence signal. Otherwise the M-DM-AUTH shall refrain from sending its authorization presence signal; see note.

NOTE: The M-DM-AUTH is permitted to implement a signal strength threshold where it need not regard the channel as busy as a result of receiving DSBs below that threshold. For example, the signal strength threshold may be set to the receiver sensitivity level.

6.5.1.5 Criteria for changing state for stand-alone M-DM-AUTH

The M-DM-AUTH shall, based upon the signalling received on the channel, update its state model accordingly. It shall change the current state condition if one of the following occurs:

- its channel surveillance procedures indicate a change from channel free to channel busy;
- the channel is in occupation or reservation, and the M-DM-AUTH receives a message from the current master indicating end of channel occupation or start or end of channel reservation;
- the channel is in occupation, and a time MT257 has elapsed without receipt of a DSB indicating circuit mode occupation (or a DSB where the message type cannot be decrypted);
- the channel is in reservation, and a time corresponding to the "reservation time remaining" element from the last received DM-TX CEASED or DM-RESERVED message has elapsed since receipt of that message;
- the channel is in short data occupation, and a time corresponding to the "SDS time remaining" element from the last received DM-SDS DATA, DM-SDS UDATA or DM-SDS OCCUPIED DSB has elapsed since receipt of that DSB.

6.5.1.6 Linearization by stand-alone M-DM-AUTH

An M-DM-AUTH wishing to transmit the free-channel authorization presence signal may, after determining that the channel is free, linearize its transmitter in the time just prior to transmitting the authorization presence signal.

When the channel is busy, the M-DM-AUTH may linearize its transmitter in those slots available for linearization by idle DM-MSs (as defined in ETS 300 396-3 [3], EN 300 396-4 [4], ETS 300 396-5 [5] and EN 300 396-7 [7]).

6.5.2 Direct mode procedures for M-DM-REP, M-DM-GATE or M-DM-REP/GATE

The direct mode protocol differences for an M-DM-REP, M-DM-GATE or M-DM-REP/GATE relative to the specifications provided in EN 300 396-4 [4], ETS 300 396-5 [5] and EN 300 396-7 [7] are indicated in annexes C, D and E.

6.6 M-DM-AUTH V+D procedures

The appropriate procedures in EN 300 392-2 [8] shall apply, with the differences described in the present document and (for an M-DM-GATE or M-DM-REP/GATE) in ETS 300 396-5 [5].

7 Operation of M-DMO channels

7.1 General procedures

When the managed RF carrier is free, it is available for use by any M-DM-MS which can tune to that RF carrier if the authorization presence signal has indicated one of the M-DM-MS's addresses and the validity time has not expired. An authorization presence signal is a DPRES-SYNC PDU with the "M-DMO flag" set to 1. It is sent by stand-alone M-DM-AUTHs, and by M-DM-REPs, M-DM-GATEs and M-DM-REP/GATEs.

If a channel is a single RF carrier, the authorization presence signal authorizes transmission on that RF carrier.

If a channel is a duplex pair of RF carriers (i.e. for a type 1B M-DM-REP, type 2 M-DM-REP or type 1B M-DM-REP/GATE), the authorization presence signal on the "downlink" RF carrier f_2 shall authorize M-DM-MS transmission on the "uplink" RF carrier f_1 for calls through that M-DM-REP or M-DM-REP/GATE. This applies also in the case of an M-DM-GATE that offers a two-frequency DM-REP function, for those calls that use the two-frequency DM-REP function.

If a channel is a duplex pair of RF carriers then both RF carriers f_1 and f_2 are authorized for direct MS-MS operation.

NOTE: Unless other arrangements have been made, a called M-DM-MS will be receiving only on RF carrier f_2 and so it will be necessary for the calling M-DM-MS to use RF carrier f_2 if it wishes to make a direct MS-MS call. However it is optional for a type 1B M-DM-REP, type 2 M-DM-REP or type 1B M-DM-REP/GATE to monitor the downlink RF carrier f_2 (see note 1 in EN 300 396-4 [4] clause 9.4.2.2.1, the note in EN 300 396-7 [7] clause 9.4.2.2.1 and note 1 in ETS 300 396-5 [5] clause 13.4.2.2.1). If the M-DM-REP or M-DM-REP/GATE does not perform this monitoring, it will not detect a direct MS-MS call on RF carrier f_2 so will continue the transmission of the free-channel presence signal during the call (and may thereby degrade the call). Therefore, unless a M-DM-MS knows, by prior arrangement or equivalent, that it may use another mechanism, it is recommended that:

a) when in range of a type 1B M-DM-REP, type 2 M-DM-REP or type 1B M-DM-REP/GATE, the M-DM-MS should use the M-DM-REP, or the DM-REP function of an M-DM-REP/GATE (if offered), in preference to making a direct MS-MS call;

b) when out of range of the type 1B M-DM-REP, type 2 M-DM-REP or type 1B M-DM-REP/GATE, the M-DM-MS should use RF carrier f_2 if it needs to make a direct MS-MS call. (As always, the M-DM-MS is not permitted to make a call unless it has received an authorization presence signal containing authorization for one of its addresses and the validity time has not expired.)

The authorization presence signal does not restrict the services offered on the M-DMO channel (except that a stand-alone M-DM-AUTH may prohibit the use of frequency efficient direct MS-MS operation). If an M-DM-MS has received authorization to transmit on a managed RF carrier then that authorization permits the M-DM-MS to make any type of call to any address.

7.2 Withdrawing authorization

An M-DM-AUTH may withdraw authorization from M-DM-MS(s) by setting the "number of validity time units" element in the presence signal to zero. If an M-DM-MS receives an authorization presence signal indicating one of its addresses and with the "number of validity time units" element set to zero, it shall obey the procedures specified on expiry of timer T_Valid (as defined in 5.4.1).

7.3 Power class

An M-DM-AUTH shall transmit the maximum allowed power class for authorized M-DM-MSs (element "maximum DM-MS power class" in the authorization presence signal). The authorized M-DM-MSs shall transmit at this power class or lower.

NOTE: This implies a requirement in M-DMO for switchable power classes under protocol control.

8 Authorization presence signal

8.1 M-DMO presence signal

The basic format of the presence signal (the DPRES-SYNC PDU) is common for all DMO variants. An M-DMO authorization presence signal shall be distinguished by setting the "M-DMO flag" element in the presence signal to 1.

The DPRES-SYNC PDU shall be identified by the "SYNC PDU type" element (as defined in ETS 300 396-3 [3], clause 9.3.28). For ease of reading of the present document, the table showing the coding of the "SYNC PDU type" element is copied here as table 2. The "SYNC PDU type" element indicates which of the synchronization PDUs is being sent in the direct mode synchronization burst (DSB).

Table 2: SYNC PDU type element

Information element	Length	Value	Remark
SYNC PDU type	2	00_2	DMAC-SYNC
		01_2	DPRES-SYNC
		10_2	Reserved
		11_2	Reserved

The content of the M-DMO presence signal shall indicate the addresses to be authorized and the validity time of the authorization. When sent on a free RF carrier, all the presence signals in one sequence of transmissions (i.e. MN253, DN253 or DN263 consecutive frames) should contain the same addresses.

8.2 Transmission rules for authorization presence signal

8.2.1 Transmission of presence signal by stand-alone M-DM-AUTH

8.2.1.1 Channel free

8.2.1.1.1 Carrier free

While a stand-alone M-DM-AUTH is authorized to transmit the authorization presence signal, it shall transmit the presence signal - the DPRES-SYNC PDU - periodically on the managed RF carrier during the time when the RF carrier is perceived by the M-DM-AUTH as being free. The presence signal shall be sent in a DSB, in MN253 consecutive frames, using the "frame countdown" element to indicate the number of frames in which the message is being repeated. In each of the signalling frames, the presence signal shall be sent in as many slots as practicable (i.e. wherever it does not conflict with V+D requirements). The minimum interval between each sequence of transmissions shall correspond to time MT253 and the maximum interval shall correspond to time MT254 (see notes 1, 2 and 3). The structure of the presence signal shall be as defined in clause 8.3.1. The M-DM-AUTH shall stop transmission of the free-carrier presence signal if it perceives the channel as becoming busy in a call.

The presence signal authorizes the indicated DM-MSs to use the RF carrier for the indicated validity time.

The presence signal sent by a stand-alone M-DM-AUTH need not be used as the timing reference when an M-DM-MS makes a call on the managed RF carrier.

When an M-DM-AUTH transmits the presence signal on a free carrier, it shall generate the transmission frequency using either a frequency synchronization obtained from the V+D channel (if it is within range of the V+D network) or its own internal frequency reference (if it is performing managed out-of-range or dual mode operation).

NOTE 1: It is recommended that the M-DM-AUTH sends the presence signal at irregular intervals. This is in order to avoid repeated collisions if more than one M-DM-AUTH is sending presence signals on the channel.

If regular transmission of the free-carrier presence signal is required in an application, this may be achieved by setting MT253 equal to MT254.

NOTE 2: Intervals MT253 and MT254 are measured from the start of one sequence of transmissions until the start of the next sequence of transmissions.

NOTE 3: The values of MT253 and MT254 may depend upon the validity time and the number of M-DM-MSs to be authorized. This dependence may be needed in order to apply the transmission procedure in 6.4.

NOTE 4: If the M-DM-AUTH is only able to send the presence signal in two slots in each signalling frame (e.g. if receives the V+D control channel in all frames and cannot switch from V+D receive to DM transmit, and vice versa, between contiguous timeslots), it is recommended that MN253 is set to greater than 2.

NOTE 5: Transmission of a presence signal withdrawing authorization (i.e. with "number of validity time units" set to zero) may take precedence over V+D requirements to transmit and/or receive on the V+D channel.

8.2.1.1.2 One DM channel free

When one DM channel (i.e. channel A or channel B) is occupied or reserved in a direct MS-MS call in frequency efficient mode, a stand-alone M-DM-AUTH may periodically transmit the free-channel presence signal on the unused DM channel (i.e. channel B or channel A respectively). If this option is used, the M-DM-AUTH shall use the timing synchronization derived from the occupied or reserved channel (though with different slot numbering). The M-DM-AUTH designer may choose when the presence signal is sent on the unused DM channel.

NOTE 1: When sending the presence signal on the unused DM channel, the M-DM-AUTH sets element "channel usage" to the unused DM channel value and sets element "channel state" to 00_2 to indicate channel free.

NOTE 2: This procedure may be used if the M-DM-AUTH needs to update the validity time for DM-MSs on the RF carrier. However the presence signal may collide with set-up signalling for a new call on the unused DM channel. Therefore frequent use of this procedure is not recommended.

The M-DM-AUTH shall stop transmission of the free-channel presence signal if it perceives the DM channel as becoming busy in a call.

8.2.1.2 Channel occupied or reserved

A stand-alone M-DM-AUTH does not generally transmit the authorization presence signal during calls. The exception is that, if the M-DM-AUTH needs to withdraw authorization from the master DM-MS during occupation or reservation, it may send the presence signal including one of the master DM-MS's addresses and with the "number of validity time units" element in the presence signal set to zero. It may send this presence signal in any of the random access slots i.e. in slot 3 of frames 2, 5, 8, 11, 14 and 17 and, in reservation, in the slot 3's indicated by the "requests bitmap"; this will cause the master DM-MS to terminate the call (see 7.2 and 5.4.1).

When the M-DM-AUTH sends the presence signal in a random access slot, it should synchronize its transmission frequency to the transmissions received from the master DM-MS (i.e. as for a slave DM-MS).

NOTE: Transmission of a presence signal withdrawing authorization (i.e. with "number of validity time units" set to zero) may take precedence over V+D requirements to transmit and/or receive on the V+D channel.

8.2.2 Transmission of presence signal by M-DM-REP

The procedures for transmission of the M-DM-REP authorization presence signal shall be as defined in clause 9.4.5 of EN 300 396-4 [4] and EN 300 396-7 [7], with the following differences:

i) It is mandatory for the M-DM-REP to transmit the free-channel presence signal periodically when the M-DM-REP is otherwise idle and the carrier is perceived by the M-DM-REP as being free. (This applies only when the M-DM-REP is authorized to transmit the authorization presence signal on the managed carrier.)

NOTE 1: As in EN 300 396-4 [4] and EN 300 396-7 [7], the M-DM-REP stops transmission of the presence signal if it perceives the channel as being busy in a call not involving that M-DM-REP.

NOTE 2: It is not mandatory for a type 2 M-DM-REP to transmit the presence signal on the unused DM channel when the M-DM-REP is active with one DM channel free (see EN 300 396-7 [7], clause 9.4.5.1.2).

ii) As in EN 300 396-4 [4] and EN 300 396-7 [7], the presence signal authorizes the indicated DM-MSs to use the DM-REP for the indicated validity time. It also authorizes the indicated DM-MSs to use direct MS-MS operation on the RF carrier (or on RF carriers f_1 and f_2 if the "two-frequency repeater flag" is set to 1).

iii) If the M-DM-REP needs to withdraw authorization from the master DM-MS during occupation or reservation, it shall set the "number of validity time units" element in the presence signal to zero and include one of the master DM-MS's addresses; this will cause the master DM-MS to terminate the call (see 7.2 and 5.4.1). A presence signal with the "number of validity time units" element set to zero shall take precedence over re-transmission of a random access message on the master link.

NOTE 3: The values of timers DT253 and DT254 may depend upon the validity time and the number of M-DM-MSs to be authorized. This dependence may be needed in order to apply the transmission procedure in 6.4.

8.2.3 Transmission of presence signal by M-DM-GATE or M-DM-REP/GATE

The procedures for transmission of the M-DM-GATE or M-DM-REP/GATE authorization presence signal shall be as defined in clause 13.4.6.2 of ETS 300 396-5 [5], with the following differences:

i) It is mandatory for the gateway to transmit the free-channel presence signal periodically when the gateway is otherwise idle and the carrier is perceived by the gateway as being free. (This applies only when the gateway is authorized to transmit the authorization presence signal on the managed carrier.)

NOTE 1: As in ETS 300 396-5 [5], the gateway stops transmission of the presence signal if it perceives the channel as being busy in a call not involving that gateway.

ii) As in ETS 300 396-5 [5], the presence signal authorizes the indicated DM-MSs to use the gateway for the indicated validity time. It also authorizes the indicated DM-MSs to use direct MS-MS operation on the RF carrier (or on RF carriers f_1 and f_2 if the "two-frequency repeater flag" is present and is set to 1).

iii) The final paragraph of ETS 300 396-5 [5], clause 13.4.6.2.1 (concerning transmission of the presence signal when not within range of the SwMI) does not apply unless the gateway has been authorized for managed out-of-range operation.

iv) If the gateway needs to withdraw authorization from the master DM-MS during occupation, it shall set the "number of validity time units" element in the presence signal to zero and include one of the master DM-MS's addresses; this will cause the master DM-MS to terminate the call (see clauses 7.2 and 5.4.1). For an M-DM-REP/GATE, a presence signal with the "number of validity time units" element set to zero shall take precedence over re-transmission of a random access message on the master link.

NOTE 2: Transmission of a presence signal withdrawing authorization (i.e. with "number of validity time units" set to zero) may take precedence over V+D requirements to transmit and/or receive on the V+D channel.

NOTE 3: The values of timers DT263 and DT264 may depend upon the validity time and the number of M-DM-MSs to be authorized. This dependence may be needed in order to apply the transmission procedure in 6.4.

8.3 DPRES-SYNC PDU

An M-DM-AUTH may be a stand-alone M-DM-AUTH, an M-DM-REP, an M-DM-GATE or an M-DM-REP/GATE. These types are identified within the authorization presence signal by the "communication type" element. The "communication type" element in an authorization presence signal is set to:

- 00_2 when sent by a stand-alone M-DM-AUTH;
- 01_2 when sent by an M-DM-REP;
- 10_2 when sent by an M-DM-GATE;
- 11_2 when sent by an M-DM-REP/GATE.

8.3.1 DPRES-SYNC PDU for stand-alone M-DM-AUTH

8.3.1.1 Definition of DPRES-SYNC PDU for stand-alone M-DM-AUTH

The DPRES-SYNC PDU for a stand-alone M-DM-AUTH shall be as shown in tables 3 and 4.

The DPRES-SYNC PDU is transmitted by the stand-alone M-DM-AUTH using the 60 available bits of the logical channel SCH/S and the 124 available bits of the logical channel SCH/H. Its purpose is to announce the presence of a stand-alone M-DM-AUTH to MSs on the DM channel and to provide authorization to the indicated M-DM-MSs for the indicated validity time.

Table 3: DPRES-SYNC PDU contents in SCH/S for stand-alone M-DM-AUTH

Information element	Length	Type	Remark
System code	4	M	
SYNC PDU type	2	M	Value 01_2 indicates DPRES-SYNC PDU
Communication type	2	M	Set to 00_2 when sent by a stand-alone M-DM-AUTH (see note)
M-DMO flag	1	M	Set to 1 when sent by an M-DM-AUTH
Reserved	3	C	Always present when sent by a stand-alone M-DM-AUTH. Default value = 000_2.
Frequency efficient mode flag	1	C	Always present when sent by a stand-alone M-DM-AUTH
Reserved	7	C	Always present when sent by a stand-alone M-DM-AUTH. Default value = 0000000_2.
Master/slave link flag	1	M	This element has no meaning when sent by a stand-alone M-DM-AUTH. Default value = 0
Channel usage	2	M	
Channel state	2	M	
Slot number	2	M	
Frame number	5	M	
Power class	3	M	
Power control flag	1	M	
Reserved	1	M	Default value = 0
Frame countdown	2	M	
Reserved	15	C	Always present when sent by a stand-alone M-DM-AUTH. Default value = all zeros.
Presence signal dual watch synchronization flag	1	C	Always present when sent by a stand-alone M-DM-AUTH
Reserved	5	C	Always present when sent by a stand-alone M-DM-AUTH. Default value = 00000_2
NOTE: Following the communication type element, the following elements in the DPRES-SYNC PDU are shown in this table only if relevant to the presence signal sent by a stand-alone M-DM-AUTH i.e. if communication type = 00_2. Similarly, conditions for the presence of the following elements are shown only for communication type 00_2.			

Table 4: DPRES-SYNC PDU contents in SCH/H for stand-alone M-DM-AUTH

Information element	Length	Type	Remark
Device address	10	C	Always present when sent by a stand-alone M-DM-AUTH
MNI of controlling SwMI	24	C	Always present when sent by a stand-alone M-DM-AUTH
Validity time unit	2	M	
Number of validity time units	6	C	Included if validity time unit $\neq 11_2$
Reserved	6	C	Included if validity time unit = 11_2. Default value = 000000_2
Maximum DM-MS power class	3	M	
Reserved	1	M	Default value = 0
Usage restriction type (URT)	4	M	
Addressing for URT = 0010_2	24	C	Included if URT = 0010_2. This element contains an MNI
Addressing for URT = 0011_2	48	C	Included if URT = 0011_2. This element contains one TSI
Addressing for URT = 0100_2 or 0101_2	72	C	Included if URT = 0100_2 or 0101_2. This element contains one TSI and one SSI
Addressing for URT = 0110_2	72	C	Included if URT = 0110_2. This element contains three SSIs
Proprietary	72	C	Included if URT = 0111_2. The proprietary element is available for proprietary uses. Its use and structure are not defined in the present document
Reserved	72	C	Included if URT = 0000_2 or 0001_2. Default value = all zeros
Reserved	48	C	Included if URT = 0010_2. Default value = all zeros
Reserved	24	C	Included if URT = 0011_2. Default value = all zeros
Reserved	2	C	Always present when sent by a stand-alone M-DM-AUTH. Default value = 00_2

8.3.1.2 DPRES-SYNC element definitions for stand-alone M-DM-AUTH

NOTE: The elements not specified in this clause are defined in ETS 300 396-3 [3], clause 9.3, except the "power class" and "power control flag" elements which are defined in ETS 300 396-3 [3], clause 9.6.

8.3.1.2.1 Addressing for URT = 0010_2

The addressing for URT = 0010_2 element contains a single 24-bit mobile network identity (MNI). DM-MSs with this MNI are authorized to use the RF carrier for the indicated validity time.

8.3.1.2.2 Addressing for URT = 0011_2

The addressing for URT = 0011_2 element contains a single 48-bit TSI. This is the TSI of a group of DM-MSs (for a group TSI) or an individual DM-MS (for an individual TSI) that is authorized to use the RF carrier. DM-MSs with an address corresponding to this TSI (either an individual or group address) are authorized to use the RF carrier for the indicated validity time.

NOTE: The 48-bit TSI comprises a 24-bit MNI followed by a 24-bit SSI.

8.3.1.2.3 Addressing for URT = 0100_2 or 0101_2

The addressing for URT = 0100_2 or 0101_2 element contains one 48-bit TSI and one 24-bit SSI.

The first TSI shall be generated by receiving DM-MSs using the MNI for SSI 1 element and SSI 1.

Then a TSI shall be generated from SSI 2 as follows:

- for URT = 0100_2 a TSI shall be generated from SSI 2 using the MNI for SSI 1;
- for URT = 0101_2 a TSI shall be generated from SSI 2 using the "MNI of controlling SwMI" element from the SCH/H block.

DM-MSs with an address corresponding to one of these two TSIs (either an individual or group address) are authorized to use the RF carrier for the indicated validity time.

Information element	Length	Value	Remark
MNI for SSI 1	24		
SSI 1	24		
SSI 2	24		

8.3.1.2.4 Addressing for URT = 0110_2

The addressing for URT = 0110_2 element contains three 24-bit SSIs. For each SSI, a TSI shall be generated by receiving DM-MSs using the "MNI of controlling SwMI" element from the SCH/H block. DM-MSs with an address corresponding to one of these three TSIs (either an individual or group address) are authorized to use the RF carrier for the indicated validity time.

Information element	Length	Value	Remark
SSI 1	24		
SSI 2	24		
SSI 3	24		

8.3.1.2.5 Channel state

The channel state element indicates the current state of the channel on which the presence signal is being sent, as defined by the channel usage element.

When the channel usage element is set to 00_2 the channel state element applies to the complete carrier. When the channel usage element is set to 01_2 or 10_2 the channel state element applies only to the indicated DM channel (i.e. channel A or channel B).

NOTE: A stand-alone M-DM-AUTH normally sends the presence signal only when the channel is free (i.e. it normally sets the channel state element to 00_2). The exception is that it may send the presence signal in the random access slots if it needs to withdraw authorization from the master MS; see 8.2.1.2.

Information element	Length	Value	Remark
Channel state	2	00_2	Channel free
		01_2	Channel in occupation
		10_2	Channel in reservation
		11_2	Used in ETS 300 396-5 [5]

8.3.1.2.6 Channel usage

The channel usage element indicates the DM channel on which the presence signal is being sent (i.e. channel A or channel B). It may also indicate that the presence signal applies to the complete carrier.

NOTE: When an M-DM-MS receives an authorizing presence signal, the authorization applies to the complete RF carrier irrespective of the setting of the "channel usage" element in the DPRES-SYNC PDU.

Information element	Length	Value	Remark
Channel usage	2	00_2	Presence signal applies to the carrier i.e. -channel A active in normal mode; or -presence signal sent on a free carrier
		01_2	Channel A, frequency efficient mode
		10_2	Channel B
		11_2	Reserved

8.3.1.2.7 Device address

The device address element identifies the stand-alone M-DM-AUTH unit to the M-DMO users.

Information element	Length	Value	Remark
Device address	10	Any	M-DM-AUTH address

8.3.1.2.8 Frequency efficient mode flag

The frequency efficient mode flag indicates whether frequency efficient direct MS-MS operation may be used by a DM-MS whose use of the RF carrier is authorized by this PDU.

Information element	Length	Value	Remark
Frequency efficient mode flag	1	0	Frequency efficient mode not permitted i.e. DM-MSs may use normal mode only
		1	Frequency efficient mode permitted i.e. DM-MSs may use normal mode or frequency efficient mode

8.3.1.2.9 Maximum DM-MS power class

The maximum DM-MS power class element specifies the maximum power class that may be used by a DM-MS whose use of the RF carrier is authorized by this PDU. When transmitting on the RF carrier, the authorized DM-MS shall transmit at this power class or lower.

NOTE: This implies a requirement for switchable power classes under protocol control.

Information element	Length	Value	Remark
Maximum DM-MS power class	3	000_2	Null value (i.e. power not defined)
		001_2	Power class 1
		010_2	Power class 2
		011_2	Power class 3
		100_2	Power class 4
		101_2	Power class 5
		110_2	Reserved
		111_2	Reserved

8.3.1.2.10 M-DMO flag

The M-DMO flag indicates whether the presence signal relates to managed direct mode operation. An M-DM-AUTH sets the M-DMO flag to 1.

Information element	Length	Value	Remark
M-DMO flag	1	0	Not a managed direct mode presence signal
		1	Managed direct mode presence signal

8.3.1.2.11 MNI of controlling SwMI

The MNI of controlling SwMI element contains the mobile network identity of the SwMI from which the M-DM-AUTH obtained its authorization.

8.3.1.2.12 Number of validity time units

The number of validity time units element indicates the validity time for use of the RF carrier by a DM-MS whose use of the RF carrier is authorized by this PDU.

The DM-MS shall use the value from the most recently received PDU authorizing it to use the RF carrier. This shall apply even if it results in the DM-MS reducing its validity time. If the number of validity time units is set to 0 then this withdraws authorization for the indicated DM-MS(s) to transmit on the RF carrier.

NOTE: A DM-MS's validity time is not affected by receipt of a presence signal if it is not addressed by the usage restrictions in that presence signal.

Information element	Length	Value	Remark
Number of validity time units	6	any	Multiplies the validity time unit

8.3.1.2.13 Presence signal dual watch synchronization flag

The presence signal dual watch synchronization flag indicates whether the stand-alone M-DM-AUTH considers that this presence signal is being sent using the dual watch synchronization appropriate for direct MS-MS operation. The M-DM-AUTH may know the dual watch synchronization if it is performing dual watch itself, or it may have deduced this from previous signalling sent by DM-MSs or by other means.

The presence signal dual watch synchronization flag may indicate only an assumption by the M-DM-AUTH. The M-DM-AUTH may set the flag to 1 even if it has only an approximate view of the dual watch synchronization or based on information that may not necessarily be accurate.

The presence signal dual watch synchronization flag is provided only for guidance to DM-MSs, particularly to those DM-MSs that are not performing dual watch. When a non-dual-watching DM-MS makes a call on a free carrier, it may use the presence signal dual watch synchronization flag to decide whether to choose a DM timing reference based on the timing defined by the presence signal.

Information element	Length	Value	Remark
Presence signal dual watch synchronization flag	1	0	No information provided about the dual watch synchronization
		1	M-DM-AUTH considers that this presence signal is sent using the dual watch synchronization

8.3.1.2.14 Usage restriction type (URT)

The usage restriction type element indicates the type of restrictions on which DM-MSs are authorized to use the RF carrier.

Information element	Length	Value	Remark
Usage restriction type (URT)	4	0000_2	No restrictions (i.e. open)
		0001_2	Restricted by prior arrangement (i.e. use of this RF carrier is available only by prior arrangement)
		0010_2	Restricted to single MNI
		0011_2	Restricted to single address (TSI)
		0100_2	Restricted to 2 addresses (TSI + SSI)
		0101_2	Restricted to 2 addresses (TSI + SSI)
		0110_2	Restricted to 3 addresses (SSIs)
		0111_2	Available for proprietary uses
		others	Reserved

8.3.1.2.15 Validity time unit

The validity time unit element indicates the time unit used for the validity time.

The DM-MS shall use the validity time from the most recently received PDU authorizing it to use the RF carrier. This shall apply even if it results in the DM-MS reducing its validity time.

NOTE: A DM-MS's validity time is not affected by receipt of a presence signal if it is not addressed by the usage restrictions in that presence signal.

Information element	Length	Value	Remark
Validity time unit	2	00_2	Multiframe
		01_2	60 multiframes
		10_2	3600 multiframes
		11_2	Not used in M-DMO

8.3.2 DPRES-SYNC PDU for M-DM-REP

The authorization presence signal (DPRES-SYNC PDU) for an M-DM-REP shall be as defined in clause 10 of EN 300 396-4 [4] and EN 300 396-7 [7], with the following differences:

i) The M-DM-REP shall set the "M-DMO flag" element to 1.

ii) The M-DM-REP shall not set the "validity time unit" element to 11_2.

iii) As in EN 300 396-4 [4] and EN 300 396-7 [7], the authorization presence signal authorizes the indicated DM-MSs to initiate transactions through the M-DM-REP for the indicated validity time.

In M-DMO, the M-DM-REP authorization presence signal also authorizes direct MS-MS operation by the indicated DM-MSs for the indicated validity time. If the "two-frequency repeater flag" element is set to 0 then this authorization applies only on the RF carrier on which the presence signal is sent; if the "two-frequency repeater flag" element is set to 1 then the authorization applies on both RF carriers f_1 and f_2.

iv) If the "number of validity time units" element is set to 0 then this withdraws authorization to transmit on the RF carrier(s) for the indicated DM-MSs. This withdrawal applies to any type of direct mode call, not only to calls through the M-DM-REP.

v) The "maximum DM-MS power class" element specifies the maximum power class that may be used by a DM-MS whose transmission is authorized by this PDU. When transmitting in any type of direct mode call (including direct MS-MS calls), the authorized DM-MS shall transmit at this power class or lower.

8.3.3 DPRES-SYNC PDU for M-DM-GATE or M-DM-REP/GATE

The authorization presence signal (DPRES-SYNC PDU) for an M-DM-GATE or M-DM-REP/GATE shall be as defined in clause 14 of ETS 300 396-5 [5], with the following differences:

i) The M-DM-GATE or M-DM-REP/GATE shall set the "M-DMO flag" element to 1.

ii) The M-DM-GATE or M-DM-REP/GATE shall not set the "validity time unit" element to 11_2.

iii) As in ETS 300 396-5 [5], the authorization presence signal authorizes the indicated DM-MSs to initiate transactions through the M-DM-GATE or M-DM-REP/GATE for the indicated validity time.

In M-DMO, the M-DM-GATE or M-DM-REP/GATE authorization presence signal also authorizes direct MS-MS operation by the indicated DM-MSs for the indicated validity time. If the "two-frequency repeater flag" element is not present or is set to 0 then this authorization applies only on the RF carrier on which the presence signal is sent; if the "two-frequency repeater flag" element is present and is set to 1 then the authorization applies on both RF carriers f_1 and f_2.

iv) If the "number of validity time units" element is set to 0 then this withdraws authorization to transmit on the RF carrier(s) for the indicated DM-MSs. This withdrawal applies to any type of direct mode call, not only to calls through the M-DM-GATE or M-DM-REP/GATE.

v) The "maximum DM-MS power class" element specifies the maximum power class that may be used by a DM-MS whose transmission is authorized by this PDU. When transmitting in any type of direct mode call (including direct MS-MS calls), the authorized DM-MS shall transmit at this power class or lower.

Annex A (normative): Timers and constants specific to M-DMO

This annex lists the timers and constants specific to M-DMO. These timers and constants are in addition to the appropriate timers and constants listed in annex A of ETS 300 396-3 [3], EN 300 396-4 [4], ETS 300 396-5 [5] or EN 300 396-7 [7].

A.1 Timers and constants in M-DM-MS

MT201 Time when loss of link to SwMI is assumed by a dual watch V+D authorized M-DM-MS.

A.2 Timers and constants in M-DM-AUTH

MT251	Time when loss of link to SwMI is assumed by an M-DM-AUTH that operates in-range.
MT253	Minimum interval between sequences of transmissions of the authorization presence signal on a free carrier by a stand-alone M-DM-AUTH. Value may depend upon the validity time and the number of M-DM-MSs to be authorized.
MT254	Maximum interval between sequences of transmissions of the authorization presence signal on a free carrier by a stand-alone M-DM-AUTH. Value may depend upon the validity time and the number of M-DM-MSs to be authorized.
MT257	Inactivity time-out for stand-alone M-DM-AUTH in channel occupation. Value should be at least 108 frame durations if the M-DM-AUTH is operating within range of the SwMI and permits frequency efficient mode.
MN253	Number of frames in which a stand-alone M-DM-AUTH transmits the free-carrier presence signal. M-DM-AUTH designer choice from the range 2 to 4.

Annex B (normative): Differences for direct MS-MS operation

When an M-DM-MS is using direct MS-MS operation, ETS 300 396-2 [2] and ETS 300 396-3 [3] shall apply with the following differences:

i) The M-DM-MS shall not transmit on the managed RF carrier unless it has received an authorization presence signal indicating one of its addresses and the validity time has not expired.

When the M-DM-MS has received a presence signal authorizing it to transmit, it is still required to obey the channel surveillance procedures on the managed RF carrier - as defined in ETS 300 396-3 [3], clause 8.4.2; i.e. the M-DM-MS shall not transmit unless permitted by the specifications in ETS 300 396-3 [3].

The M-DM-MS shall not change the perceived channel state as a result of receiving an authorization presence signal indicating that the channel is free. (I.e. the M-DM-MS uses its own perception of the channel state when it perceives the channel as being occupied or reserved.)

ii) The M-DM-MS shall inhibit transmission if the validity time expires or if it receives an authorization presence signal indicating one of its addresses and with the "number of validity time units" element set to zero. In both of these cases, the M-DM-MS shall obey the procedures specified on expiry of timer T_Valid, as defined in 5.4.1.

iii) When transmitting on the managed RF carrier, the M-DM-MS shall transmit at a power class less than or equal to the power class indicated in the "maximum DM-MS power class" element from the most recently received DPRES-SYNC PDU that authorized the M-DM-MS to use the RF carrier.

iv) If the procedures in the first two paragraphs of ETS 300 396-3 [3], clause 8.4.2.2.3 would result in the DM-MS transmitting call set-up signalling during the transmission of a multiple-frame free-channel presence signal then the DM-MS should wait until the end of the repetitions of the presence signal. It may then transmit its call set-up signalling immediately (or may choose to observe the channel for a random period before transmitting).

In the third and fourth paragraphs of ETS 300 396-3 [3], clause 8.4.2.2.3, the DM-MS should not regard a free-channel presence signal as "traffic or signalling activity" causing the call set-up to be abandoned. However, if the defined procedures would result in the DM-MS transmitting call set-up signalling during the transmission of a multiple-frame free-channel presence signal, the DM-MS should wait until the end of the repetitions of the presence signal and then choose a new value of integer R randomly from the specified range and plan to start sending its message after R frame durations.

v) The M-DM-MS shall not use frequency efficient mode on the managed RF carrier if the DPRES-SYNC PDUthat authorized the M-DM-MS to use the RF carrier was sent by a stand-alone M-DM-AUTH and the M-DM-AUTH did not permit frequency efficient mode (i.e. "communication type" element set to 00_2 and "frequency efficient mode flag" set to 0).

NOTE 1: The M-DM-MS may use frequency efficient mode on the managed RF carrier if the DPRES-SYNC PDU that authorized the M-DM-MS to use the RF carrier was sent by a stand-alone M-DM-AUTH and the "frequency efficient mode flag" was set to 1.

The M-DM-MS may use frequency efficient mode for direct MS-MS calls on the managed RF carrier if the DPRES-SYNC PDU that authorized the M-DM-MS to use the RF carrier was sent by an M-DM-REP.

The M-DM-MS is not precluded from using frequency efficient mode for direct MS-MS calls on the managed RF carrier if the DPRES-SYNC PDU that authorized the M-DM-MS to use the RF carrier was sent by an M-DM-GATE or M-DM-REP/GATE. Note however that there is no procedure for pre-empting a frequency efficient direct MS-MS call in order to make a normal mode call (such as a call through a gateway) so use of this option while within range of the gateway will stop gateway operation until the RF carrier is completely free.

vi) Whenever the M-DM-MS is using normal mode (i.e. element "A/B channel usage" set to 00_2), the following differences shall apply:

a) Whenever the DM-MS is sending a DM-SETUP message, it shall transmit the message in all four timeslots in each of the signalling frames.

b) Whenever the DM-MS is sending a DM-SETUP PRES message, it shall transmit the message in all four timeslots in each of the signalling frames except the final signalling frame where timeslot 4 shall not be used.

c) Whenever the DM-MS is sending a DM-SDS UDATA or DM-SDS DATA message starting with DSBs, it shall transmit the DSB in all four timeslots in each of the set-up signalling frames except that, for a non-fragmented DM-SDS DATA message, timeslot 4 of the final set-up signalling frame shall not be used.

d) When master in circuit mode occupation, the DM-MS should send the DM-OCCUPIED message in timeslots 2 and 4 in every frame 18, and may send the DM-OCCUPIED message in timeslots 2 and 4 of frames 6 and 12. (This is in addition to the usual transmissions in timeslot 3 of frames 6 and 12 and timeslots 1 and 3 of frame 18.)

e) During the transmission of SCH/F for a DM-SDS DATA or DM-SDS UDATA message, the master DM-MS may send the DM-SDS OCCUPIED message in timeslots 2 and 4 of frames 6, 12 and 18 (in addition to timeslot 3 of frames 6 and 12 and timeslots 1 and 3 of frame 18.)

f) When master in reservation, the DM-MS should send the DM-RESERVED message in timeslots 2 and 4 in every frame 18, and may send the DM-RESERVED message in timeslots 2 and 4 of frames 6 and 12. (This is in addition to the usual transmissions in timeslots 1 and 3 of frames 6, 12 and 18.)

g) When the DM-MS is sending the DM-RELEASE message, it should transmit the message in timeslots 2 and 4 in each of the signalling frames (in addition to timeslots 1 and 3), unless it is releasing the channel because it is accepting a pre-emption request.

h) When the DM-MS is announcing a timing change, it should transmit the message in timeslots 2 and 4 in each of the signalling frames (in addition to timeslots 1 and 3).

When transmitting in timeslot 2 or 4, the DM-MS shall use a DSB.

NOTE 2: The additional transmissions of set-up messages and occupation and reservation messages are needed because, for some types of stand-alone M-DM-AUTH and some channel timings, timeslot 2 or 4 may be the only position in which the M-DM-AUTH is able to receive DSBs during the call. The M-DM-AUTH needs to receive some DSBs during the call; otherwise the M-DM-AUTH may perceive that the RF carrier is free and therefore transmit its presence signal (causing possible interference to the call).

NOTE 3: It is expected that differences a), b) and c) will be included within future editions of ETS 300 396-3 [3] .

vii) When the M-DM-MS is a channel B master in circuit mode occupation, it shall transmit the DM-OCCUPIED message in timeslot 1 of frame 18 at least once every 3 multiframes.

NOTE 4: These transmissions in slot 1 are needed because, for some channel timings, they may be the only positions in which the M-DM-AUTH is able to receive a channel B DSB during circuit mode occupation. The M-DM-AUTH needs to receive some channel B DSBs during the call; otherwise, when channel A is unused, the M-DM-AUTH may perceive that the RF carrier is free and therefore transmit its presence signal (causing possible interference to the call).

NOTE 5: It is expected that difference vii) may be included within future editions of ETS 300 396-3 [3] .

viii) When the M-DM-MS is a master, it may receive the authorization presence signal in the slots where it is required to monitor for random access requests (see ETS 300 396-3 [3], clause 8.5.7.2.2). If this occurs, and the presence signal indicates one of the M-DM-MS's addresses and the "number of validity time units" element is set to zero, the M-DM-MS shall obey the procedures specified on expiry of timer T_Valid, as defined in 5.4.1.

ix) In addition to the definition in ETS 300 396-3 [3], clause 9.6.3A, a DM-MS making a new call may set the dual watch synchronization flag to 1 if it is using a DM timing reference based on the timing defined by a stand-alone M-DM-AUTH presence signal in which the presence signal dual watch synchronization flag was set to 1.

When an M-DM-MS transmits using direct MS-MS operation, it generates the transmission frequency using the frequency synchronization methods defined in ETS 300 396-2 [2], clause 7, without amendment. Thus the M-DM-MS does not use the frequency synchronization from the M-DM-AUTH's presence signal. (This contrasts with the method used when making calls through a repeater or gateway.)

Annex C (normative): Differences for type 1 repeater operation

C.1 Differences for M-DM-MS

When an M-DM-MS is operating with a type 1 M-DM-REP, the procedures defined for a DM-MS in EN 300 396-4 [4] shall apply with the following differences:

i) The M-DM-MS shall not transmit on the managed RF carrier unless it has received an authorization presence signal indicating one of its addresses and the validity time has not expired.

NOTE: For operation with a type 1A M-DM-REP, the M-DM-REP's authorization presence signal authorizes transmission by the M-DM-MS on that RF carrier. For operation with a type 1B M-DM-REP, the M-DM-REP's authorization presence signal on the downlink RF carrier f_2 authorizes transmission by the M-DM-MS on the uplink RF carrier f_1 for calls through that M-DM-REP.

When the M-DM-MS has received a presence signal authorizing it to transmit, it is still required to obey the channel surveillance procedures - as defined in EN 300 396-4 [4], clause 8.4.2; i.e. the M-DM-MS shall not transmit unless permitted by the specifications in EN 300 396-4 [4].

ii) The M-DM-MS shall inhibit transmission if the validity time expires or if it receives an authorization presence signal indicating one of its addresses and with the "number of validity time units" element set to zero. In both of these cases, the M-DM-MS shall obey the procedures specified on expiry of timer T_Valid, as defined in 5.4.1.

If an M-DM-MS makes a direct MS-MS call on a managed RF carrier authorized by an M-DM-REP, it shall use the procedures defined in annex B.

C.2 Differences for M-DM-REP

The direct mode procedures for a type 1 M-DM-REP shall be as defined for a type 1 DM-REP in EN 300 396-4 [4], with the following differences:

i) Clauses 6.1 and 6.3 of the present document shall apply.

The M-DM-REP shall not accept call set-ups from DM-MSs at times when it is not permitted to transmit the authorization presence signal according to clauses 6.1 and 6.3 of the present document.

When the M-DM-REP is authorized to transmit on the managed RF carrier, it is still required to obey the channel surveillance procedures - as defined in EN 300 396-4 [4], clause 9.4.2; i.e. the M-DM-REP shall not transmit unless permitted by the specifications in EN 300 396-4 [4].

ii) When transmitting on the managed RF carrier, the M-DM-REP shall transmit at a power class less than or equal to the power class indicated by the authorizing SwMI or management station when it authorized the M-DM-REP to operate on the RF carrier.

iii) Clause 8.2.2 of the present document shall apply.

iv) Clause 8.3.2 of the present document shall apply.

Annex D (Normative): Differences for gateway operation

D.1 Differences for M-DM-MS

When an M-DM-MS is operating with an M-DM-GATE or M-DM-REP/GATE, the procedures defined for a DM-MS in ETS 300 396-5 [5] shall apply with the following differences:

i) The M-DM-MS shall not transmit on the managed RF carrier unless it has received an authorization presence signal indicating one of its addresses and the validity time has not expired.

NOTE: For operation with a DM-GATE or type 1A M-DM-REP/GATE, the authorization presence signal authorizes transmission by the M-DM-MS on that RF carrier. For operation with a type 1B M-DM-REP/GATE, the authorization presence signal on the downlink RF carrier f_2 authorizes transmission by the M-DM-MS on the uplink RF carrier f_1 for calls through that M-DM-REP/GATE.

When the M-DM-MS has received a presence signal authorizing it to transmit, it is still required to obey the channel surveillance procedures - as defined in ETS 300 396-5 [5], clause 8.4.2; i.e. the M-DM-MS shall not transmit unless permitted by the specifications in ETS 300 396-5 [5].

ii) The M-DM-MS shall inhibit transmission if the validity time expires or if it receives an authorization presence signal indicating one of its addresses and with the "number of validity time units" element set to zero. In both of these cases, the M-DM-MS shall obey the procedures specified on expiry of timer T_Valid, as defined in 5.4.1.

If an M-DM-MS makes a direct MS-MS call on a managed RF carrier authorized by an M-DM-GATE or M-DM-REP/GATE, it shall use the procedures defined in annex B.

D.2 Differences for M-DM-GATE or M-DM-REP/GATE

The direct mode procedures for an M-DM-GATE or M-DM-REP/GATE shall be as defined for a DM-GATE or DM-REP/GATE in ETS 300 396-5 [5], with the following differences:

i) Clause 6.1 and clause 6.2 (or 6.3) of the present document shall apply.

The gateway shall not transmit any PDUs on the managed RF carrier at times when it is not permitted to transmit the authorization presence signal according to clause 6.1 and clause 6.2 (or 6.3) of the present document.

When the gateway is authorized to transmit on the managed RF carrier, it is still required to obey the channel surveillance procedures - as defined in ETS 300 396-5 [5], clause 9.4.2; i.e. the gateway shall not transmit unless permitted by the specifications in ETS 300 396-5 [5].

ii) When transmitting on the managed RF carrier, the gateway shall transmit at a power class less than or equal to the power class indicated by the authorizing SwMI or management station when it authorized the gateway to operate on the RF carrier.

iii) Clause 8.2.3 of the present document shall apply.

iv) Clause 8.3.3 of the present document shall apply.

v) The value of DT267 - the inactivity time-out for an idle gateway in channel occupation - shall be at least 108 frame durations (6 multiframe durations).

When a gateway transmits on the managed RF carrier, it shall generate the transmission frequency using the frequency synchronization obtained from the V+D channel if it is within range of the V+D network, or its own internal frequency reference if it is performing managed out-of-range operation.

Annex E (Normative): Differences for type 2 repeater operation

E.1 Differences for M-DM-MS

When an M-DM-MS is operating with a type 2 M-DM-REP, the procedures defined for a DM-MS in EN 300 396-7 [7] shall apply with the following differences:

i) The M-DM-MS shall not transmit on the managed RF carrier unless it has received an authorization presence signal indicating one of its addresses and the validity time has not expired.

NOTE: The M-DM-REP's authorization presence signal on the downlink RF carrier f_2 authorizes transmission by the M-DM-MS on the uplink RF carrier f_1 for calls through that M-DM-REP.

When the M-DM-MS has received a presence signal authorizing it to transmit, it is still required to obey the channel surveillance procedures - as defined in EN 300 396-7 [7], clause 8.4.2; i.e. the M-DM-MS shall not transmit unless permitted by the specifications in EN 300 396-7 [7].

ii) The M-DM-MS shall inhibit transmission if the validity time expires or if it receives an authorization presence signal indicating one of its addresses and with the "number of validity time units" element set to zero. In both of these cases, the M-DM-MS shall obey the procedures specified on expiry of timer T_Valid, as defined in 5.4.1.

If an M-DM-MS makes a direct MS-MS call on a managed RF carrier authorized by an M-DM-REP, it shall use the procedures defined in annex B.

E.2 Differences for M-DM-REP

The direct mode procedures for a type 2 M-DM-REP shall be as defined for a type 2 DM-REP in EN 300 396-7 [7], with the following differences:

i) Clauses 6.1 and 6.3 of the present document shall apply.

The M-DM-REP shall not accept call set-ups from DM-MSs at times when it is not permitted to transmit the authorization presence signal according to clauses 6.1 and 6.3 of the present document.

When the M-DM-REP is authorized to transmit on the managed RF carrier, it is still required to obey the channel surveillance procedures - as defined in EN 300 396-7 [7], clause 9.4.2; i.e. the M-DM-REP shall not transmit unless permitted by the specifications in EN 300 396-7 [7].

ii) When transmitting on the managed RF carrier, the M-DM-REP shall transmit at a power class less than or equal to the power class indicated by the authorizing SwMI or management station when it authorized the M-DM-REP to operate on the RF carrier.

iii) Clause 8.2.2 of the present document shall apply.

iv) Clause 8.3.2 of the present document shall apply.

Annex F (normative): Differences for V+D authorized M-DM-MS

The direct mode procedures for a V+D authorized M-DM-MS shall be as defined for a DM-MS in ETS 300 396-2 [2] and ETS 300 396-3 [3], EN 300 396-4 [4], ETS 300 396-5 [5] or EN 300 396-7 [7], with the following differences:

i) The procedures described in clauses 5.3 and 5.4.2 of the present document for enabling and inhibiting transmission on the managed RF carrier shall apply.

   When the M-DM-MS is authorized to transmit on the managed RF carrier, it is still required to obey the channel surveillance procedures on the managed RF carrier - as defined in clause 8.4.2 of ETS 300 396-3 [3] , EN 300 396-4 [4] , ETS 300 396-5 [5] or EN 300 396-7 [7]; i.e. the M-DM-MS shall not transmit unless permitted by the specifications in ETS 300 396-3 [3] , EN 300 396-4 [4] , ETS 300 396-5 [5] or EN 300 396-7 [7] .

ii) When transmitting on the managed RF carrier, the M-DM-MS shall transmit at a power class less than or equal to the power class indicated by the authorizing SwMI or management station when it authorized the M-DM-MS to use the RF carrier.

History

Document history			
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