# IEEE P802.15
# Wireless Personal Area Networks

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| Project | IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) | |
| Title | **TG3 Draft D08 to D09 changes** | |
| Date Submitted | [1 December, 2001] | |
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| Abstract | [This document is contains the issues and resolutions developed by the TG3 subcommittee at the Rolling Meadows ad-hoc meeting. It also serves to document the addtions made to the draft standard D08 to produce D09.] | |
| Purpose | [To provide a record of the resolutions of TG3 and the changes to the draft standard D08 to make D09.] | |
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# 1. Changes from "Austin Draft Ammendements," document 01/496r2

The list of changes to be made are:

1) Make changes identified in document 01/485r4
2) Make changes identified in document 01/488r1
3) Make changes identified in document 01/476r3
4) Make changes identified in document 01/503r0
5) Make changes identified in document 01/328r4 with caveat to add CTRB parameter of desired maximum GTS.
6) Make changes identified in document 01/517r2
7) Make changes identified in document 01/502r1
8) Make changes identified in document 01/410r0
9) Make changes identified in document 01/469r3
10) Make changes identified in document 01/530r2
11) Items in 01/374r12, entered into D09 and noted in the minutes.
12) Change the MLME commands to reflect the frame formats and information described in clause 7 and 8.
13) Change backoff algorithm to use PHY dependent parameters rather than numeric times. Use 802.11 as a model to write this.
14) Update neighbor piconet information to reflect changes in 01/481r4
15) Add mapping of supported data rates from 5 bits to 8 bits by adding 3 binary 0's as the MSB.
16) Move supported data rates field in figure 19, 7.4.3, to be bits b0-b4. Add bit b10 to be neighbor piconet bit. Text for neighbor piconet bit is: "The neighbor piconet bit shall be set to 1 if the DEV is intending to be a neighbor PNC in the current piconet and shall be set to 0 otherwise." Change "is set to" to be "shall set to" in 7.4.3. Change 01/481r4 to use neighbor piconet bit instead of 0 capability field to identify and neighbor association request.
17) Change "is shown in figure xx" to be "shall be formatted as illustrated in figure xx" for frame formats, information elements, command types and field format figures in clause 7.

## 1.1 Document 01/485r4

7.5.11 EPS Configuration Request

*MkS Editor note: Eliminate this command from D08*

7.5.12 EPS Configuration Response

*MkS Editor note: Eliminate this command from D08*

7.5.13 EPS PS Configuration command

*MkS Editor note: Eliminate this command and replace the Action Commands shown below*

Ed. action: The above three commands have been deleted from the Frame Formats clause. The EPS PS configuration command was called the PS PNC configuration command in D08.

7.5.13.1 EPS Action command

This command is found in Figure 1 along with the interpretation of the fields as shown in Figure 2.

7.5.13.2 EPS Action response

This command is found in Figure 1 along with the interpretation of the field as shown in Figure 3.

This is used to create and maintain EPS Sets as well as EPS Set membership. When an EPS Set is confirmed as created, the PNC shall begin keeping the time base specified for that EPS Set.

| **Octets:2** | **2** | **1** | **1** | **2** | **4** |
|---|---|---|---|---|---|
| Command type | Length (=2 or 8 based on request type) | Request/Response type | EPSSet value | EPSTime | EPSNext |

Figure 1 PS PNC configuration command/response

| **Request type** | ***EPS set value*** | ***EPSTime & EPSNext*** |
|---|---|---|
| Release request (0 value) | Value Required | Not present |
| New request (1 value) | Set to 0 | Required |
| Place me in set request (2 value) | Value Required | Not present |
| Give me information on the EPS set request (3 value) | Value Required | Not present |

Figure 2 Request entries

| **Reply type** | ***EPS set value*** | ***EPSTime & EPSNext*** |
|---|---|---|
| Release confirm (0 value) | Value released | Not present |
| New confirm (1 value) | New value provided | Not present |
| Place me in set confirm (2 value) | Value of set place into | Not present |
| Give me information on the EPS set response (3 value) | Value Required | Part of reply |
| Failure code Incorrect command length | Set to 0 | Not present |
| Failure code – Already a member | Set to 0 | Not present |
| Failure code – EPS set does not exist | Set to 0 | Not present |
| Failure code – Cannot create new set | Set to 0 | Not present |
| Failure code – Illegal command | Set to 0 | Not present |

Figure 3 Response entries

*PS editor note: Security methods may impact which devices are permitted to use this command. TBD*

Ed. action: new commands are listed below:

7.5.5.1 EPS action request command

The EPS action request command shall be formatted as illustrated in Figure 1. This command is used to create and maintain EPS sets as well as EPSSet membership. When an EPS set is confirmed as created, the PNC shall begin keeping the time base specified for that EPS set.

| **octets: 2** | **2** | **1** | **1** | **2** | **4** |
|---|---|---|---|---|---|
| Command type | Length (=2 to 8) | Action type | EPSSet value | EPSTime | EPSNext |

**Figure 1—EPS action request/response command format**

The value of the action type determines the length of the command since the EPSTime and EPSNext fields may be left out for certain action types. The valid request types and the corresponding values for EPS set, EPSTime and EPSNext are given in Table 1.

The EPS set value is a octet that that is assigned by the PNC to a group of DEVs that share the same EPSTime and EPSNext.

**Table 1—EPS action request command entries**

| Action type | Action type value | EPSSet value | EPSTime and EPSNext |
|---|---|---|---|
| Release request | 0 | Value required | Not present |
| New request | 1 | Set to 0 | Required |
| Place in set | 2 | Value required | Not present |
| Information request | 3 | Value required | Not present |
| Reserved | 4-255 | | |

The EPSTime has a range of 0 to 65,535 ms. A value of zero indicates that the DEV is waking for each superframe. Depending on the value of superframe duration parameter, values of EPSTime that are less than the current value of superframe duration indicate that the DEV wakes for each superframe. Since the wake time is bounded by superframe beacon location, the beacon start point immediately preceding the completion of EPSTime shall be the wake point.

EPSNext is a beacon number as defined in piconet synchronization parameters element, 7.4.2. EPSNext informs the PNC or DEVs when the next EPSTime will occur. For this command, the value of EPSNext is taken from the EPSSync parameter in the MLME-POWERMGT.request primitive. The current beacon number when that primitive is received by the SME is used to calculate the beacon number for the next EPSTime event and inserts that beacon number as EPSNext when building the EPS configuration request command.

7.5.5.2 EPS action response command

The EPS action request command shall be formatted as illustrated in Figure 1. This command is used to create and maintain EPS Sets as well as EPS Set membership. When an EPSSet is confirmed as created, the PNC shall begin keeping the time base specified for that EPSSet.

The defintions of the EPSSet value, EPSTime and EPSNext fields in the command are the same as for the EPS action request, .

The value of the action type determines the length of the command since the EPSTime and EPSNext fields may be left out for certain action types. The valid action types for an EPS action response and the corresponding values for EPSSet, EPSTime and EPSNext are given in Table 2.

7.5.14 DEV to PNC PS information

*MkS Editors Note: Keep this command in D07. It is needed to give the PNC information about PS capabilities to the PNC.*

**Table 2—EPS action response command entries**

| Action type | Action type value | EPSSet value | EPSTime and EPSNext |
|---|---|---|---|
| Release confirm | 0 | Value released | Not present |
| New confirm | 1 | New value provided | Not present |
| Place in set confirm | 2 | Value of set place | Not present |
| Return information on the EPS set response | 3 | Value required | Part of reply |
| Incorrect command length | 4 | Set to 0 | Not present |
| Already a member | 5 | Set to 0 | Not present |
| EPS set does not exist | 6 | Set to 0 | Not present |
| Cannot create new set | 7 | Set to 0 | Not present |
| Illegal command | 8 | Set to 0 | Not present |
| Reserved | 9-255 | | |

*MkS Editors Note: D07, Table 63, printed page 80, line 18-19. Fix momentary command entry.*

| **Command type**<br>**Hex value** | **Command name** |
|---|---|
| 0x0002 | Channel time request (*enhancement*) |
| 0x0003 | Channel time grant (*enhancement*) |
| 0x0015 | EPS action request |
| 0x0016 | EPS action response |
| | |
| 0x0017 | DEV to PNC PS information |
| 0x0018 | Switch to ACTIVE mode |
| 0x0019 | Switch to EPS mode |
| 0x001a | Momentary EPS CTA slot |
| | |

*MkS Editors note: D08 The channel time request block with will have to be modified to add a 1 octet field for "EPS Set". This modification will not be shown in this document.*

Ed. action: The command DEV to PNC PS information is retained. The command summary table has been updated and is now cross-linked to the section headings so the words and locations are always current. The CTRB does not yet have the EPS set element since we need a definition for it.

7.5.21.1 Channel time request

*MkS Editors note: D08 printed page 101, line 45-48.*

Replace paragraph with text below.

EPS status indicates whether the CTA requested is for ACTIVE mode channel time or EPS mode channel time. The PNC shall maintain separate ACTIVE mode type CTAs and EPS mode type CTAs. Values of 0, or 1 are used for making ACTIVE mode channel time requests, and the value of 2 is used for making EPS mode channel time requests.

For a device without EPS capability: A value of 0 shall be used for an ACTIVE mode channel time request. For an EPS capable device, a value of 0 or 1, shall be used for an ACTIVE mode channel time request and a value of 2 shall be used for an EPS mode channel time request.

The difference between using a 0 and a 1 EPS status is the persistence of the CTR. The values 0 and 1 are used to tell the PNC whether it should delete this CTR when the "Switch to EPS mode" command is received by the PNC. A 0 indicates that the PNC shall delete this CTR and de-allocate the associated channel time, and a 1 indicates that the PNC shall retain the CTR, and if possible, return the channel time to the device when the PNC it the device returns to ACTIVE mode from EPS mode.

The EPS status value of 2 is used to create an EPS channel time request. The PNC shall create and retain this EPS CTR based on this request. If possible, the PNC shall provide the requested channel time when the PNC switches the device back to EPS mode from ACTIVE mode.

See section 8..c.m for details about CTA management.

All other values of EPS status are reserved.

*MkS Editors note: I have deleted the use of the value 3 in the EPS status field (broadcast/multicast) until a specific reason for this feature is indicated to the MAC group. No one seems to know whyit was put in.*

Ed. action: Small re-arrangement of the text, actual text follows:

EPS status indicates whether the CTA requested is for ACTIVE mode channel time or EPS mode channel time. The PNC shall maintain separate ACTIVE mode type CTAs and EPS mode type CTAs. Values of 0, or 1 are used for making ACTIVE mode channel time requests, and the value of 2 is used for making EPS mode channel time requests. All other values of EPS status are reserved. CTA management is discussed in 8.13.3.5.

For a device without EPS capability a value of 0 shall be used for an ACTIVE mode channel time request. For an EPS capable device, a value of 0 or 1, shall be used for an ACTIVE mode channel time request and a value of 2 shall be used for an EPS mode channel time request.

The difference between using a 0 and a 1 EPS status is the persistence of the CTR. The values 0 and 1 are used to tell the PNC whether it should delete this CTR when the "Switch to EPS mode" command is received by the PNC. A 0 indicates that the PNC shall delete this CTR and de-allocate the associated channel time, and a 1 indicates that the PNC shall retain the CTR, and if possible, return the channel time to the DEV when the PNC it the device returns to ACTIVE mode from EPS mode.

The EPS status value of 2 is used to create an EPS channel time request. The PNC shall create and retain this EPS CTR based on this request. If possible, the PNC shall provide the requested channel time when the PNC switches the device back to EPS mode from ACTIVE mode.

7.5.17 Momentary EPS CTA slot command.

*MkS Editor's Note: D08 Page 96, line 42-53. Replace txt with the following.*

The structure of the command is indicated in Figure 45 This command instructs the PNC to use the EPS CTR slot size in the EPS CTA of the next WAKE beacon. This substitution is only in effect for one EPS superframe. If the WAKE beacon already has an EPS slot, there is no change to the CTA, andif the EPS CTA scheduled was a null CTA, then the null CTA shall be replaced with a non-zero CTA, the length specified by the EPS CTR for that DEV.

Ed. action: text added as indicated.

7.4.10 Channel time allocation (CTA) element

*MkS Editors note: The text does not change until D08 printed page 84, line 31.*

Figure 26 shows the structure of the CTA element. This shall be used by the PNC to describe the location of a dynamic or pseudo static time slot for the specified Source AD-AD, Destination AD-AD, and Stream Index field values. The use of the next field, Slot Location, is summarized in Table xxcc. Slot Location is slot start time if there is a time slot in the corresponding superframe, and as the next slot's beacon number (SFN-ext) if the next time slot is in a future superframe. The Beacon-Time bit of the CTA Control field shall be set by the PNC to indicate how the two bytes of the Slot Location field are interpreted. A Beacon-Time of 0 shall cause the Slot Location field to be interpreted as the Slot Start Time.

The slot stop time is Slot Start time of the next GTS slot minus the aSlotGuardTime. The slot stop time is also measured relative to the start of the beacon frame and in the same units. In EPS mode only, the values of Slot Start time and slot stop time may both be identical to indicate a zero length time slot.

A value of 1 shall cause Slot Location to be interpreted as the least significant two bytes of a beacon count corresponding to the superframe in which the next slot will be allocated. Figure 26 shows this Slot Location field as SFNext in Figure 26. The interpretation of the Slot Location field is the same for devices in ACTIVE mode as it is for devices in EPS mode. For a device is in EPS mode, the SFNext contains the two least significant bytes of EPSNext.

Figure 26 also shows the CTA Type bit contained in the CTA control field. This bit specifies whether the Source DEV and Destination DEV are in ACTIVE mode, 0, or EPS mode, 1.

The Slot Start time field indicates the start time or end time of the time slot. The value of this field is always measured relative to the start of transmission of the beacon frame sent by the PNC. The resolution of this field is 8 µs and so the range is [0-524280] µs.

The third bit in the CTA Control block is Key Change. If this bit is set to 1, this flag indicates that the DEV must update its symmetric keys before continuing peer to peer communication. The security section (x.?.?.?) explains this process in detail.

The remaining 5 bits in the CTA block are reserved.

Figure 25-Channel time allocation element

*MkS Editors Note: no change to figure 25 and to the associated text.*

Ed. action: Lots of changes to format this like the rest of the Frame Formats clause. Actual text for the CTRB is below:

Each CTA element consists of multiple, 6-octet wide CTA blocks, which shall be formatted as illustrated in Figure 2.

| **octets: 1** | **1** | **1** | **1** | **2** |
|---|---|---|---|---|
| Source DEV address | Destination DEV address | Stream index | CTA control | Slot Start time or SFNext |

**Figure 2—Channel time allocation block**

The source DEV address indicates the DEV to whom the channel time is being allocated.

The destination DEV address indicates the DEV to whom the source DEV may send the frames. If this is a broadcast address, then the source DEV shall send broadcast frames only during that time slot.

For a child PNC, the source DEV and destination DEV addresses shall both be the AD-AD of the DEV that is the child piconet's PNC.

For a neighbor piconet, the source and destination addresses shall both be the AD-AD assigned by the parent PNC for the neighbor piconet and shall be one of the reserved neighbor piconet addresses, 7.2.3.

The stream index is the number assigned by the PNC that indicates the stream associated with the channel time.

The CTA control field shall be formatted as illustrated in Figure 3..

| bits: b0 | b1 | b2 | b3-b7 |
|---|---|---|---|
| Time-beacon | CTA type | Key change | Reserved |

**Figure 3—CTA control block**

The time-beacon bit of the CTA Control field shall be set by the PNC to indicate how the two bytes of the slot location field are interpreted. The bit shall be set to 0 if the slot location field to be interpreted as the slot start time. It shall be set to 1 if the slot location field is to be interpreted as the SFNext.

The CTA type specifies whether the source DEV and destination DEV are in ACTIVE mode or EPS mode. The bit shall be set to 0 if they are in ACTIVE mode and shall be set to 0 if they are in EPS mode.

The key change bit is reserved for possible security implementation with TBD meaning.

The slot location field is interpreted as either the slot start time field or the SFNext field, depending on the value of the time-beacon bit. The use of this field is summarized in Table 3.

**Table 3—Summary of slot location field usage**

| Type of activity for destination DEV | Slot location octets | Time-beacon bit value | CTA type bit value |
|---|---|---|---|
| ACTIVE CTA, GTS present in this super-frame | Slot start time | 0 | 0 |
| ACTIVE CTA, no GTS in this superframe | Next GTS slot start time | 1 | 0 |
| EPS CTA, AWAKE superframe | Slot start time | 0 | 1 |
| EPS CTA, no GTS, just WAKE | Slot start time = 0 | 0 | 1 |
| EPS CTA, Momentary EPS CTA GTS | Slot start time | 0 | 1 |
| EPS CTA, not a WAKE superframe | SFNext | 1 | 1 |

If the slot location field is to be interpreted as the slot start time, then the field contians the start time of the allocated slot. The value of this field is always an offset from the start of superframe and hence the start of transmission of beacon frame from the PNC. The resolution of this field is 8 μs and so the range is [0-524280] μs.

The end of each GTS slot is the start time of the next GTS slot minus the guard time indicated in the beacon.

If the slot location field is to be interpreted as the SFNext field, then the field contains the least significant two bytes of a beacon count corresponding to the superframe in which the next AWAKE slot will be allocated.

Clause 8 additions ...

Ed action: Text added by Jay Bain. JPKG moved the definitions to the Definitions clause. New definitions are below:

**1.2 active mode:** This mode is the default mode after a device joins the piconet. A device in active mode listens to every beacon.

**1.3 active channel time allocation:** A type of channel time allocation where the device will be using the allocated time slot in the current superframe.

**1.4 awake mode:** In this mode, a device that is using enhanced power save mode begins using the previously allocated time slots while still maintaining its enhances power save mode status.

**1.5 enhanced power save:** A the power management technique used to reduce the amount of power used by devices in the piconet.

**1.6 enhanced power save time:** The fundamental operating parameter for enhanced power save modemode. It is the nominal time value for the inter-wake periods for enhanced power save devices. The actual wake beacon is the beacon for the superframe when the nominal time is reached.

**1.7 enhanced power save next:** The beacon number value for the very next wake beacon for an enhanced power save set.

**1.8 enhanced power save set:** A grouping of devices where at least one member of the group will use enhanced power save mode. A single enhanced power save mode set shares a common timing information with regards to the enhanced power save time and enhanced power save next.

**1.9 enhanced power save channel time allocation:** A type of channel time allocation element generated to enable a power saving mode by the device.

**1.10 reduced power save:** The mode of a device that reduces its power level for part and only part ofa superframe, excluding the beacon.

**1.11 wake beacon:** The beacon to which the enhanced power save devicewill listen. For other beacons, the enhanced power save mode device can be presumed to be unavailable for communications.

**1.12 wake superframe:** A superframe when the enhanced power save device will listen to the beacon and also be available for sending or receiving operations.

Ed. action: New acronyms were added as well, as shown below:

| | |
|---|---|
| ACTIVE | active mode |
| ACTIVE CTA | active mode channel time allocation |
| AWAKE | awake mode |
| CTR | channel time request |
| EPSTime | enhanced power save time |
| EPSNext | enhanced power save next |
| EPS set | enhanced power save set |
| EPS CTA | enhanced power save channel time allocation |

WAKE wake mode

Ed. action: Some changes to “Overview of CTA managment.” New text is given below

8.13.3.5 Overview of CTA Management

The PNC shall create CTA elements in every beacon, after the PNC has allocated their slot time. An EPS CTA is the CTA of a DEV in EPS mode. An ACTIVE CTA is the CTA of a DEV in ACTIVE mode. If a DEV does not have an ACTIVE or EPS slot in a particular superframe, the PNC shall include a CTA with the beacon number of the next ACTIVE or EPS time slot according to the CTA block definitions of 7.4.11.

The constant presence of CTA element allows any member of the network that has missed hearing some number of beacons, to re-synchronize with other members of the piconet after hearing just one beacon. Any DEV may read the CTA mode of a device as well as its slot start time or beacon number value.

In order for a device to determine the duration of the time slot identified in a particular CTA, that same device shall use the Slot Location field of the next contiguous CTA whose Time-Beacon bit is set to 0. This slot location field shall be interpreted as "slot stop time + aSlotGuardTime". The device shall ignore all intermediate CTA blocks that have time-beacon bit set to 1.

When a DEV is in EPS mode the EPS set and the EPS channel time request are used together by the PNC to create the EPS CTAs, and time slots with the correct characteristics and at the correct times.

Figure 84 describes the three sequences of switching CTAs for an EPS DEV that is depicted as DEV B. DEV A may be operating as EPS or ACTIVE for this description. Without loss of generality, the direction of information flow is shown here from DEV A to DEV B.

The first sequence describes the transition of DEV B from ACTIVE mode to EPS mode and the operation of the DEV when it is in EPS mode. DEV A first sends a switch to EPS CTA mode command, 7.5.5.5, to the PNC either in the CAP or an MTS. The PNC then switches both the mode of DEV B and the specification it uses to create CTAs. The CTA specification switches from the DEV B's ACTIVE CTRB to the combination of the DEV B's EPS CTRB and the EPS Set specified therein. The first sequence shows that DEV B previously specified the EPS CTRB using an allocation period field set to 2. The resulting CTAs have a time slot allocated in every other superframe, with a null CTA allocated in the superframes in-between.

The second sequence set describes the operation for the momentary EPS CTA, 7.5.5.6. This command forces an EPS CTA into the next WAKE beacon. It may be issued by a source DEV by sending it in superframe prior to the desired WAKE superframe. The PNC shall create an EPS CTA in the next WAKE superframe with a slot size specified by the original EPS CTR block. It is possible for an EPS DEV to specify that all WAKE times have null slots except when the momentary EPS CTA command is issued. Doing so gives simple direct control over the creation of EPS slots that are still synchronized to the EPS set time base.

The third sequence describes the transition of DEV B from EPS mode back to ACTIVE mode. The switch to ACTIVE mode command, 7.5.5.4, is send by DEV A in the CAP or MTS slot allocated in the superframe before the WAKE superframe. Since this command is sent prior to the WAKE superframe, the PNC is able to switch DEV B to ACTIVE mode and begin using the corresponding CTA elements starting with the next (WAKE) superframe. Since this is the normal WAKE superframe, all devices hearing the beacon will see from the mode bit of the CTA element for DEV B that it is now in ACTIVE mode. The transition is both synchronized and seamless.

*PS Editors note: make sure that Mark’s Allocation Interval and not the older Duration Between Slots is correct in clause 7. Also pickup the value of Allocation Interval and place above. Make sure that "EPS Set" added as a new field to the Channel Time Request*

Ed. action: The allocation interval in clause 8 was renamed to be the allocation period to match the clause 7 usage. EPS set is a new field in the channel time requrest (but not the stream management command).

Ed. action: Add CTR acronym (noted above), Also added a new EPS set element to the channel time request block, the table and definition follow:

| octets: 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
|---|---|---|---|---|---|---|---|
| Target AD-AD | EPS status | EPS set | Stream index | Allocation period | Minimum GTS time | Desired GTS time | Maximum allocation delay |

**Figure 4—Channel time request block for a particular stream**

The EPS set is the one for which this channel time is requested if the EPS status indicates that this is for an EPS mode CTA. The DEV that sends this command shall be a member of EPS set before it sends this request for an EPS mode CTA. The field shall be set to zero for an ACTIVE mode channel time request.

Ed. action: Edited text for "ACTIVE and EPS channel time requests and allocations", actual text follows:

8.13.3.4 ACTIVE and EPS channel time requests and allocations

The operation of channel time requests for EPS mode is shown in Figure 82. Channel time requests (CTRs), 7.5.8.1 and 7.5.8.3, that correspond to the operation of ACTIVE CTA and EPS CTA are required for DEVs operating in EPS mode.

The ACTIVE CTA in a beacon by the PNC is the result of an ACTIVE CTR. The creation of an EPS CTA in a beacon by the PNC is the result of an EPS CTR. However, there is one additional requirement placed on a DEV for the creation of the EPS CTA. The DEV shall also be a member of at least one EPS set. The DEV shall first become a member of an EPS set, and then may issue an EPS CTR using the number of an EPS set to which it belongs as a parameter.

The role of the EPS CTR, as defined in 7.5.8.1, is to specify two parameters:

1) The size of the EPS time slots used for data
2) The value of N such that a proportion 1:N of EPS time slots that will be of that length.

For an EPS CTR, the allocation period field, 7.5.8.1, is used to specify the value of N. If the value of N is 1, then every EPS CTA has the slot duration specified by the CTR block. If instead, the value of N is 4, then 1 EPS CTA out of each 4 occurrences of the CTA has this specified size. In either case, each data slot is followed by N-1 null EPS slots (i.e. zero time duration slots).

For EPS channel time requests, N = 0 is a special case in which the PNC shall create all EPS CTA slots with zero length. The zero length, or null CTA identifies that the EPS DEV shall listen to this beacon, and that the EPS DEV does not have GTS time allocated for data transmission.

After 2 or more EPS mode CTA devices have submitted EPS type CTR blocks with the same EPS set value, the PNC follows the rules defined in 8.13.1.

The PNC shall decline the EPS channel time request if the DEV is not a member of the EPS set specified, which could be due to the condition that the EPS set does not exist. This rejection shall be sent with a channel time grant command containing the reject code, not a member of requested EPS set, 7.5.8.3.

## 1.2 Document 01/488r1

Ed action: The two MSCs from 01/488r1 were added to D09 by Jay Bain.

## 1.3 Document 01/476r3

Ed. note: Draft D08 contains 01/476r0. Text that is new from 01/476r0 is listed below:

### 1.3.1 Management time slots

New Clause 8.3.4 MTS slot Access

Management Time Slots (MTSs) are identical to GTSs except that the PNC address (zero) is the source or the destination address in the CTA. A PNC can choose to use MTSs instead of the CAP for command frames. When MTSs are used, the PNC shall ensure that sufficient MTSs are allocated to allow for transmission of commands to and from the PNC. There can be as little as a single MTS in a superframe whose ownership changes from superframe to superframe. At the other extreme, there can be one or more uplink and downlink MTS per associated DEV per superframe plus MTSs for associatnion. It is up to the PNC to determine the appropriate number of MTS in a superframe the same way the PNC is responsible for choosing the CAP size if a CAP is used. The PNC determines which DEVs to allocate MTSs to and how often. The PNC determines which DEVs to allocate MTSs to and how often. The PNC shall allocate at least one association MTS every aMTSAssocPeriod.

Ed. Note: add aMTSAssocPeriod with a value of 0.6s.

An open MTS is an MTS where the source address in the CTA for the MTS is the broadcast address. Any DEV associated to the piconet can attempt to send a command frame to the PNC in an open MTS. An MTS with the association address as the SA in the CTA for the MTS is called an association MTS. Any station not currently associated to the piconet can attempt to send an association command to the PNC in an association MTS. Association commands are not permitted in open MTSs. Likewise, only association commands are allowed in association MTSs.

Open MTSs enable the PNC to service a large number of DEVs with low MTS requirements using a minmum number of MTSs. When there are few DEVs in a piconet it will be more efficient to use assigned an MTS to a DEV instead of using open MTS. It is the PNC's responsibility to determine how many and what type of MTSs to use.

The PNC shall assign an uplink MTS within aMTSAssocPeriods of a successful association command in order to support the 1 second connection target.

Ed. action: The above text was merged by Jay Bain with the existing text. The parameter aMTSAssocPeriod was added to the table at the end of clause 8 with a value of 0.6 s. JPKG performed minor changes to formalize the language, actual text is below:

8.4.3.4 Management Time Slots

Management Time Slots (MTSs) are identical to GTSs except that the PNC address is the source or the destination address in the CTA. A PNC may choose to use MTSs instead of the CAP for command frames. When MTSs are used, the PNC shall ensure that sufficient MTSs are allocated to allow for the transmission of commands to and from the PNC. There may be as few as a single MTS in a superframe where the ownership of the MTS changes from superframe to superframe. At the other extreme, there may be one or more uplink and downlink MTSs per associated DEV per superframe plus MTSs for association. The PNC is responsible for determining the appropriate number of MTSs in a superframe in the same way that the PNC is responsible for choosing the CAP size if a CAP is used. The PNC determines which DEVs will be allocated MTSs and how often. The PNC shall allocate at least one association MTS every aMTSAssocPeriod.

An open MTS is one where the source address in the CTA for the MTS is the broadcast address. Any DEV that is associated to the piconet may attempt to send a command frame to the PNC in an open MTS. An MTS with the association address as the SA in the CTA for the MTS is called an association MTS. Any station not currently associated to the piconet may attempt to send an association command to the PNC in an association MTS. Association commands shall not be sent in open MTSs. Likewise, only association commands shall be sent in association MTSs. Open MTSs enable the PNC to service a large number of DEVs with low MTS requirements by using a minmum number of MTSs. When there are few DEVs in a piconet it would be more efficient to use MTSs assigned to a DEV instead of using an open MTS. It is the PNC's responsibility to determine how many and what type of MTSs to use for each superframe.

The PNC shall assign an uplink MTS within aMTSAssocPeriod of a successful association command in order to support a 1 second connection target.

Clause 8.12.3.5 Additional Traffic to EPS DEVs

Add the following paragraph:

If management time slots are used, the PNC shall assign management time slots for a device in EPS mode during the superframes when the EPS device is scheduled to be awake and the superframe before that.

Ed. action: Text added by Jay Bain, minor edits by JPKG, actual text is below:

If management time slots are used, the PNC shall only assign management time slots for a DEV in EPS mode during superframes when the EPS device is scheduled to be listening to the beacon. The preceding superframe shall have an MTS allocated with the EPS DEV as the source to allow for a Switch to AWAKE CTA mode command, 7.5.5.5, or a Momentary EPS CTA command, 7.5.5.7, to be sent to the PNC.

### 1.3.2 Static GTS

Clause 7.5.21 Figure 49

Change Reason code to 4 bits. Use 1 bits for GTS type. 3 bits reserved.

Note: Modified stream management command appears below.

Ed. action: JPKG changed as indicated.

Clause 8.3.3.1

Add the following sentence:

There are two types of GTS: dynamic GTS, and pseudo-static GTS. The type of GTS slots are indicated in the stream management command as specified in 7.5.21.

New Clause 8.3.3..1.1 Dynamic Guaranteed Time Slots

The PNC is free to move dynamic GTSs within the superframe on a superframe by superframe basis. This allows the PNC the flexibility to rearrange GTS assignments to optimize the utilization of the slot assignments. The PNC can move a dynamic GTS by simply changing the CTA parameters in the Beacon.

New Clause 8.3.3.1.2 Pseudo-Static Guaranteed Time Slots

Pseudo static GTSs require a stream connection - non-stream GTSs cannot be pseudo-static. Pseudo static GTSs can be moved within the CFP by the PNC, but the PNC shall notify the affected DEVs by sending them acknowledged Channel Time Grant frames with the new CTA. As with dynamic GTSs, the PNC can rearrange pseudo static GTSs so that the GTS assignments can be optimized, but it must use the Channel Time Grant and coordinate the channel time grants with the CTAs in the beacon.

Before a pseudo static GTS is moved, the PNC shall ensure that the new position is unoccupied by another GTS. Then, the PNC sends a directed channel time grant to the receiving DEV so that the receiving DEV is listening to both the old GTS position and the new position. This channel time grant contains both the old and the new CTA. If the old and the new position overlap, the CTA can be one larger CTA.

Next the PNC sends a channel time grant to the transmitting DEV that contains only the new CTA. By moving the receiver first, the PNC ensures that no frames are lost if Channel time requests are corrupted.

Lastly, the PNC sends a channel time grant to the receiving DEV which only contains the new CTA.

Ed. action: Most of the text was already in D08, small changes to D09 made by Jay Bain and corrections to the language by JPKG (an evil “must” was purged).

Modified Clause 8.3.3.2 paragraph 1

(Ed. note: the changes are in the following sentences)

The slot assignments for dynamic GTS may change from superframe to superframe as required by the PNC. Slot assignments for pseudo-static GTS slots require directed channel time grant commands.

Ed. action: Changes made by Jay Bain, small change to the wording by JPKG, actual text below:

The slot assignments for dynamic GTSs may change from superframe to superframe as required by the PNC. Changing the slot assignments for pseudo-static GTSs requires directed channel time grant commands, as described in 8.4.3.1.

Modified Clause 8.3.3.2 paragraph 4

In any superframe there may be one or more DEVs in the piconet that receives the Beacon in error. This may not happen to the same DEV all the time but may happen to different DEVs at different times depending upon their location and type of interference they are subjected to. If a DEV did not receive the ~~CTA information~~ beacon correctly, it shall not access the ~~channel~~ dynamic GTS during CFP. Stations with pseudo-static GTS(s) are allowed to transmit during these GTS(s) as long as the number of consecutive lost beacons is less than or equal to MaxLostBeacons. A DEV shall stop transmitting in its pseudo-static GTS when the number of consecutive lost beacons exceeds MaxLostBeacons.

Ed. action: Corrections made by Jay Bain, editorial changes by JPKG, actual text is below:

If a DEV did not receive the beacon, it shall not access any dynamic GTSs during the CFP. Stations with pseudo-static GTSs are allowed to transmit during these GTSs as long as the number of consecutive lost beacons is less than or equal to aMaxLostBeacons. A DEV shall stop transmitting in its pseudo-static GTS when the number of consecutive lost beacons exceeds aMaxLostBeacons.

### 1.3.3 Private GTS (was formerly known as Unassigned GTS )

New Clause 3.3.3.3 Private GTS

A private GTS is a GTS where the same DEV is the source and destination. A private GTS is not used for communication in the piconet. Rather, it is used to reserve channel time for some other use. The other use may be for another 802.15.3 piconet, or a different type of network sharing the same channel.

Private GTS slots will usually be pseudo-static GTS slots, so that the slot is periodic for the other use. A DEV requests a private GTS slot by inserting it's own AD-AD in the source and destination address for the stream and channel time request.

Ed. action: Corrections made by Jay Bain, editorial changes by JPKG, actual text is below:

A private GTS is a GTS where the same DEV is both the source and the destination. A private GTS is not used for communication in the piconet. Instead, it is used to reserve channel time for some other use. The other use may be for another 802.15.3 piconet, or a different type of network sharing the same channel.

Private GTSs will usually be pseudo-static GTSs, so that the slot is periodic for the other use. A DEV requests a private GTS by using it’s own AD-AD as the originator and target address for the stream management command, 7.5.8.3, or channel time request command, 7.5.8.1.

### 1.3.4 Modified Stream Management Command

Reserved Byte for max Delayed ACK frames in stream Mgt Command (Issue 310) and source/target address field in stream management command (Issue 400). Modified Action Type and Reason Code address Issues

Figure 49 Modified Stream Management Command

| Octets: 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 20 |
|---|---|---|---|---|---|---|---|---|---|
| Command type | Length (=30) | Stream request identifier | Originator AD-AD | Target AD-AD | DSAA | Max Frames (delayed ACK) | Reason code/GTS type | reserved | Stream QoS parameters |

Note: Reserved field will not be needed if the stream QoS parameters become odd after pending changes.

New Figure Reason code / GTS Type field (after figure 50)

| 4 bits | 1 bits | 3 bits |
|---|---|---|
| Reason Code | GTS Type | reserved |

Replace line 50 and 51 of page 95 with the following:

The Originator AD-AD is the 8 bit address of the originator of the stream management command. The Target AD-AD is the 8 bit address of the target of the stream management command.

Add the following text after line 29, page 96:

Max Frames specifies the maximum number of frames that can be outstanding when the ACK policy for the stream is Delayed ACK.

Ed action: Changed command illustration, new figures and text shown below:

| **octets: 2** | **2** | **1** | **1** | **1** | **1** | **2** | **20** |
|---|---|---|---|---|---|---|---|
| Command type | Length (=26) | Stream request indentifier | Originator AD-AD | Target AD-AD | Max frames (Del-ACK | Control Information | Stream QoS parameters |

**Figure 5—Stream management command format**

The originator AD-AD is the allocated address of the DEV that is the originator of the stream manament command.

The target AD-AD is the allocated address of the DEV that is the target of the stream managment command.

The max frames field specifies the maximum number of frames that can be outstanding when the ACK policy for the stream is Del-ACK.

The control information field is illustrated in Figure 6.

| bits b0:b1 | b2:b3 | b4:b6 | b7 | b8:b11 | b12 | b13-b15 |
|---|---|---|---|---|---|---|
| Action Type | ACK Policy | Security | Direction | Reason code | GTS type | Reserved |

**Figure 6—Control information field in the stream management command**

Modify the Action Type description as follows:

- Value of '0' means that this is a request for stream connection. This request is sent from the DEV that originates the stream management request to the PNC.
- Value of '1' means that this is the indication forwarded request frame sent from the PNC to the target of the stream management frame. This command contains the QoS-parameters, except the retransmission window, set by the PNC.
- Value of '2' means that this is a response to the stream connection sent from the target DEV to the PNC. The target DEV can lower the QoS-paremeters in the response.
- Value of '3' means that this is a Stream Management confirm forwarded response command for the stream connection. This request is sent by the PNC to the originator DEV to complete the stream connection. It is also sent from the PNC to the originator and target DEV to reject or disconnect a stream.
- Value of "4" means that the frame is sent by one of the DEVs to the PNC to reject or disconnect the stream
- Value of "5" means that the frame is sent by the PNC to one of the DEVs to reject or disconnect the stream

Ed. action: Text updated with editorial changes (JPKG), actual text follows:

- A value of '0' indicates that this is a request for stream connection. This request is sent from the DEV that originates the stream management request to the PNC.
- A value of '1' indicates that this is a forwarded request frame sent from the PNC to the target of the stream. This command contains the QoS-parameters set by the PNC, except for the retransmission window.
- A value of '2' indicates that this is a response to the stream connection. This is sent from the target DEV to the PNC. The target DEV can modify the QoS-parameters to smaller values in the response.
- A value of '3' indicates that this is a confirmation of the acceptance of the stream connection. This request is sent by the PNC to the originator DEV to complete the stream connection.
- A value of "4" indicates that the frame is sent by one of the DEVs to the PNC to reject or disconnect the stream
- A value of "5" indicates that the frame is sent by the PNC to one of the DEVs to reject or disconnect the stream

Modify the reason code as follows:

The reason code is a 4 bit field that is valid in the Stream Management Confirm when a stream connection is being completed, rejected or disconnected. It is also valid in the Stream Management response from the target to the PNC. Otherwise this field is ignored. Valid reason codes are:

- 0 ->Success
- 1 ->invalid stream parameters
- 2 -> non-negotiable stream parameters
- 3 -> system resources unavailable

— 4 -> bandwidth allocation failure
— 5 -> currently disassociating from the piconet
— 6 -> too many streams
— 7 -> lack of required security
— 8 -> unauthorized stream
— 9-> Stream rejected or disconnected by other DEV
— 10-16-> reserved

Add the following text:

GTS type zero signifies that the stream shall use dynamic GTS. GTS type one indicates that the stream shall use pseudo-static GTS.

Ed action: Reason codes and GTS type modified, actual text is below:

The reason code is a 4 bit field that is valid when a stream connection is being completed, rejected or disconnected. It is also valid in the response from the target to the PNC. Otherwise this field shall be ignored. Valid reason codes are:

— 0 -> success
— 1 -> invalid stream parameters
— 2 -> non-negotiable stream parameters
— 3 -> system resources unavailable
— 4 -> insufficient channel time available
— 5 -> currently disassociating from the piconet
— 6 -> too many streams
— 7 -> lack of required security
— 8 -> unauthorized stream
— 9-> Stream rejected or disconnected by other DEV
— 10 -> target unreachable
— 11-16-> reserved

The GTS type bit is set by the requesting DEV and shall be set to 0 for dynamic GTSs and shall be set to 1 for pseudo-static GTSs.

### 1.3.5 DEV GTS Status Information Element

Add new element GTS status information element to the beacon frame with type in every frame.

New Clause 7.4.x DEV GTS Status Information Element

This element is a 256 bit bitmap where each bit corresponds to an AD-AD. The PNC sends the DEV GTS Status element in the Beacon. The purpose of this element is to enable a DEV to know if any GTSs where it is a SA or DA have change since the last Beacon. If any of the GTSs for a given DEV has changed since the last Beacon, the bit corresponding to the AD-AD for that DEV shall be set to a one. If none of the GTSs for that DEV have changed since the last beacon, the bit corresponding to the AD-AD for that DEV shall be set to zero. If a broadcast GTS has changed since the last beacon, the broadcast GTS bit will be set, and not all bits in the bitmap.

| Octets:1 | 1 | 8 | |
|---|---|---|---|
| ElementID | Length=8 | lsb | DEV GTS Status bitmap msb |

Figure 2 DEV GTS Status Information Element

If a DEV correctly received beacon n, it does not need to process the CTAs in beacon n+1 if its DEV GTS Status bit and the broadcast GTS status bit in beacon n+1 is set to zero. If its DEV GTS Status bit is set to one or the broadcast GTS status bit, the DEV shall process the CTAs in that beacon.

Ed. action, add element and update information element table. New section for the information element is below:

7.4.13 DEV GTS status

The DEV GTS status element, illustrated in Figure 29, is a 256 bit bitmap where each bit corresponds to an AD-AD. The DEV GTS status element may only be sent by the PNC in the beacon. The purpose of this information element is to enable a DEV to know if any GTSs where it is either the SA or DA have changed since the last beacon. If any of the GTSs for a given DEV has changed since the last beacon, the bit corresponding to the AD-AD for that DEV shall be set to a one. If none of the GTSs for that DEV have changed since the last beacon, the bit corresponding to the AD-AD for that DEV shall be set to zero. If a broadcast GTS has changed since the last beacon, only the broadcast GTS bit shall be set, and not all bits in the bitmap

| **octets: 1** | **1** | **8** |
|---|---|---|
| Element ID | Length (=8) | (lsb) DEV GTS status bitmap (msb) |

**Figure 7—DEV GTS status information element**

If a DEV correctly received beacon n, it does not need to process the CTAs in beacon n+1 if it's DEV GTS status bit and the broadcast GTS status bit in beacon n+1 are set to zero. If either it's DEV GTS status bit or the broadcast GTS status bit is set to one, then the DEV needs to process the CTAs in that beacon.

## 1.4 Document 01/503r0

### 1.4.1 Clause 8.8 Probe

- Fixed timeout not acceptable for EPS DEVs
- Require sending DEV to use EPS information, EPSTime & EPSNext to determine allowable time to resend probe
- Allow sender to switch EPS DEV to ACTIVE to speed up the exchange.
- Allow sender an aggressive resend

Ed. action: Text added to D09 by Jay Bain, new text in 8.9 follows:

EPS DEVs present a special case for use of the probe request command. It is the responsibility of the DEV sending a probe request command to understand when the EPS DEV will be able to receive it. Use of aProbeResponseDelay is not

appropriate as a timeout. It is acceptable for the sending DEV to switch an EPS DEV into ACTIVE mode to improve the responsiveness. The sending DEV shall return the receiving DEV to EPS mode after completion of probing.

### 1.4.2 Clause 7.5.19 Device information

- This serves to support discovery
- Add fields to provide
  1) Status information
  2) A single EPS set

Ed. action: Changed the terminology to from "requested channel time" to be CTRB, updated the table and the text. The CTRB has both the EPS status and the EPS set for the CTA. New text for the device information response command is given below:.

| **octets: 1** | **1** | **6** | **2** | **2** | **12** | **12** | **…** | **12** |
|---|---|---|---|---|---|---|---|---|
| AD-AD | Reserved | Device ID | Capability field | Number of TX slots (= n) | CTRB for stream-1 | CTRB for stream-2 | … | CTRB for stream-n |

**Figure 8—Format of a record in device information response command**

...

The CTRB is the channel time request block for a given stream which shall be formatted as illustrated in Figure 11.

### 1.4.3 Clause 7.4.x Power management parameters element

- Add this element to the text
- Provides EPS sets a DEV is a member of
- Provides status information
  1) Power management mode
  2) Current state (ACTIVE/EPS)

Ed. action: Add new information element and update summary table, text given below:

7.4.14 Power management parameters

The power managment parameters element shall be formatted as illustrated in Figure 9. The purpose of this information element is to communicate the EPS information to the requesting DEV.

| **octets: 1** | **1** | **1** | **1** | **1** | **…** | **1** |
|---|---|---|---|---|---|---|
| Element ID | Length (=2+n) | EPS status | EPS set 1 | EPS set 2 | … | EPS set n |

**Figure 9—Power management parameters element**

The EPS set(s) are a listing of the numbers assigned by the PNC to all of the EPS set(s) to which the DEV belongs.

The EPS status field shall be formatted as illustrated in Figure 10

| bits: b0 | b1 | b2-b7 |
|---|---|---|
| EPS state | EPS mode | Reserved |

**Figure 10—EPS status field**

The EPS state bit indicates the current state of the DEV. If the DEV is in EPS state, this field shall be set to 1. It shall be set to 0 otherwise.

The EPS mode bit indicates the current EPS mode of the DEV and shall be 1 if the DEV is in EPS mode and shall be set to 0 otherwise.

### 1.4.4 Clause 6.3.1 changes

| Parameter name | Request | Response | Indicate |
|---|---|---|---|
| Request type (xref 7.5.13) | Add | Add | ------- |
| EPS set (xref 7.5.13) | Add | Add | ------- |
| EPS status | Add | Add | |
| EPSTime (xref 7.5.13) | Retain | add | ------- |
| EPSSync (develops EPSNext, xref 7.5.13) | Retain | ------ | ------- |
| PeerPowerManagementMode | OK (note) | ------- | delete |
| PeerPowerManagementRole | delete | ------- | delete |
| PowerManagement Priority (xref 7.5.14) | OK | ------- | ------- |

| | | | |
|---|---|---|---|
| PeerWakeup | ——— | ——— | OK |
| DeviceID | ——— | ——— | delete |
| PowerManagement RecoveryMode | OK | ——— | ——— |
| Wakeup (xref 7.5.15, .16, .17) | OK (note) | ——— | ——— |
| Resultcode (match xref 7.5.13) | ——— | Retain and add values | ——— |
| ActualEPSTime | ——— | delete | ——— |
| PeerEPSTime | —— | ——— | delete |

Ed. action: This results in a re-write of 6.3.1, the results of which are given below:

6.3.1 Power management

This mechanism supports the process of establishment and maintenance of the power management mode of a DEV. The parameters used for these commands are defined in Table 4

6.3.1.1 MLME-POWERMGT.request

This primitive requests a change in the power management operation. The modes and operational considerations for sending and receiving DEVs in a piconet that want to use EPS operation in a variety of configurations. It is available to the DEV prior to association and may be used at additional times during operation to change configurations. This primitive works in conjunction with the MLME-STREAM-CONNECT.xxx primitives, 6.3.10, to set the EPS modes. The semantics of the primitive are as follows:

```
MLME-POWERMGT.request        (
                             RequestType
                             PowerManagementMode,
                             PowerManagementRecoveryMode,
                             PowerManagementPriority,
                             WakeUp,
                             EPSSet
                             EPSStatus
                             EPSTime,
```

**Table 4—MLME-POWERMGT.xxx primitive parameters**

| Name | Type | Valid Range | Description |
|---|---|---|---|
| RequestType | Integer | As defined in 7.5.5.1 | Determines the type of power management request that is being made. |
| EPSSet | Octet | 0-255 | The EPS set for which the command applies, as defined in 7.5.5.1 |
| EPSStatus | Enumeration | ACTIVE, EPS | The status of the DEV. The EPS states are defined in 8.13 |
| EPSTime | Integer | 0-65,535 ms | Time interval for an EPS device to be in reduced power state and unavailable for reception of packets. The operating super-frame length adjusts this value. A value of zero is to wake for each beacon. This element has no meaning if the EPS DEV is not in power management mode.Defined in 7.5.5.1 |
| EPSSync | Boolean | True, False | When true, the MAC will force the phase of EPSTime to zero across the EPS set and determines the value of EPS next. False has no effect. Defined in 7.5.5.1 |
| PowerManagementMode | Enumeration | PM_OFF, RPS, EPS | An enumerated type that describes the desired power management mode of the DEV. |
| PowerManagementRecov-eryMode | Boolean | True, False | When true, the DEVs will perform recovery from errors rather than waiting for next EPSTime. |
| PowerManagementPriority | Enumeration | LOW, MEDIUM, HIGH | An enumerated type that is an indication of battery sensitivity. It is used by the PNC to allocate CTA locations. High indicates a very battery sensitive device requiring optimal CTA locations. Used in RPS and EPS modes. |
| Wakeup | Boolean | True, false | When true, the MAC is forced immediately into the ACTIVE state. This parameter has no effect if the current power management mode is ACTIVE. |
| ResultCode | Octet | 0-255 | The result of a power management command. The codes are the action type returned by an EPS action response command as defined in 7.5.5.2. |

EPSSync
)

The parameters for this command are defined in Table 4

6.3.1.1.1 When generated

This primitive is generated by the DME to implement the power-saving strategy of an implementation.

6.3.1.1.2 Effect of receipt

This request sets the DEVs power management parameters. The MLME subsequently issues a MLME-POWER-MGT.confirm that reflects the results of the power management change request.

6.3.1.2 MLME-POWERMGT.confirm

This primitive confirms the change in power management mode. The semantics of the primitive are as follows:

```
MLME-POWERMGT.confirm (
                      RequestType,
                      EPSSet,
                      EPSStatus,
                      EPSTime,
                      ResultCode
                      )
```

The parameters for this command are defined in Table 4

6.3.1.2.1When generated

This primitive is generated by the MLME as a result of an MLME-POWERMGT.request. It is not generated until the change has completed.

6.3.1.2.2 Effect of receipt

The DME is notified of the change of power management mode.

6.3.1.3 MLME-POWERMGT.indication

This primitive reports power management changes from a specific peer MAC entity. The semantics of the primitive are as follows

```
MLME-POWERMGT.indication (
                         PeerWakeup
                         )
```

The parameters for this command are defined in Table 4

6.3.1.3.1When generated

This primitive is generated by the DEV as a result of a command or activity by another DEV in the piconet.

6.3.1.3.2 Effect of receipt

The DME is notified of changes in power management configuration or to wake up for information reception.

### 1.4.5 Clause 7.5.15, 16 ,17 changes

- Switch to – commands call for informing DEV as well as PNC.
- 485r4 provides alternate mechanism to provide this the destination DEV

Ed. action: No specific suggestions here, apparently taken care of by changes in 01/485r4, which was added as a part of the ammendments. No action taken from the above information.

## 1.5 Document 01/328r4

With caveat to add CTRB parameter of desired maximum GTS.

Definitions;

- $f_D$ = bits per second of delivered data.
- $N_B$ = bits of source buffer available to store the data to be communicated.
- $N_{MPDU}$ = bits of the data portion of one packet of data.
- $N_{OH}$ = Equivalent bits of overhead of one packet of data including: actual MAC header bits, slot guard times, PHY or PLCP overhead, etc., everything-but-data, etc. It simplifies the explanation to express this as an equivalent number of bits.
- $N_E$ = Channel (PHY) encoding, bits per symbol
- $f_S$ = Channel symbol rate, symbols per second.
- $T_{BCN}$ = Beacon Period

| Octets: 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
|---|---|---|---|---|---|---|---|
| Target Address | EPS status | EPS Set | Stream index | Allocation Period | Minimum GTS Time | Desired GTS Time | Maximum Allocation Delay |

CTRB field that exists in draft D0.8

CTRB field proposed in this proposal

CTRB field proposed in document 01/485

Allocation period

a) $T_{AP} = N_B/f_D$
b) This is how often the $N_B$ buffer must be sent to get the desired delivered data rate $f_D$.
c) This is the size of the source buffer divided by the desired data rate.
d) We need to send $N_P$ packets over the network in order to transmit one buffer:
e) $N_P = N_B/N_{MPDU}$ Assume an integer for simplicity.
f) $N_T = N_{MPDU}+N_{OH}$, the total number of bits that would have to be sent over the network to cover both the data and the overhead.

Minimum GTS time

a) $T_{GTS}$ is the total time requested for GTS allocated in order to send one buffer of data.
b) $T_{GTS} = (N_P N_T / N_E f_S)$.
c) For the sending $N_P$ packets of equivalent size, $N_T = (N_{MPDU} + N_{OH})$ with a PHY encoding of $N_E$ bits per symbol and a PHY symbol rate of $f_S$.\
d) $1/(N_E f_S)$ is a constant as long as the symbol rate and encoding method is unchanged.
e) From before: $N_P = N_B/N_{MPDU}$
f) Stating the obvious: $N_T$ and $N_P$ will also be constants if the transmit packet size and the transmit buffer size both remain constant.

Desired GTS time, i.e. GTS time per allocation period

a) $T_{DMG}$ defines the maximum amount of GTS time per allocation period that a DEV is capable of using. $T_{DMG} > T_{GTS}$
b) If there is unused bandwidth, the extra channel bandwidth can be divided up among DEVs based on what they can actually use.
c) Allows channel utilization to be maximized.

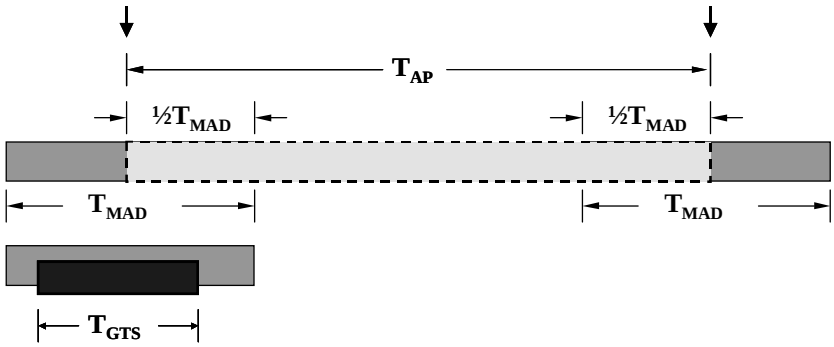
Maximum allocation delay

a) $T_{MAD}$ defines an allowable time jitter to the allocation of time slots by the piconet coordinator, PNC.
b) The maximum allocation delay starts before the end of the allocation period, but does not affect the PNC's reference timing of the $T_{AP}$ period. It allows some variability in position of the GTS slot(s).

Requirements for Data Rate Only QoS

a) The transmit buffer is large enough to accept GTS slots anywhere in the superframe.
b) The amount of bandwidth only depends on the data rate required fd, the data rate available, and the amount of overhead.
c) $T_{AP}$ / TGTS = ($f_D/f_S$) / ( $N_T$ / $N_E N_{MPDU}$ )
d) Define $T_{MAD}$ = 0xFFFF, which will be a special value indicating "anywhere in CFP".

The $T_{GTS}$ (blue) time is the total amount of slot time that must be allocated by the PNC within the $T_{MAD}$ (green) time centered around the start of the $T_{AP}$ interval (vertical arrows).



Ed. action: Change the CTRB to match the figure. The new figure and new text are below:

| **octets: 1** | **1** | **1** | **2** | **2** | **2** | **2** |
|---|---|---|---|---|---|---|
| Target AD-AD | EPS status | Stream index | Allocation period | Minimum GTS time | Desired GTS time | Maximum allocation delay |

**Figure 11—Channel time request block for a particular stream**

The allocation period has different meanings depending on the value of the EPS status field.

If the EPS status field indicates that this request is for an EPS mode channel time request, then the allocation period is an integer, N, ranging from 1-65535 that indicates what fraction, 1/N, of the EPS slots require this allocation. A zero value is not allowed for this field and shall cause the command to be ignored by the recipient.

Otherwise, the allocation period is for an ACTIVE mode CTA and defined as the block of time that the DEV is using to calculate the other parameters in this block. The resolution of this field is 1 ms and so the range of this field is [0-65535] ms.

The minimum GTS time is the minimum duration of the time that is acceptable at the requesting DEV in any time slot. The resolution of this field is 8 ms and so the range of this field is [0-524280] μs.

The desired GTS time is the amount of time that the DEV would prefer to have allocated. The resolution of this field is 8 ms and so the range of this field is [0-524280] μs.

The maximum allocation delay defines the allowable time jitter in the allocation of the GTSs with respect to the allocation period. The value 0xFFFF indicates that the DEV has no jitter requirements for the GTS. The resolution of the channel time field is 8 ms and so the range of requested time is [0-524272] μs.

The relationship of the allocation period, minimum GTS time, desired GTS time and maximum allocation delay is discussed in 8.4.3.3.

New section added to clause 8, is 8.4.3.3, text follows;

8.4.3.3 QoS considerations for channel time allocation

The DEV needs to map its QoS requirements into the parameters of the channel time request block, Figure 60. This subclause describes one way to map the DEVs requirements into the CTRB parameters. A compliant DEV may use another method to determine what values of the CTRB are required to fulfill its throughput and QoS requirements. In this subclause, the following terms are used:

- $f_D$ = Bits/s of delivered data.
- $N_B$ = Number of bits of source buffer available to store the data to be communicated.
- $N_{MPDU}$ = Number of bits in the data portion of one packet of data.
- $N_{OH}$ = Equivalent bits of overhead of one packet of data including: actual MAC header bits, slot guard times, PHY overhead, etc. (i.e. everything but the data). It simplifies the explanation to express this as an equivalent number of bits.
- $N_E$ = Channel (PHY) encoding in bits/symbol
- $f_S$ = Channel symbol rate in symbols/s.
- $T_{BCN}$ = Beacon period in seconds.
- $T_{AP}$ = The allocation period, in seconds.
- $T_{GTS}$ is the total time, in seconds, requested for GTS allocated in order to send one buffer of data.
- $T_{MAD}$, defines an allowable time jitter to the allocation of time slots by the piconet coordinator, PNC.

The allocation period, is a time reference that the DEV uses in calculating the other parameters. In general, the allocation period is how often the $N_B$ buffer must be sent to get the desired delivered data rate $f_D$, i.e . $T_{AP} = N_B/f_D$. In order to transmit the buffer, the DEV needs to send $N_P$ packets over the network, where each packet is $N_T = N_{MPDU}+N_{OH}$ bits in length.

The minimum GTS time is then be calculated using $T_{GTS} = (N_P N_T / N_E f_S)$. The desired GTS time should not be more than the maximum amount of GTS time per allocation period that a DEV is capable of using. If there is unused bandwidth in the piconet, the PNC could choose to allocate the extra channel bandwidth among the DEVs based on what they can actually use. This allows channel utilization to be maximized.

The maximum allocation delay starts before the end of the allocation period, but does not affect the PNC's reference timing of the $T_{AP}$ period. This allows some variability in position of the GTS(s). The DEV determines this time based on the jitter requirements of the data stream that it needs to send. Figure ?? illustrates the position of $T_{MAD}$ within $T_{AP}$. The $T_{GTS}$ time is the total amount of slot time that needs to be allocated with in the $T_{MAD}$ time cntered around the start of the $T_{AP}$ interval.

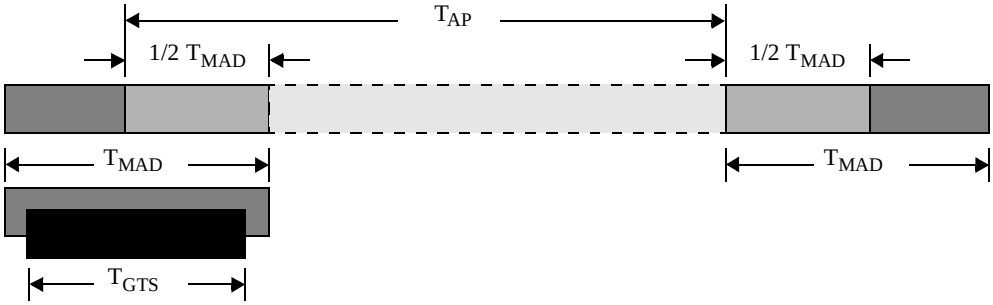



**Figure 12—Illustration of the position of $T_{MAD}$ within $T_{AP}$**

Based on the requirements for $T_{MAD}$ within $T_{AP}$, the PNC has many possible ways to allocate the GTSs required by the DEV, as illustrated in .

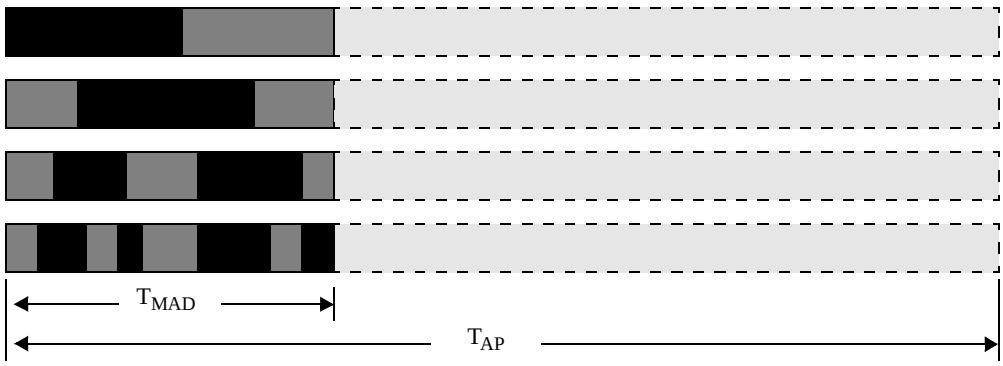



**Figure 13—Possible GTS allocations that meet $T_{MAD}$ requirements**

For streams with only data rate requirements for QoS, the transmit buffer needs to be large enough to accept GTS slots anywhere in the superframe. The amount of bandwidth only depends on the data rate required, $f_D$, the data rate available, and the amount of overhead. In this case, $T_{AP}/ T_{GTS} = (f_D/f_S) / ( N_T / N_E N_{MPDU} )$ and the value of $T_{MAD}$ is set to 0xFFFF, which is the special value indicating "anywhere in CFP", 7.5.8.1.

### 1.6 Document 01/517r2

| Octets: 1 | 1 | 1 | N |
|---|---|---|---|
| Element ID | Element Length | AD-AD | Application Specific Data |

**Figure ??--Application Specific Information Element (ASIE)**

The Element ID field shall have the value (the next available reserved ID).

The Element Length shall be K+1 where K is the number of octets in the Application Specific Data field.

The AD-AD is set by the PNC as the index of the application specific capable device that will make use of this information element.

The Application Specific Data is specified by the PNC. Its use by the application specific capable device is beyond the scope of this standard.

More than one ASIE may be placed in any beacon by the PNC. All ASIEs shall be the last information elements in the beacon.

The ASIE shall be the last information element in the beacon.

The ASIE shall only be used by the PNC after negotiating the application specific capability with a DEV using a standard a GTS or CFP message exchange.

The negotiation of the application specific capability between the DEV and the PNC is beyond the scope of this specification.

The use of the DATA field of the information element is beyond the scope of this specification.

Ed. action: Added new element and updated the summary table. New text and figure follows:

7.4.15 Application specific information

The power managment parameters element shall be formatted as illustrated in Figure 14. The purpose of this information element is to allow custom information for enhanced operation that is outside of the scope of this standard .

| octets: 1 | 1 | 1 | variable |
|---|---|---|---|
| Element ID | Length | AD-AD | Application specific data |

**Figure 14—Application specific information element**

The AD-AD is set by the PNC as the index of the application specific capable device that will make use of this information element.

The application specific data is specified by the PNC. Its use by the application specific capable device is beyond the scope of this standard.

More than one application specific information element (ASIE) may be placed in any beacon by the PNC. All ASIEs shall be the last information elements in the beacon. The ASIE shall only be used by the PNC after negotiating the application specific capability with a DEV using a standard a GTS or CFP message exchange. The negotiation of the application specific capability between the DEV and the PNC is beyond the scope of this specification. The use of the application specific data field of the information element is beyond the scope of this specification.

## 1.7 Document 01/502r1

### 1.7.1 Remove Delayed ACK Expedite (Issue 248)

Issue: This is redundant with 7.2.1.8 Del-ACK Request in the frame control field. Section and figure numbers are from D07.

Clause 7.2.4 Stream ID

Remove pg 75 line 1 and 2:

"The Del-ACK expedite field is used to request that the accumulated Del-ACK's be sent as soon as possible. This is described in more detail in 8.7.3."

Modified Figure 5 Stream ID Field

| **its: 0** | **1:3** | **4:11** | **12:15** |
|---|---|---|---|
| **tream type** | **Priority** | **Stream index** | **Reserved** |

Ed. action: Deleted the Del-ACK, re-arranged the bits so that stream index was on a byte boundary and fiddled some of the words. Complete stream control section is below:

7.2.4 Stream control

The stream control field is 16 bits in length and is used to uniquely identify a data stream. This field is valid only for data frames. This field is is set to zero, and ignored upon reception, in all other frame types.

| **bits 0:7** | **8** | **9:11** | **12:15** |
|---|---|---|---|
| Stream index | Stream type | Priority | Reserved |

**Figure 15—Stream control field**

This field contains three sub-fields, stream index, stream type and priority.

The stream index field is an 8-bit field with the value of zero reserved for non-stream data. The DEVs use the rest of the values of the stream index as dynamically assigned by the PNC during the setup of the data stream. The PNC allocates a unique value of stream index for each stream in the piconet.

The stream type shall be set to '1' for streams requiring isochronous services and shall be set to '0' otherwise.

The priority field indicates the priority of the stream and is defined in A.3.

Any frame that does not belong to an established stream and does not need a stream connection is a non-stream data frame. Any non-stream data frame is transmitted with the stream index value of zero. The use of a stream connection for asynchronous or isochronous data is up to the DEV.

### 1.7.2 Multicast Stream Establishment (Issue 339)

Issue: There is currently no mechanism specified to set up a multicast stream

Clause 7.5.21 Figure 49

Modify

For a broadcast stream, the involvement of intended receiver is precluded.

To

For a broadcast or multicast stream, the involvement of intended receiver is precluded.

Ed. action: This sentence occurs in 8.6.1, not in 7.5.21 Figure 49. The sentence was changed as indicated in D09. Excerpt from D09 is below

8.6.1 Stream connection

A stream shall be connected only after tripartite communication/negotiation among the DEV that is originating the stream, the DEV that is the intended receiver of the stream and the PNC. For a broadcast or multicast stream, the involvement of intended receiver is precluded. Once connected, the stream is sent in a peer-to-peer style.

### 1.7.3 Slotted ALOHA Reference for the Bibliography (Requested by Jim Allen)

Stallings, Data and Computer Communications, Second Edition, Macmillan, 1988, pp300-302

Ed. action: reference added to Bibliography clause, text is below:

[B1] Stallings, *Data and Computer Communications, Second Edition*, Macmillan, 1988, pp. 300-302

### ~~1.7.4 Channel Time Requests - only from stream source (Issue 412)~~

~~Issue: Since the originator of a stream request can be the source or the target of the stream, it is not clear which DEV can make Channel time requests: the originator of the request, the source of the stream, either if they are not the same?~~

~~8.3.3.2 Channel Time Allocation (CTA) and channel time usage~~

~~Add the following sentence the first paragraph:~~

~~Only the DEV that is the source of a stream can send Channel Time Request commands for that stream.~~
Tabled 11/13/01

Ed. action: No action taken.

### 1.7.5 Association Response Success Reason Code (Issue 410)

Issue: DEV should not have to look at AD-AD field to determine success or failure of the association. That should be in the reason code.

Association Response Command Format 7.5.3

~~Remove the following sentence from the sixth paragraph:~~

~~If this field contains the association address (0xFE), the DEV is not allowed to associate for the reason mentioned in the reason code.~~ Keep this 11/13/01, James will modify as appropriate.

Change the reason codes as follows:

The valid reason codes are:

- 0 -> Success
- 1->Already serving maximum number of DEVs
- 2 -> Lack of available bandwidth to serve the DEV
- 3 -> Channel is severe to serve the DEV
- 4 -> PNC is turning off with no AC in the piconet
- 5 -> DEV wishes to disassociate
- 6 -> Channel change is in progress
- 7 -> PNC hand over is in progress
- 8 -> DEV authentication failed
- 9-255 -> reserved

Ed. action: Reason codes modified as indicated above. I changed code 3 to read “Channel is too severe to serve the DEV”

### 1.7.6 MAC Frame Formats (Issue 393)

Issue: Since there are now only 4 frame types, all DEVs shall be able to process all frames, except only PNC capable devices must be capable of creating beacon frames.

Clause 7

Replace "In addition" through the end of the paragraph with:

In addition, every DEV shall be able to construct these frame formats for transmission, and to decode frame formats upon validation following reception. The only exception is that a DEV that is not PNC capable need not be able to construct beacon frames.

Ed. action: Changed as indicated in D09.

### 1.7.7 Beacon Information Elements (Issue 398)

Issue: D07 does not explicitly specify which information elements are optional or mandatory in the Beacon.

Table 62

| Information Element | Note | Present in beacon |
|---|---|---|
| Device ID | … | In Every Beacon |
| Piconet Synchronization Parameters | … | In Every Beacon |
| TPC element | … | As Needed |
| Channel change | … | As Needed |
| Channel time allocation (CTA) | … | As Needed |
| Parent Device ID (if child or neighbor piconet) | … | As Needed |

Ed. action: Added new column to the beacon table, new table is below:

**Table 5—Beacon frame body**

| Information element | Sub-clause | Note | Present in beacon |
|---|---|---|---|
| Device identifier | 7.4.1 | IEEE 802 address of the PNC | In every beacon |
| Piconet synchronization parameters | 7.4.2 | Beacon number and other time duration elements | In every beacon |
| Piconet maximum transmit power | 7.4.10 | Sets the max TX power level in the piconet | As needed |
| Channel change | 7.4.5 | During change to new channel | As needed |
| Channel time allocation | 7.4.11 | All the channel time allocation in the current superframe | As needed |
| Device identifier of parent PNC (if child or neighbor piconet) | 7.4.1 | IEEE 802 address of the parent PNC | As needed |

### 1.7.8 Open Scan (Issue 317)

Issue: Need to define passive scanning for any PNID. 8.2 currently only addresses searching for a specific PNID.

Clause 8.2.1 Scanning through Channels

Replace the following sentence:

While scanning, the DEV shall ignore all the received frames with a different PNID than the one for which the DEV is searching.

With:

If open scan is specified in the MLME-SCAN.request, the DEV shall perform open scan. In open scan, the DEV searches for any PNID. If open scan is not specified, the DEV shall ignore all the received frames with a different PNID than the one for which the DEV is searching.

Ed. action: Changed as indicated by Jay Bain.

Clause 6.3.2.1 MLME-SCAN.request

Modify the primitive as follows:

MLME-SCAN.request ( OpenScan,
PNID,
ChannelList,
ChannelScanDuration)

Add the following Entry to Table 5

| | | | |
|---|---|---|---|
| Open Scan | Boolean | TRUE/FALSE | Identifies if scan is Open Scan or not |

Ed. action: OpenScan added as a parameter and entry added to the tabel for MLME-SCAN.request as indicated above. Added “Open scan is defined in 8.2.1” to the description element.

### 1.7.9 Peer Discovery (Issue 365)

Issue: … any DEV may send any directed command frame to any other DEV in the piconet to determine if the destination DEV is still present in the piconet." Comment: This sentence implies that the DEV can send a Retransmission req, Channel Status request, Association req, Disassociation req, and Sleep state req as "pings" to the destination device. Doesn't this get confusing if all the transmitting DEV wants to do is determine whether the destination DEV is present?

Clause 8.8, paragraph 3

Modify the sentence as follows:

In addition to the above, any DEV may send probe request command with the information request field set to zero and ACK set to immediate ACK ~~any appropriate directed command frame~~ to any other DEV in the piconet to determine if the destination DEV is still present in the piconet.

James will add additional clarification to the probe request text to specify that if the request field is null, the DEV shall respond with immediate ACK only.

Ed action: Sentence modified as indicated above in D09. The modified probe request command is shown below, text that was added is underlined.

The probe request command is used either to request information about a DEV or to see if a DEV is still present in the piconet. This command may be exchanged between any two DEVs in the piconet. The individual information elements used in this frame are described in 7.4. The stream control field in the probe request frame header shall be set to 0x00 and shall be ignored upon reception. The probe request command frame structure shall be formatted as illustrated in Figure 16

| octets: 2 | 2 | 2 | Variable |
|---|---|---|---|
| Command type | Length | Information request | Information elements |

**Figure 16—Probe request command format**

The least significant 15 bits of the information request field is a bitmap to indicate the information requested of the destination of DEV. The sender sets a value of '1' in a bit to request the information element that corresponds to the bit position. Otherwise the sender sets the bit to '0'. The bit position for an information element is same as the value of the element-ID for that information element. That is, the bit position of 'n' in information request field corresponds the information element whose element ID, Table 74, is 'n'. An all-zero value in this field means that the source DEV is not expecting any probe information from the destination DEV, but is providing the information about itself to the destination DEV in the elements following this field. In this case, the destination DEV only ACKs the frame if it is received correctly and does not respond with a probe response command.

## 1.8 Document 01/410r0

Ed. action: Changes made by Allen Heberling, in D09. New MLMEs include: MLME-CHANNEL-STATUS, MLME-CHANGE-CHANNEL, MLME-PROBE-PNC, MLME-DEV-INFO and MLME-STREAM-CTA.

## 1.9 Document 01/469r3

Ed. action: All changes from r2 are in D08, new information in r3 is editorial, i.e. it is in MLMEs and MSCs that reflect what is in the normative text but do not provide new technical information. All edits and updates performed by Allen Heberling.

## 1.10 Document 01/530r2

Ed. note: Awaiting input from security subcommittee.

## 1.11 Items in 01/374r12, entered into D09 and noted in the minutes.

Ed. action: Changes already made at Austin meeting, notes on changes are included in 01/374r12.

## 1.12 Change the MLME commands to reflect the frame formats and information described in clause 7 and 8.

Ed. action: Changes made by Allen Heberling.

## 1.13 Change backoff algorithm to use PHY dependent parameters rather than numeric times. Use 802.11 as a model to write this.

## 1.14 Update neighbor piconet information to reflect changes in 01/481r4

Ed. note: 01/481r3 was included in D08. The changes from r3 to r4 of the document were:

Rev 40

1) Removed the neighbor association request command (see rev 1) and added text to the (normal association request format to accommodate the neighbor association.
2) Removed the neighbor channel time request from figure def.
3) Modified table 63 to remove the neighbor association request and the neighbor channel time request.

Ed. action: Removed the extra commands as noted with new text for the association request. Note that the text is changed based on item 16 below. Made changes to 8.2.6 in the first paragraph to reflect the new usage of the association request command. Actual text is below:

8.2.6 Neighbor piconet

If after following the scan procedure in 8.2.1, no channels are available, then a neighbor alternate coordinator (i.e. an AC from a different system), may attempt to start a neighbor piconet within an existing piconet. To start a neighbor piconet, the neighbor AC shall send an association request, defined in 7.5.2.1, using the association address, 7.2.3, as the source address of the frame. The neighbor PNC bit in the capability field shall be set as indicated in 7.4.3 when the association request command is sent.

## 1.15 Add mapping of supported data rates from 5 bits to 8 bits by adding 3 binary 0's as the MSB.

Ed. action: Added the following text to the PHY clause, last paragraph of the clause:

The encoding of the supported PHY data rates into an octet number is accomplished by adding bits b5-b7, all set to zero, to the encoding given in Table 102. Bit b0 is the lsb while bit 7 is the msb. Thus a DEV that supports 11, 22 and 33 Mb/s would have a capability information element 01000 (lsb to msb) and an octet encoding of 0x2.

## 1.16 Move supported data rates field in figure 19, 7.4.3, to be bits b0-b4. Add bit b10 to be neighbor piconet bit. Text for neighbor piconet bit is: "The neighbor piconet bit shall be set to 1 if the DEV is intending to be a neighbor PNC in the current piconet and shall be set to 0 otherwise." Change "is set to" to be "shall set to" in 7.4.3. Change 01/481r4 to use neighbor piconet bit instead of 0 capability field to identify and neighbor association request.

Ed. action: Changed as indicated, figure and text follows:

| bits: b0-b5 | b6-b9 | b10 | b11 | b12 | b13 | b14 | b15 |
|---|---|---|---|---|---|---|---|
| Supported data rates | Reserved | Neighbor PNC | PSAVE | PSRC | SEC | PNC-Des-Mode | AC |

**Figure 17—Capability field format**

The supported data rates element is a PHY dependent mapping of the optional data rates to a 5 bit field that indicates which of the optional data rates are supported by a DEV. For the 2.4 GHz PHY, this mapping is defined in Table 105.

The neighbor piconet bit shall be set to 1 if the DEV is intends to be a neighbor PNC, 8.2.6, in the current piconet and shall be set to 0 otherwise.

The PSAVE bit shall be set to 1 if if the DEV is planning to use sleep state as a part of power management. Otherwise the PS bit shall be set to 0. The PNC shall always set this bit to 0 in its capability field.

The PSRC field shall be set to 1 if the DEV is receiving power from the AC (alternating current) mains and shall be set to 0 otherwise.

The SEC bit shall be set to 1 if the DEV is capable of supporting encryption for its data streams. Otherwise SEC bit shall be set to 0.

The PNC-Des-Mode is the designated mode of the DEV as currently set. This bit shall be set to 1 if the DEV is in the PNC mode. Otherwise this bit shall be set to 0.

The AC bit shall be set to 1 if the DEV is capable of being a PNC in the piconet. Otherwise AC bit shall be set to 0.

## 1.17 Change "is shown in figure xx" to be "shall be formatted as illustrated in figure xx" for frame formats, information elements, command types and field format figures in clause 7.

Ed. action: Changed as indicated in clause 7 for all frame format figures.

## 2. Editorial changes

- 7.4.12 MAX CTAs element, reformat to match the previous sub-clauses in 7.4 and move the functional description to clause 8.
- Check the PNC handover process to make sure that we state that the current PNC checks the DEV-info table to find the most qualified AC to become the new PNC.
- 7.3.1 Add xref to the channel change element and the CTA element in table 58 verify the use of the correct terminology. Also, change the Device ID entry to be device identifier element with description “IEEE 802 address of the PNC, xref 7.4.1” Change to piconet synchronization element and xref in notes.
- 7.3.1 Add text that says that the beacon elements can occur in any order and that DEVs shall ingnore information elements other than the ones defined.
- 7.4.6 Add pad byte for word alignment and text for how to handle the pad byte.
- 7.4.3 Fix the TBD in the PHY table mapping by adding the appropriate section to the PHY and the xref to it in 7.4.3.
- 7.4.2 Fix length parameter for piconet sychronization parameter.
- 7.3.3 and 7.3.4, define the SA and DA for the command and data frames.
- 7.5.1, 7.5.2, 7.5.3, Make notes that the PNC selection commands, and the association commands are never sent with other commands. Or perhaps better is to say that a command can only be piggy-backed with commands that are sent with the same SA and DA pair.
- 7.2.1.9 Note that the beacon shall not have the SEC bit set (perhaps this is true of the command frames?).
- 7.5.2 ATP definitions disagrees with 8.2.5 definition of ATP. Did we fix this since Schaumburg.

Ed. action: ATP is now consistent in the document, changes were made in Austin and all issues related to this were closed.

- 7.5.17 (D06) add xref to stream identifier element to the appropriate information element (stream ID)
- Page 104, change aa to a

Ed. action: Fixed in D09

- 7.5.21 Fix QoS paramters length in table 49, fix table sizing for table 51
- 7.5.21 Need to get a good definition for Max Burst Size
- Figure 27, change length of the individual elements to be 7 instead of 6.
- 8.8 The acronyms TPC and DCS are mentioned, but are not defined. It should be DFS rather than DCS. Perhaps delete this sentence.

Ed. action: TPC was added to the acronym list in D08, DCS was added in D09 as “dynamic channel selection.

- Change format of annex A CS-SAP parameters to match the format in the layer management clause.
- MA-UNITDATA.request supports 3 types of ServiceClass:
  for asynchronous: reorderable and strictly ordered
  for stream based: only reorderable multicast.
  However, the MA-UNITDATA.indication indicates only two possible classes:
  reorderable and strictly ordered.
  Shouldn't reorderable multicast be an option?
- What about adding "channel sucks right now" to the MA-UNITDATA-STATUS.indication as a potential error code? (Actually, we would add something like "undeliverable, possibly due to poor channel conditions")