IEEE P802.15
Wireless Personal Area Networks

Project	IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)	
Title	**TG3 Chicago Ad-Hoc Meeting Working Document**	
Date Submitted	[29 August, 2001]	
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Re:	[]	
Abstract	[This document is contains the issues and resolutions developed by the PHY subcommittee at its interim meeting..]	
Purpose	[To provide a record of the resolutions of the PHY subcommittee.]	
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1. Goals

1) Transmit Power Control recommendation and wording - **RESOLVED**
2) Power Management Criteria recommendation and wording **- RESOLVED**
   Proposals from R. Gubbi and J. Bain
   Use Evaluation Criteria Matrix to select one of the PM proposals
3) Security Proposal recommendation and wording
   Propsal by G. Rasor
4) Resolve QoS MLME-primitives
   Proposal by A. Heberling
5) The rest of the issues list. (perform triage prioritization on issues and resolve the most important ones first.) **- Results in P802.15-01/374r0**

Items to communicate:

1) Describe Protocol Implementation Conformance Spec. (PICS) to authors
2) SDL Scope and Effort

2. Agenda

Tuesday August 28th:

8:00 am	Call meeting to order
8:01 am	Approve/modify agenda
8:05 am	Begin work on goals* in the order listed
10:00 am	Recess for break
10:20 am	Meeting called to order
10:21 am	Continue work
12:00 pm	Recess for lunch
1:00 pm	Meeting called to order
1:01 pm	Continue work
3:00 pm	Recess for break
3:20 pm	Meeting called to order
3:21 pm	QoS presentation and discussion by Heberling
4:00 pm	Conference Call w/ Eryk Dutkiewicz of Motorola Labs Australia re: QoS
6:00 pm	Recess for dinner

Wednesday, August 29th:

8:00 am	Meeting called to order
8:01 am	PICS presentation - Gilb
8:15 am	SDL scope and effort presentation - Heberling
9:00 am	Continue work on goals
10:00 am	Recess for break
10:20 am	Meeting called to order
10:21 am	Continue work
12:00 pm	Recess for lunch
1:00 pm	Meeting called to order
1:01 pm	Continue work
2:40 pm	Recess for Break
3:00 pm	Meeting called to order
3:01 pm	Continue Work
4:00 pm	Adjourn meeting

3. Items to resolve

3.1 Transmit Power Control recommendation and wording

Document numbers 01/292r1 section 7.4.8, 01/293r1 section 8.12, 01/319r0 (comparison)

NOTE: Two modifications is needed in the PHY for TPC. In order to enforce consistency and interoperability for TPC, standardized transmitter power levels are required. Following the guidelines of the ERC, the TX power levels are specified as Effective Isotropic Radiated Power (EIRP). A table of the defined TX power level settings needs to be defined. These settings can be defined in 1 dB steps, in order to allow appropriate EIRP settings for all frequencies and regulatory domains. It is not required, nor is it expected, that all power levels will be implemented in a given DEV. The only requirement is that the device is capable of TX power levels that will allow compliance. Under this scheme there are two basic mechanisms that can be used for TPC, a fixed maximum power level for all DEVs within a piconet or multiple power settings that are controlled by PNC. These are described below.

8.12 Transmit power control

(editorial comments about how wonderful this is, JPKG will write it) Adjustable transmitter power is a flexible way to achieve transmit power control while at the same time reducing overall interference levels.

8.12.1 Fixed maximum transmitter power for CAP and beacon

With this method, the appropriate maximum power level for the CAP and beacon may be determined by the PNC. The PNC shall convey this information to the DEVs via the beacon frames using the TPC element, xref. The PNC shall not set the maximum CAP power level below the aPHYMinReqTXPower, which is defined for the 2.4 GHz PHY in xref. All DEVs within the piconet shall set their nominal maximum transmit power level for frames in the CAP to be no more than the value indicated in the TPC element in the beacon.

8.12.2 Adjustable transmitter power in the GTS

With adjustable TPC, each DEV may request that the other DEV it is communicating with in an allocated GTS set its transmitter power to a certain level. A DEV shall use the TPC element in a TBD command, xref, to request the change in the power level setting of the other DEV for all GTSs assigned between the two DEVs. The other DEV shall increase or decrease its transmit power level as indicated in the TBD command if the power level setting is supported by that DEV. If the power level change is not supported by the other DEV, it shall use the closest implemented TX power level. The other DEV shall apply the change in the power level for all GTSs assigned between the two DEVs.

An example of this is:

1) DEV-1 estimates that its receive power from the DEV-2 is 6 dB higher than necessary.
2) DEV-1 sends a TBD command with a TPC element to the DEV-2 with the requested TX power level change.
3) DEV-2 sets the TX power level to the requested power level. If the chosen power level is not implemented by DEV-2, it chooses the closest implemented TX power level and sets that as the TX power level for subsequent transmissions to DEV-1 in the GTS allocated.

Note: A DEV may also change its transmit power based on its own estimation of the channel.

Changes to clause 7.

Add TPC information element, length 2 bytes, first byte is number of supported TX power levels, second byte is power level step size in 1 dB resolution, e.g. a number 4 in this field means the devices has nominaly 4dB steps. If a DEV does not support TPC, it shall set both numbers to 0.

7.4.8 Transmit power control (TPC) element

The TPC element is illustrated in Figure 1.

Octets: 1	**1**	**1**	**1**
Element ID	Length (=2)	TX power level	Reserved

Figure 1—Transmit power control (TPC) element

The TX power level element is a one byte field that indicates reqested TX power level change in dB at the destination DEV in 2s complement format. For example, a +2 db change in the TX power level is 0x02 while a -2 dB TX power level change is encoded as 0xFE.

3.2 Power Management Criteria recommendation and wording

Proposals from R. Gubbi (01/292r0, 01/293r0) and J. Bain (01/262r2, 01/315r4, 01/421r0)

Differences:

- (RG) PNC shall have the capability to buffer frames sent to sleeeping DEVs in repeater mode. (MS + JB) Only if repeater service is supported, the PNC may store frames for forwarding to a sleeping station.
- (JB) All operations for sleeping stations are synchronized with each other, not just with the PNC.
- (RG) The DEV that wishes to sleep (in repeater mode) requests the sleep state only from the PNC, not by a negotiation with the other DEV in the repeater service.
- (MS + JB) Sleep state is approved via the ACK of the request command rather than by a response frame from the PNC.
- (MS+ JB) 2 CTA's vs. 1 CTA (RG) and uses the 2-CTA's to manage the sleeping as opposed to using 3 commands in either the CAP or GTS.
- Is the PNC responsible for buffering data sent to stations that are sleeping? (RG) Yes (JB+MS) No.

Differences in the support of applications

- (MS+JB) Supports persistent low data rate, low power usage devices, e.g. audio terminals. (via 2 CTA's and no additional handshakes) To add to RG, would like to drop the 2-handshake sequence to send data.
- (RG) Makes sure that the DEV is awake before attempting to send data (2-handshake)
- Match EPS operation to the application requirements (JB+MS) via the negotiation process.
- Supports dual-rate applications, e.g. video-conferencing, audio + video. (JB+MS) via 2-CTA's

Potential problems

— (RG) Max sleep time until you have to send an “I’m awake” message. Can this be less than ATP? Suggest that this time (MaxSleepTime) is set equal to ATP.

3.3 Use Evaluation Criteria Matrix to select one of the PM proposals

3.4 Security Proposal recommendation and wording

Proposal by G. Rasor

3.5 Resolve QoS MLME-primitives

802.16 has service-flows to differentiate QoS parameters.

Provision - service flow with QoS determined by provider.

4. New Items

4.1 Improvements to PS modes

Add “Wake-on-WPAN” capability via the MLME-POWERMGT.indication, needs some work in the table and description of the parameter.

Add Null-CTA element, proposal due from M. Schraeder. Include analysis of the impact on the size of the beacon.

Proposal to add information element to the device information request that communicates a DEV’s current PS state by John Barr.

Proposal to use un-used bit in CTA to indicate EPS or awake modes - M. Schraeder.

Proposal to create 2 byte information elements (i.e. no length) - James Gilb

4.2 Changes to PNC selection process

Delete the following sentences from 8.2.3

“ Under this scenario, the winning AC may also send a directed PNC-selection frame to the other AC and the other AC shall ACK the frame if it is received correctly.”

and

“announce its pullout from the competition by sending a broadcast alternate PNC pullout command, 7.5.1.2. In addition, the AC may send a directed alternate PNC pullout command announcing the pullout to the winning AC and the intended recipient shall ACK the frame if it is received correctly. This process shall continue until all the ACs except the winning AC announce their pullout.”

and add the text

“If the AC finds that its parameters score higher than the received ones, the AC shall continue to broadcast the PNC-selection frame. If the AC finds that its parameters score lower than the ones received, the AC shall

no longer send the alternate PNC selection command and wait for the piconet to start within the last received indicated timeout."