IEEE P802.11

Wireless Access Method and Physical Layer Specification

Section 5.3 Response to Draft D1 Letter Ballot Processed at May, 1995 Meeting

Michael Fischer
Digital Ocean, Inc.
4242Ð3 Medical Drive
San Antonio, TX 78229 USA
Phone: +1Ð210Ð614Ð4096
Fax: +1Ð210Ð614Ð8192
E-Mail: mfischer@CHILD.com

Abstract: This paper presents the Section 5.3 Response to Draft D1 Letter Ballot comments processed at the May, 1995 meeting of IEEE P802.11.

Action: Adopt the changes recommended in this set of comment responses to replace the relevent portions of Section 5.3 of P802.11/D1.1,
as shown in the companion document P802.11-95/101. In cases where the recommendations resulting from these comment responses affect sections other then 5.3, the recommended text changes are identified in ÒeditorÕs notesÓ in document P802.11-95/101.

5.3 PCF 1	bdobyns	T	RESPONSE The stated problem is acknowledged as a flaw. The resolution of comments on subsequent material in this section provides the mechanisms by which a PCF can operate over a singleÐchannel PHY. Restriction that PCF cannot overlap coverage area with another PCF on same channel is fundamental flaw. Prohibits use of PCF with single-channel PHY, severely restricts use of PCF with N-channel PHY where N is small. PCF must be redesigned to permit the functionality of PCF to be delivered with single channel PHYs (or alternative way to deliver functionality). 1. superframe timing 2. cf period management 3. cf data delivery	
5.3 PCF 2	bdobyns	T	RESPONSE: Rejected because resolution of subsequent comments defines the operation of contention free service under such overlap conditions. Append to paragraph 2 "The restriction on PCF operation for few-channel PHY need not preclude the overlap of Access Points for those PHY. It only precludes the PCF-style beacon behavior and a superframe delimited contention free service."	
5.3 PCF 3	C. Heide	t	RESPONSE: This information appears in section 5.3.2. Comment is accepted but the material does not belong in this introductory section. specify what happens if there is a collision in the contention free period (by some STA which is hidden from part of the BSS).	since the PCF is build on the DCF, when the Point Coordinator backs off, what if a DCF STA gets control? Is there a gap in the CF period for the transaction to complete?
5.3 PCF 4	C. Heide	t	RESPONSE: The start of the contention free period is identified by a field in beacon frames. The contention free period must start with a beacon frame. specify how a STA knows the start of a superframe.	the success of the contention free period is largely based on STAs knowing that it is in progress and setting their NAVs. If they can't do this, then partially hidden STAs will often see DIFS when there aren't any and destroy the CF burst.
5.3 PCF 5	C. Heide	t	RESPONSE: Remove 2nd paragraph, overlap behavior is discussed in subsequent section. second paragraph, second sentence, remove the clause "in a manner that results in destructive interference with frame transfer."	there is no manner of overlap that won't result in destructive interference, so why leave the excuse open?

5.3 see PCF 5	C. Thomas Baumgartner	t	RESPONSE: same as comment PCF 1. 2nd paragraph is not acceptable to PAR requirements. Remove it. Can substitute discussion of mechanism decided on to handle overlapping point-coordinated BSA's.		There is no fully defined way to support time bounded services other than PCF. PAR says we must support time bounded services. Therefore can't restrict some (radio?) PHY's from using PCF. Not necessary to restrict any PHY. I propose a method to handle overlapping PCF BSA's (on same channel). If a STA hears PCF polls from an AP not it's own it tells its own AP of situation which causes the AP to change channels. I'm not sure how this works in FHSS since hop sequences eventually intersect but I'm sure we can quickly figure out how to handle this. Maybe the STA using FHSS concludes it is on same channel if it hears other AP polls twice within a number of hops. IR doesn't have overlap problem so not a problem that it has only one channel.
5.3 PCF 6	D. Johnson	T	RESPONSE: Rejected as unnecessary under current PHY, can be added when new PHYs are defined in frequency bands which have a defined etiquette. The mechanism used to permit a CFP to span multiple dwells with an FH PHY is probably applicable to permit a CFP to span multiple medium occupancy periods, with intervening, non-CF traffic, as would be necessary under typical etiquette rules. Modify the PCF specifications to be consistent with a spectrum etiquette.	Operation in the US with unlicensed spectrum now, and likely in the future, will require conformance to an etiquette. The etiquette must operate on a power sense/timing basis only and must control fair access to any system conforming to it. This includes systems that do not necessarily conform to an interoperability standard. As a long-shot alternative, it may be possible to establish a regulatory arrangement in the US in which only one interoperability standard is permitted, much as HiperLAN in Europe. In this case the PCF could operate as specified, but this would require development of a very strong rationale. This change is highly recommended, but may not be possible in a convenient time schedule and is not a condition for changing the vote. A dialog should be set up with WINForum to determine what may be required to provide for a PCF function in the US in a future revision.	

5.3 PCF 7	Fischer, Mike.	T	RESPONSE: replace paragraph 1 with the text replace text with: The Point Coordination Function (PCF) provides contention free services. It is an option for a station to become the Point Coordinator. All stations inherently obey the medium access rules of the PCF, because they are based on the DCF, with the Point Coordinator gaining priority access to the medium using a PIFS which is smaller than the DIFS used for the DCF access to the medium. The operating characteristics of the PCF are such that all stations are able to operate properly in the presence of a BSS where a PCF is in operation, and (if associated with a point coordinated BSS) receive asynchronous data frames send under PCF control. It is an option for a station to become the Point Coordinator, as well as to be able to respond to contentionÐfree polls by a Point Coordinator with CFÐdata transmissions. A station which is able to respond to contentionÐfree polls is referred to as CFÐAware, and may request to be polled by an active Point Coordinator during each superframe. When polled by the Point Coordinator, a CFÐAware station may send one data or CFÐdata frame to any destination (not just to the Point Coordinator). If the addressed recipient of a CFÐdata transmission is not CFÐAware, that station acknowledges the transmission using the normal DCF acknowledgement rules, and the Point Coordinator retains control of the medium using a PIFS duration before resuming CFÐtransfers.	update to match CFÐusage and subtype encoding that appear elsewhere in this draft
5.3 SEE PCF 5	Geiger	T	RESPONSE: same as comment PCF 5. The basic restriction is that a PCF can not overlap with another PCF on the same channel in a manner that results in destructive interference	This can not be guaranteed! Several things are missing from the standard to even come close to making this possible. First, there is no way to control a mobile unit's power. A 1000mW node can cross over several PCF functions with no control. Secondly, we specify no area restrictions in standard to limit range of PCF and associated nodes. This must be investigated further before it is either accepted or rejected in the Draft. I feel that this function must be removed.
5.3 SEE PCF 5	Lewis	T	RESPONSE: same as comment PCF 5. clarify limitations. If restricted to certain PHYs, state which PHYs. Need a clear mechanism to either control PCF contention or clearly define the set of conditions in which PCF is permitted or supported. If all conditions are not met, a station should not be permitted to intiate PCF.	
5.3 SEE PCF 5	Rick White	T	RESPONSE: same as comment PCF 5. ¶ 2: If the use of PCF access is restricted to certain PHY type, these types must be defined. Otherwise this sentence should be removed.	Not defined
5.3. SEE PCF 1	Mahany	T	RESPONSE: same as comment PCF 1. Add mechanism to control PCF contention in ESS or multiple independent BSS installations.	Second paragraph, it is not clear how PCF contention controlled in <u>any</u> PHY when multple BSS's are present simulataneously. IR is single channel , DS with limited channel set has high probability of overlap on a given frequency, or even in FH when occasional simultaneous usage of a given frequency will occur.
5.3.1 PCF 8	bdobyns	T	RESPONSE: Rejected Ñ There does not appear to be a need for the max an min to be managed (in fact, it is unclear that there is any need to restrict these values in the standard). Define a Superframe Length Minimum and maximum (and put the min, max in the MIB).	
5.3.1 PCF 9	C. Heide	t	RESPONSE: Accepted insofar as DCF operates during CF period as well as contention period. clarify the first paragraph and figure 5-15 to be consistent with figure 5-2.	The PCF runs over the DCF, they are not mutually exclusive.

5.3.1 PCF 10	C. Heide	t	RESPONSE: The Òsuperframe lengthÓ is a poor name, since what is being described is a Òcontention free repetition rateÓ rather than a length. Rename (globally) superframe to CFP rate. Add CFP_Rate managed object (GET, REPLACE) and add a CFP_duration field to beacon frames. explain where the length of CF parameter originates.	to preset their NAVs all STA must have the same parameter for length of superframe - from where to they get this and how is it assured they all have the same.
5.3.1 See PCF 9	C. Thomas Baumgartner	t	Change 3rd sentence of 1st paragraph to " Within a given SF period, the PCF shall be active in the Contention Free Period, while the DCF is active all the time.	Figure 5.2 shows that DCF is basis for and always present with PCF. This is important to me because this was the major claim of superiority made for this protocol so we better not forget it.
5.3.1 PCF 11	C. Thomas Baumgartner	t	RESPONSE: Partially accepted. ÒThe CFP_rate is determined by a higheyer managment entity. The current CFP duration is determined by the point coordinator, subject to the CFP_Max managed entity.Ó Change 1st sentence of 2nd paragraph to "The length of a SF is determined by the PC."	If manageable we need to say by whom
5.3.1 See PCF 10	David Bagby	T	RESPONSE: Covered by response to PCF 10. **1. Superframe Structure** Hum, the MAC group needs to discuss the super frame stuff again - I have heard it argued that the concept of the super frame is no longer applicable due to the way the CFA stuff has evolved. IF this is true then, the references to superframe need to be removed from the draft before sponsor ballot (refs in this section and others).[DB1]	See imbeded comments and annotations
5.3.1 PCF 12	Fischer, Mike.	T	RESPONSE: The access procedure updated in 5.3.2 provides for CFPs which span dwells wth an FH PHY, so the restriction is removed, thereby addressing the problem. The restriction of the superframe duration to not exceed the dwell time in an FHSS PHY renders the FHSS PHY essentially unable to support CF services of any kind with the typical dwell times listed in the current draft. This is unacceptable, so if the FHSS PHY is retained a means of permitting multipleÐdwell superframes must be found. Lengthening the dwell to several hundred milliseconds is not an appropriate solution, because of excessive delivery delays and variance that introduces to time bounded service when retries are necessary. I do not have a good solution to suggest, but urge that one be found or we will have to choose between no TBS or no contentionÐbased service with the FHSS PHY.	see column to right as well as other comments of mine regarding the dwell time limits (section 10.6.12)
5.3.1 PCF13	Geiger	T	RESPONSE: This section no longer attempts to define the hop dwell time. The hop dwell time is undefined	Define the period of time
5.3.1 PCF 14	Rick White	T	RESPONSE: Partially accepted. Superframe terminology is removed. The possibility of delay of transmission of beacon transmissions still exists, but particular MAC/PHY pairs can minimize the occurrence of this by appropriate setting of MIB elements if desired. Superframe stretching must be removed.	There is not reason for it and it just complicates the synchronization of STAs. A STA should not transmit an Asynchronous frame if it and its ACK are not complete before the end of a superframe.

5.3.1 PCF 15	Wim Diepstraten	T	RESPONSE: Accepted in the context of other changes. CFP always begins with a beacon, CFP_rate is an integral number of beacon intervals. The start of a CFP is determined by a Beacon with a nonÐzero CFP_remaining_duration field. Superframe boundaries should be specified, such that they relate to the TSF. This allows stations to setup their NAV for a length of CF_Boundary, when they detect that a PCF is active in the BSS. The following is needed: "The target SF starting time will be when TSF mod SF_Length = 0." The text should also identify how the relevant parameters of SF_length and CF_Boundary are distributed. The prefered method is to put them in the Beacon.	The relevant parameters need to be put in the Beacon, rather then in the Association Response, because the latter will not work for overlapping stations of an other BSS.
5.3.1, et seq See PCF 10	Bob O'Hara	T	RESPONSE: Same response as PCF 10. Delete the Superframe concept.	Superframe is a holdover from PCF TBS. Since PCF TBS is no longer supported, the superframe is no longer necessary. Because the PCF can gain priority access to the medium (through the use of PIFS) a superframe is not needed to support STAs in power saving modes either.
5.3.2 PCF 16	C. Heide	t	RESPONSE: Accepted. first paragraph third sentence remove the word "associated".	Any STA can become a PC not just a AP according to previous paragraphs.
5.3.2 PCF 17	C. Heide	t	RESPONSE: Bits are in the frame subtype, as listed in Section 4. specify what bit in the header.	cannot find any such bit in section 4.
5.3.2 see PCF 17	C. Thomas Baumgartner	t	RESPONSE: Same response as PCF17. Get these authors of this section together with the authors of Section 4 to determine where the CFP ACK bit should go in the frame header. There is a reserved bit in Frame Control field.	Wonderful improvement to the efficiency but not implemented in the frame format description of Section 4.
5.3.2 PCF 18	Fischer, Mike.	T	RESPONSE: Rejected. Instead insert statement that ÒA point coordinator may only operate at a station the provides DSS functionality. This can either be an AP in an infrastructure network, or a station designated as an AP, with null DS, in an IBSS. Ad-hoc networks cannot use the PCF. Add a statement that ÒThe PCF is not required to be located at the same station as the AP, but for most uses of contention free communication, any other configuration results in reduced throughput and increased transit delays for most frames.Ó	A sizeable percentage of BSS traffic is expected to have the AP as either transmitter or receiver. Hence the greatest gains from the lack of need for backoff and the piggybacking of acknowledgements comes when the AP station is TA of each CFÐdown frame and RA of each CFÐup frame.
5.3.2 PCF19	Rick White	T	RESPONSE: By setting CFP_rate nonÐzero in a CF_Aware AP. How is the "one special STA per BSS called the Point Coordinator" determined. This must be defined.	Not defined
5.3.2 PCF20	Rick White	T	RESPONSE: Accepted. There are no longer any CF-Up and CF-Down frames. This section must be rewritten to reflect the currently defined Frame types and subtypes	
5.3.2.1 See PCF 20	Bob O'Hara	T	RESPONSE: Same response as PCF20. Update to reflect current frame types in table 4-1	out of date

5.3.2.1 PCF 21	C. Thomas Baumgartner	t	RESPONSE: Accepted. Change last sentence to "Even if a DCF station do not set its NAV to the maximum CF-Period at the beginning of a SF for some reason, the shorter PIFS...needed by stations using DCF only."	Seems to me the setting of NAV is primary method of DCF deferal. Stations don't have a protocol called Contention period, the use DCF which results in their transmissions being in the Contention period.
5.3.2.1 PCF2 2	Geiger	T	RESPONSE: Agreed, but the definition belongs in Section 4, not Section 5.3. CF-End Frame needs to be defined	CF-End Frame is not defined anywhere
5.3.2.2 see PCF 4	A. Bolea	T	RESPONSE: Same response as PCF 4.	It is not clear how a station knows when the SF is starting.
5.3.2.2 PCF 23	C. Heide	t	RESPONSE: Accepted. first paragraph, last sentence, replace "eliminates" with "minimizes".	because of hidden stations the possibility of a corrupted CF period cannot be eliminated.
5.3.2.2 PCF 24	C. Heide	t	RESPONSE: Accepted with modifications for current terminology. ÒAll STA in the BSS, other than the PC, shall set their NAVs to the value in the CF_dur_remaining field in the beacon frame.Ó first paragraph, first sentence should be "All non CF-aware STA shall preset their NAVs to the maximum ..."	If CF aware STAs set their NAVs, then they cannot transmit during the CF period.
5.3.2.2 see PCF 24	C. Thomas Baumgartner	t	RESPONSE: Same response as PCF24. Must describe how STA knows the beginning of the SF so it can set its NAV.	This important operation not explained
5.3.2.2 PCF 25	C. Thomas Baumgartner	t	RESPONSE: Accepted. Updated text is ÒDuring the CFP, stations shall ignore their NAV when directed to transmit by receipt of a Data+CF-Poll, Data+CF-Ack+CF-Poll, CF-Poll, or CF-Ack+CF-Poll frame.Ó Add to end of 1st paragraph "Stations operating in PCF mode will ignore their NAV when they are directed to transmit by PC."	If everyone sets NAV at beginning of SF then no STA could transmit according to rules set up previously.
5.3.2.2 PCF 26	Fischer, Mike.	T	RESPONSE: Accepted with modification that the PIFS immediately precedes the beacon rather than immediately following the beacon. There appears to be considerable simplification to synchronizing the superframe with the beacon interval, especially in cases where the AP and PCF are colocated. Recommend adding a statement that ÒThere shall be an integral number of superframe intervals per beacon interval. The timing of these shall be synchronized such that the PIFS interval to gain medium access for one of these superframes immediately follows each beacon transmission.Ó	simplification, avoidance of severe delay in beacon generation when the nominal beacon interval occurs during a superframe (when the PCF and AP are not colocated) and the AP is not near the head of the polling list
5.3.2.2 - see PCF1 0	Gegier	T	RESPONSE: Same response as PCF10. CF_Period parameter add to MIB table	CF_Period not listed in MIB table
5.3.2.2 see PCF 10	Renfro	T	RESPONSE: Same response as PCF 10.	Describe how stations know superframe timing.
5.3.2.2 PCF 27	Rick White	T	RESPONSE: Rejected. The PCF distributes the CF_dur_remaining value in the beacon. The MIB contains the CF_max_duration. How does a station know what the Maximum CF-period length is? This must be defined and must be a PCF distributed value.	

5.3.2.2 PCF 28	Tom T.	T	RESPONSE: Rejected, this information is sent in the beacon frame which is required to occur at the beginning of each CFP. It is necessary to provide synchronization between beacon interval and CFP repetition interval. As a result, this is better done in a beacon field rather than overlaying yet another usage on the duration field (which is supposed to be uniform across multiple frame types). Replace the first sentence of the first paragraph with the following: The Duration field of the first Data frame sent by the PCF at the beginning of the Superframe shall have a value equal to the length of the contention-free period desired for this superframe by the PCF. Subsequent Data frames will have a duration field equal to the time remaining until the end of the Contention-Free period.	Throughout section 5.3 there is mention of the 'Start of the Superframe'. In this section each station is somehow supposed to know when this start is. There are two choices; use the duration field as mentioned to the left, or have a beacon or some kind of CF-Start frame at the beginning of each Superframe. (I would personally prefer a CF-Start frame, however the duration field solution builds on an existing capbility and has less impact on the standard)
5.3.2.2. See 23	Fischerma:NAV Operation (Within the context of PCF operation)	T	RESPONSE: Same response as PCF23. First paragraph, missing reference: how do stations determine the beginning of the SF?	I cannot find a reference in D1 that indicates the mechanism for STATIONS to determine the beginning of the SuperFrame.
5.3.3.1 PCF 29	Bob O'Hara	T	RESPONSE: Provisionally accepted. Certainly immediate retransmission for the retry count used for DCF is inappropriate. There is a potential benefit to having a separate CF_retry_count parameter. When CF_retry_count = 0, the behavior is as suggested in the comment. When CF_retry_count = 1 there is some recovery for bit errors on the medium. Larger CF_retry_count values are not likely to be beneficial. The addition of the CR_retry_count is an issue for further discussion. Add as the last sentence in the section: "CF frames shall not be retransmitted in the case of failure of acknowledgement."	The combination of priority access and retransmission without competition will lead to starvation of non-CF STAs in cases of noisy media or marginal transmission conditions.
5.3.3.1 PCF 30	C. Heide	t	RESPONSE: No change needed. The PC transmits after a PIFS interval in the case that the medium is not busy at that time. If the STA responds after an SIFS interval, the medium will be busy at the PIFS interval after the PCÕs last transmission. third paragraph second sentence says "after a PIFS gap" - if this means without regard to busy medium it should say so.	if this is the case I want it pointed out so that I can object. If the response is there, but not being seen by the PCF, then transmitting blindly after a PIFS will corrupt it and the retransmission will never work and is just a waste of everybody's time.
5.3.3.1 PCF 31	C. Thomas Baumgartner	t	RESPONSE: Rejected. The concept of ÒCF-AwareÓ pertains to whether a station is able to respond to a CF-Poll. All stations are capable of receiving Data frames (of any Data subtype) during the CFP, as well as Data frames (basic data subtype) during the contention period. If a non-CF-Aware station receives a valid Data frame, an ACK control frame is used to acknowledge because the non-CF-Aware station is not able to piggyback its acknowledgement on a Data frame sent in response to the CF-Poll. Second paragraph describes something that can't happen--a non CF aware station transmitting during the contention free period. I don't know solution but must be decided and changed.	But can a station that is not CF aware transmit during the CF period because it has set its NAV at the beginning of the SF period? I assume that all stations can ser NAV at beginning of SF since the description of that action didn't say otherwise. On thinking about this more I believe that pseudocode for sending of ACK and CTS in any circumstance includes ignoring NAV.

5.3.3.1 PCF 32	C. Thomas Baumgartner	t	RESPONSE: Accepted. change last sentence of 3rd paragraph to "...control and transmit the next frame after sensing that the medium is clear for a PIFS gap..."	Sentence doesn;t make it clear that PC is checking for medium busy during the PIFS gap.
5.3.3.1 PCF 33	Rick White	T	RESPONSE: Accepted. ¶ 1: There is not a CF-Poll bit in the subtype field. CF-Polls are Async Data frame subtypes.	
5.3.3.1 PCF 34	Rick White	T	RESPONSE: Accepted. ¶ 2: There is not a CF-Ack bit in the subtype field. CF-Acks are Async Data frame subtypes.	
5.3.3.1 PCF 35	Rick White	T	RESPONSE: Rejected. The paragraph will be reworded to clarify that the CF-Ack function in the frame subtype represents an acknowledgement of the immediately preceding frame, without regard to the addressed recipient of the payload if the frame type is Data+CF-Ack or Data+CF-Poll+CF-Ack. ¶ 2: D2 must be for the same station if it id to be used for Acking the U1 frame. Otherwise the PCF will send a normal ACK.	
5.3.3.1 PCF 36	Rick White	T	RESPONSE: The clarification is that the non-response applies to CF-Poll. Receipt of a valid frame must be acknowledged in all cases. ¶ 4: In ¶3 it states that if a station is not PCF aware, it should responded with an ACK to a CF-Down frame. In ¶4 it states that a CF-Down frame need not be acked. Contradiction must be resolved.	

5.3.3.1. PCF 37	Fischerma:PC F Transfers when the PCF station is Transmitter or Recipient	T	RESPONSE: Rejected. The problem described in the column to the right does not occur. The PC knows whether a response is expected by whether a CF-Poll (alone or with Data and/or CF-Ack) is encoded in the subtype of a transmission from the PC. If a response is expected and the response does not occur after the SIFS interval, the PC can assume that the response will not occur, and can maintain control of the medium with the transmission of another frame after the PIFS interval from its preceding transmission. Last paragraph of section: Note that a station must at least respond with an acknowledgement for the preceeding CF-Down frame. The lack of any response to the CF-Down frame will be considered an error.	See first paragraph of this section: The PCF shall send (CF-Down) frames between the start of the CF–Period and the CF–End using the SIFS gap except in cases where a transmission by another station is expected by the PCF and an SIFS gap elapses without the receipt of the expected transmission. In such cases the PCF shall send the next (CF-Down) frame a PIFS gap after the end of the last transmission. A CF-Poll bit in the Subtype field of these frames will allow the stations to send their (CF-Up) data if any. Stations shall respond to the CF-Poll immediately when a frame is queued, by sending this frame after an SIFS gap. This results in a burst of Contention Free traffic; the CF-Burst. .... Last paragraph of this section: Note that a station need not respond when the station has no CF-Up traffic to send, and no acknowledgment is required to be returned for the preceding CF-Down frame. A responding CF-Up frame in these cases shall not be considered an error. This section has the following problem: How can the PCF know whether to expect a response or not if this is an option for the receiver? This forces the PCF to a choice of "always separate PCF transfers by PIFS, because there might be a response frame for any transfer." I.e.: If no acknowledgement is required to be returned, then the PC is likely to begin a new CF-down frame after SIFS, since the PCF is allowed to separate CF-down frames by SIFS when it does not expect a response. Now assume that the receiver of the first CF-down frame takes the "option" of generating a "responding CF-Up frame" in this case (even though it is NOT required), but the PCF is NOT expecting a response. The receiver will create a collision with the PC because it has taken this option. Therefore, the "option" should be stricken from the specification, and the generation of a responding CF-Up frame when the PCF is not expecting it should be considered an ERROR and illegal. Basically, the problem here is that there needs to be explicit requirements on the part of the CF-aware station, such that the PCF can determine whether or not a response is forthcoming. If the PCF cannot make this determination, then the rule earlier in this section needs to be changed, such that all CF-down traffic for which a response cannot be predicted should be separated by PIFS instead of by SIFS. Such a delineation is not currently clear.

5.3.3.2 PCF 38	C. Heide	t	RESPONSE: Rejected. The two issues listed in the column to the right are not problems. For issue (1), the destination station is irrelevant. If the source station received the CF-Poll, the PC will be able to hear the transmission to the destination, the duration field of which provides the information the PCF needs to know when it may resume transmissions. The resumption by the PC occurs an SIFS duration after the ACK or a PIFS duration after the duration in the Data frame, whichever occurs first. For issue (2), these stations cannot Òseize the mediumÓ because the CF-Poll function permits the station to initiate one transmission, so the frame + Ack length limits apply. station to station transfer in the CF period should not be allowed	(1) if the PC can't hear the destination station the transfer will never work and will corrupt forthcoming transmissions from the PC. (2) the length limit of the CF period cannot be guaranteed because the PC has no control over how long these two STA seize the medium.
5.3.3.2 PCF 39	C. Thomas Baumgartner	t	RESPONSE: Accepted. Add after 2nd sentence "To allow this transaction the PCF, when it receives a data frame no directed to it, waits PIFS instead of SIFS.	This action is implied but better to explicitly state it.
5.3.3.2 PCF 40	Mahany	T	RESPONSE: Accepted. Change Max MPDU Length (Figure 5-17) to MSDU Length	Must allow for full MSDU, with fragmentation. Also see Mahany comment at 5.3.4.1
5.3.3.2 PCF 41	Renfro	T	RESPONSE: Update text to clarify that receipt of a CF-Poll allows the transmission of a single MPDU, and that each MPDU is acknowledged, just as with transfers during the contention period.	States that PCF will resume CF-Down transmissions after SIFS period after ACK. What if message being acked contains additional fragments? Either PCF must be assured of hearing message or PCF must wait PIFS after ACK to begin transmission.
5.3.4 PCF 42	C. Heide	t	RESPONSE: Remove this material from Section 5.3. The PCF provides an alternative mechanism for frame delivery, not a different service class. If a time bounded service using contention free frame delivery is to be defined, the subject of this comment needs to be addressed. However, this text does not belong in Section 5.3. define TBS that "may have multiple service levels."	what does that mean?
5.3.4 PCF 43	Fischer, Mike.	T	RESPONSE: Accepted. Replace this text with ÒThe PCF provides an alternate mechanism to access the WM. Within this contention free medium access, both asynchronous and time bounded services can be provided.Ó	clarify that CF is not a service but a medium access modality
5.3.4 See PCF 42	Rick White	T	RESPONSE: Same response as PCF 42. If Contention Free Time Bounded Services "may have multiple service levels", they must be defined.	Not defined.
5.3.4.1 PCF 43	Fischer, Mike.	T	RESPONSE: Accepted. Change equation for CF_Boundary to be Max. Fragmented MPDU with RTS/CTS and ACKÓ	leave room for a full contention-based frame per superframe
5.3.4.1 PCF4 4	Geiger	T	RESPONSE: CF_max is being added to MIB. aMax_Frame_Length is in MIB, and is relevant parameter, rather than maximum async MPDU. Question on backoff is unclear Ñ the people processing this comment see no difference between backoff at the end of the superframe and backoff at any other time during the superframe. Also Ñ the comments to the right do not appear to relate to these questions Ñ has some text been lost in aggregation of the comments? How does BACKoff operate during the end of the superframe? CF_Boundary missing from MIB. Max. Async MPDU is undefined and missing from MIB.	The amount of time allowed for the contention period, one max size MPDU is silly. I believe that the contention free period should take no more than 1/2 of the superframe, especially if it is intended for real-time traffic. This allows bursty traffic to get through at a reasonable rate without moving up to priority type of traffic. The priority traffic doesn't have any defined mechanism for congestion control. This is unacceptable.

5.3.4.1 PCF4 5	Geiger	T	RESPONSE: Accepted. The CF_duration_remaining field in the beacon frame provides for a CFP that exceeds one FH dwell period. Some people would like to see the dwell time in FHSS PHY not exceed more than a few max packet lengths. This is to avoid interference from microwave ovens etc. We might consider that a Superframe extend over several hop & hop dwell periods rather than size it to a single dwell time	One consideration for Superframes to contain several hops & hop dwell periods is that one might be able to scale hop times dynamically without impacting the Superframe.
5.3.4.1 PCF 46	Greg Smith	T	RESPONSE: Rejected. This sort of arbitrary limit is unnecessarily restrictive for a general rule that does not take application or traffic characteristics into account. The contention free period shall be limited to 50% of the SuperFrame	Having a mechanism in the standard that allows one implementation (CF-aware) to shut down async only stations to one packet per SuperFrame could be considered predatory. After all in an ISM band the CF period is going to have to cope with other outside interference, why not async traffic.
5.3.4.1 see PCF 43	Mahany	T	RESPONSE: A functionally comparable resolution with a more general timing s proposed for PCF 43. Revise so that superframe allows at least one fragmented Asynchronous MSDU may be transmitted per superframe using RTS, CTS mechanism, , with fragment length set to aMPDU_Minimum. Alternatively setting fragment length to aMPDU_Current_Maximum would be acceptable.	It is not clear whether the provision for one max. Asynchronous MPDU allows for fragmentation, RTS, CTS collision avoidance, etc. This must be made explicit, as it may preclude use of some access mechanisms (or fragmentation) if PCF is used, or it may force adaptive algorithms to establish SF length.
5.3.4.1 PCF 47	Renfro	T	RESPONSE: Accepted.	Must allow time for max MPDU and Max contention window. If large amount of contention traffic, superframe will continually stretch to the point where there will be insufficient time for contention free service in a particular superframe.
5.3.4.1 PCF 48	Rick White	T	RESPONSE: Rejected. The relevant MIB variables are CFP_rate and CFP_max_duration. Must define a MIB Value for length of the Contention Free period.	Not defined.
5.3.4.1 See PCF 14	Rick White	T	RESPONSE: Same response as PCF 14. ¶ 2: Superframe stretching must be removed.	There is not reason for it and it just complicates the synchronization of STAs. A STA should not transmit an Asynchronous frame if it and its ACK are not complete before the end of a superframe.

5.3.4.1. PCF 49	Fischerma:Contention Free Length Limit	T	RESPONSE: Accepted in principle. The superframe concept is largely irrelevant, but the expected transmission time for beacons, some of which occur at the start of CFPs can, and will be delayed under a variety of circumstances. The principal requirement for minimizing these variations occurs in a PHY-specific manner (such as FH needing to maintain hop synchronization), not for a CF-mandated purpose. Time bounds can be calculated for a time bounded service that uses CF frame transfer with or without rules about the apportionment of time within the contention free repition period. The time usage guidelines will be reexamined after completion of the rules to permit PCF operation with overlapping single-channel PHYs. Size of superframe should be revisited, based upon objective.	The reasoning given for the chosen value of the limit is nonsensical. The requirement needed in order to guarantee the time necessary for "at least one maximum size Asynchronous MPDU" to be transmitted during the contention portion of the superframe is infinite. This is because in a heavily loaded network, it is possible (although not likely) for collisions to consume the entire contention portion of the SF. The choice of the size of one maximum size Asynchronous MPDU increases the probability of transmission of a contention period frame, but it does not guarantee it. Once a frame begins, the medium should be sensed busy by the PCF, and therefore, SF stretching should result to allow any size asynchronous frame to be transmitted. If the point is to avoid SF stretching, then this method might help to minimize SF stretching, but there is still the possibility of a first contention frame (or a combination of frames) using 99% of the contention period, and the next asynchronous frame being a maximum size MPDU then stretching the SF into the next CF period for the maximum possible amount of time anyway. The limit should be set based upon the 95% confidence interval for collision resolution given a "large" number of contending nodes all attempting to gain control of the network immediately following the end of the CF period PLUS some period of time (like the maximum length asynchronous MPDU) in order to attempt to guard against excessive SF stretching. Probability of SF stretching is very likely in any case anyway.
5.3.4.2 PCF 50	A. Bolea	T	RESPONSE: Accepted.	References to CF-Poll, CF-ACK Bits need to be corrected using new frame types. This applies to other sections also.
5.3.4.2 PCF 51	Bob O'Hara	T	RESPONSE: Accepted. replace the second sentence of paragraph two with: " A CF-aware station shall acknowledge receipt of each Asynchronous Data frame of the CF-Poll subtypes from the PCF using Data frames of the CF-ACK subtypes, sent after an SIFS interval. A CF-aware stationshall acknowledge receipt of all other Asynchronous Data frames using ACK Control frames sent after an SIFS interval.	Update to reflect new frame subtypes.
5.3.4.2 PCF 52	C. Heide	t	RESPONSE: RTS/CTS is never used during the contention free period. rule 1 - previous sections say that RTS/CTS use is controlled by the RTS_Threshold parameter. Clarify how this rule is broken in the CF period.	contradicts section 5.2.7
5.3.4.2 PCF 53	C. Heide	t	RESPONSE: Accepted. rule 3 - correct the last sentence, a STA is allowed to respond or not respond.	contradicts 5.3.3.1
5.3.4.2 See PCF 52	C. Thomas Baumgartner	t	RESPONSE: Same response as PCF 52. Change to "1. Only Data frames, resulting ACK frames (if any), RTS frames, and resulting CTS frames shall be sent..."	Sentence was incorrect. RTS/CTS is allowed to enhance reliability of CF transmissions against hidden nodes and to aid in resolving overlapping BSA contention.

5.3.4.2 PCF 54	Fischer, Mike.	T	RESPONSE: Accepted, especially because some PHYs may have good reasons to transmit beacon frames during the CFP, and there seems to be little benefit in allowing beacon frames but prohibiting other management frames. There appears to be no reason for prohibiting management frames during the CF period. Suggest deleting usage rule #1.	In general, management frames can be send anywhere data frames are allowed, hence they should be permitted during the CF period.
5.3.4.2 See PCF 50	Rick White	T	RESPONSE: Same response as PCF 50. Contention Free usage rules must be rewritten in order to eliminate the reference to bits and instead reference frame subtypes.	There are no longer CF bits in the control field of the MAC header. They are different Frame types.
5.3.4.2 See PCF 54	Wim Diepstraten	T	RESPONSE: Same response as PCF 54. All management frames should also be allowed to be send during the CF-period.	The limitation is not necessary, and does greatly increase the Beacon timing complexity, because the SF-interval and Beacon interval can not be alligned.
5.3.5 PCF 55	bdobyns	T	RESPONSE: Rejected. The rational statement seeks to overcome the single-channel restrictions which have been addressed elsewhere in this section. Also, the asynchronous CF service is connectionless, so the use of Start Connection Request is inappropriate. Permit ACFS to be initiated in a non-PCF environment with a *Start Connection Request*	This allows few-channel PHY which cannot support PCF functions because of overlap restrictions to still support a contention-free service which may have a better Qos than the regular Async service.
5.3.5 See PCF 50	Bob O'Hara	T	RESPONSE: Accepted. Update paragraphs to reflect new subtypes in table 4-1	Out of date.
5.3.5 PCF5 6	Geiger	T	RESPONSE: Accepted. The introductory wording predates the current CF mechanism, and will be rewritten to reflect the usability of the CFP to convey asynchronous (e.g. connectionless) and connection based traffic. Asynchronous traffic is characterized by its bursty, connectionless nature. The ACFS allows	This paragraph is a bunch of bull. The difference between data transfers in the contention free period versus the contention period is the QoS. The contention free period allows a connection oriented service to be established with some QoS associated with the access to the media and predictable results when the media is busy or no more contention free period is available. The contention period provides no QoS. No bandwidth can be reserved or guaranteed nor can delay or congestion be managed. Access to the contention free period is managed by the PFC. Access to the media during the contention period is asynchronous in the sense that the point in which a stations grabs the media is not predictable by any other station in WLAN. Accesses in the CF period are predictable by the PCF and other station in the WLAN. Talking about a ACFS procedure is silly. The discussion here should be about connection oriented or connectionless services, not ACFs what every that means.
5.3.5 See PCF5 7	Geiger	T	RESPONSE: Same response as PCF 57. The polling list is a logical construct,... This list has to be more than this. If the intent of the CF period is to provide better QoS than the contention period, how the QoS is implemented is a function of the MAC.	If the MAC is going to control the access to the media, and part of that access involves some QoS parameters, then how the MAC administrates the QoS of the polling list better be in the standard. Managing the CF polls and who needs service versus who doesn't during each frame must be a function of the MAC, not some higher layer.

5.3.5 PCF 57	Rick White	T	RESPONSE: Accepted. The full scope of how polling list management might be pefformed does not have to be within the standard. However, a minimum set of polling list management facilities must be defined to permit arbitrary CF-aware stations to operate with arbitrary CF-capable Aps. This minimum set appears to include modal listing (request CF as part of association, and remain on polling list as long as association continues), connection-initiated listing (added to polling list when connection granted, remain on list until connection ended, only for connection-oriented services), and trafic based (indicate CF-aware at association, be added to polling list after sending a contention-based frame with toAP=1, remain on polling list until some number of CFPs have elapsed without generating any toAP traffic nor receiving any fromAP traffic). Must define how a station gets on the "polling list".	
5.3.5.1 See PCF 50	Bob O'Hara	T	RESPONSE: Accepted. Update paragraphs to reflect new subtypes in table 4-1	Out of date.
5.3.5.1 PCF 58	Bob O'Hara	T	RESPONSE: Accepted. Paragraph two is difficult to understand and must be rewritten	Ambiguous
5.3.5.1 PCF 59	C. Heide	t	RESPONSE: If this occurs, the PC does not send or poll for any traffic, but immediately sends a CF-End frame. clarify what the PC does if the superframe has been delayed s long there is no longer time to send at least one Data frame.	conflict between requirement to send at least one data frame and to restrict the maximum length of a superframe and allow superframe start delay.
5.3.5.1 PCF 60	Rick White	T	RESPONSE: The PC may change the length of the CFP up to the CFP_Max duration from the MIB. The current value in use is available to the stations from the CF_duration_remaining field in the Beacon frame. Must define whether the PCF can change the CF_Boundary based on the amount of CF traffic expected.	Not defined.
5.3.5.1 PCF 61	Rick White	T	RESPONSE: Accepted. The polling list is processed in sequential order by SID, with processing resuming at the first entry after reaching the end of the list. If there is insufficient time to process the entire list in a single CFP, processing resumes on the next CFP at the point where processing was suspended at the end of previous CFP. To facilitate the use of the CFP in conjunction with power saving operation by stations, it would be beneficial to have beacons include information on which SID in the TIM will be processed first in the CFP that follows the beacon (if any). Must define how the PCF works through the "polling list". If it is not completed during a CF period, does the PCF start over the next period or pick up where it left off?	Not defined.
5.3.5.1 See PCF 50	Rick White	T	RESPONSE: Accepted. Must rewrite to reference Data frame subtypes, not bits in the header	There are no longer CF bits in the control field of the MAC header. They are different Frame types.
5.3.5.2 See PCF 57	Rick White	T	RESPONSE: Same response as PCF 57. How a STA gets on the "polling list" must be inside the scope of the standard and must be defined. A mechanism must be defined to allow a station to be added to the "polling list".	
5.3.6 PCF 62	C. Heide	t	RESPONSE: Accepted. Relevant changes will be made in 5.3.6, but the connection mechanism definition in Section 3.2 is where most of the updates are needed. specify how a connection request is denied.	how is a connection request denied - sending an End Connection in response to a request Connection? This section doesn't say.

5.3.6 PCF 63	Rick White	T	RESPONSE: Accepted, but this belongs in Section 4, not Section 5.3. Must define all frames and the content of each of the fields.	This whole section must be rewritten with more detailed information on how the frames are used and what happens when a frame is received. Since they are management frames, they are not passed up to or received from the LLC.
5.3.6.1 PCF 64	Bob O'Hara	T	RESPONSE: Defined in Section 3.2.3. However, these definitions (in D1) are inconsistent with 5.3.6, which needs to be fixed in conjunction with those working on section 3. Define "Start Connection Request"	There is no "Start Connection Request" defined in the MAC service interface.
5.3.6.1 See PCF 64	Bob O'Hara	T	RESPONSE: Same response as PCF 64. Define "Start Connection Indication"	There is no "Start Connection Indication" defined in the MAC service interface.
5.3.6.2 See PCF 64	Bob O'Hara	T	RESPONSE: Same response as PCF 64. Define "Start Connection Request"	There is no "Start Connection Request" defined in the MAC service interface.
5.3.6.2 PCF 65	Bob O'Hara	T	RESPONSE: Accepted. replace "N.B." with appropriate standard language and functional description.	Proper standard language required
5.3.6.2. See PCF 65	Fischerma:AP Start Connection Request	T	RESPONSE: Same response as PCF 65. Last pargraph of this section: N.B. AP and STA Start Connection Request frames are the same type, using the "To AP" bit to distinguish them.	Let's be definite about the type designation - the two type fields are identical or they are not - the original text used the term "can" in the sense of they might be if you want them to be...
5.3.6.3 PCF 66	C. Heide	t	RESPONSE: Accepted. last sentence, change the second "connection" to "STA".	the STA is what gets added to the poll list, not the connection.
5.3.6.3 PCF 67	Tom T.	T	RESPONSE: Accepted. Change Grant Connection frame type to Connection Response. Change in first line: 'MAC may reply' with 'MAC shall reply'. Delete first sentence of second paragraph. Replace third paragraph with: The connection may be granted or denied by the AP and shall indicate this using the Status Value and Error Indicator elements.	It is better to make these exchanges more deterministic. Getting no response at all gives the higher layers no information about what's happening, therefore a negative response should be used.