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Re:	Supporting document for Comment to 802.16maint.
Abstract	Changes required in order enabling good operation of 802.16 systems.
Purpose	The document is intended for consideration within the comments resolution process.
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Problems with Initial Ranging in OFDM PHY and a Solution

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References

[1] IEEE, "IEEE Standard for Local and metropolitan area networks Part 16: Air Interface for Fixed Broadband Wireless Access Systems," IEEE Std 802.16-2004.
[2] IEEE, "IEEE Draft Standard for Local and metropolitan area networks Part 16: Air Interface for Fixed Broadband Wireless Access Systems," IEEE P802.16-REVd/D5-2004.

Introduction

The changes proposed in this document are to correct errors in the description of Initial Ranging, and in particular the lack of detailed specification for the use of sub-channelised initial ranging for the OFDM PHY mode, as described in IEEE 802.16-2004 [1, 2].

Description of Problem

In section 8.3.7.2 [2, page 479] there are a number of statements regarding the mechanism a sub-channel capable SS is to adopt during initial ranging. However, there are no STL diagrams showing the actions of either the BS or the SS during these phases. This requires modifications in section 6.3.9.5 [2, page 177 forward] and changes to the diagrams in figures 61, 62. In addition, the process described in 8.3.7.2 indicates a single-shot subchannelized initial ranging. No timers are defined indicating whether this should be done once or many times, and using maximum power implies that the SS could generate a power overshoot (as observed by the BS) of 12dB.

Page 182, Line 34
Test "Time to increase power?" does not seem to have a timer associated with it.
Page 182, Line 42, "Go to minimum power" needs modifying to have subchannelised ranging adding.
Note, even if not subchannelised, is there a timer that will stop a terminal from trying again for a while? If not, then we need further changes: surely this is needed as a failing terminal will generate access noise that may in turn stop other SS from acquiring a link.

The steps in power are not defined. If they are chosen too small, then the number of contention ranging retries will be exhausted before the SS has increased its power sufficiently. Number of re-tries is fixed (16).

The timer that stops additional initial ranging is available in the current text through T19. But T19 is an SS internal parameter whose value is not accessible to the BS, and the BS may like to encourage the SS not return for a large amount of time. At very least a well known minimum value should be provided.

Another problem in the subchannelized initial ranging is that the text specifies that SS shall attempt subchannelization IR if the BS supports that. However, there is a problem, because the SS does not know at this stage whether the BS actually is capable of subchannelization. This capability is negotiated only at the SBC stage. One solution is that the BS shall report the subchannelized IR capability in the UCD message, as indicated in the text changes that follow.

1

Text Changes

Text changes are relative to [2].

Insert section as follows:

6.3.9.5 Initial ranging and automatic adjustments
6.3.9.5.1 Contention based Initial ranging and automatic adjustments

[*Modify the second paragraph as indicated*:]
For SC, SCa and OFDM PHY, the SS shall put together a RNG-REQ message to be sent in an Initial Ranging
Interval. The CID field shall be set to the non initialized SS value (zero). <u>For the OFDM PHY, if the SS is attempting subchannelized initial ranging, the SS shall follow the process specified in 8.3.7.2.</u> For the OFDMA PHY, the initial ranging process shall begin by sending initial-ranging CDMA codes on the UL allocation dedicated for that purpose (for more details see 6.3.10.3), instead of RNG-REQ messages sent on contention slots.

Page 178, lines 24, 26, 33, 42 (D5): Replace EIRxPIR,max with $RSS_{IR,max}$
Page 178, line 42 (D5):
[Modify the seventh paragraph as indicated:]
In the case that the ~~EIRxPIR,max~~ <u>$RSS_{IR,max}$</u> and/or BS_EIRP are/is not known, the SS shall start from ~~the~~ <u>its</u> minimum transmit power level ~~defined by the BS~~<u>.</u>

6.3.9.6 Ranging parameter adjustment

[Add after part (d) of the first paragraph of section 6.3.9.6 as follows:]

For the OFDM PHY and if subchannelization is supported then subchannelized initial ranging shall be performed instead of marking the DL channel unusable (see 8.3.7.2).
[Replace Figure 61 with the following figure:]

2

NOTE 1 —Timeout T3 may occur because the RNG-REQs from multiple SSs collided. To avoid these modems repeating the loop in lock-step, a random backoff is required. This is a backoff over the ranging window specified in the UCD. T3 timeouts can also occur during multi-channel operation.
NOTE 2 —On a system with multiple uplink channels, the SS must attempt initial ranging on every suitable uplink channel before marking the downlink channel unusable and moving to the next available downlink channel.
NOTE 3 — For OFDM PHY, if subchannelized initial ranging is supported, subchannelized initial ranging (see 8.3.7.2) shall be performed instead of marking the channel unusable.
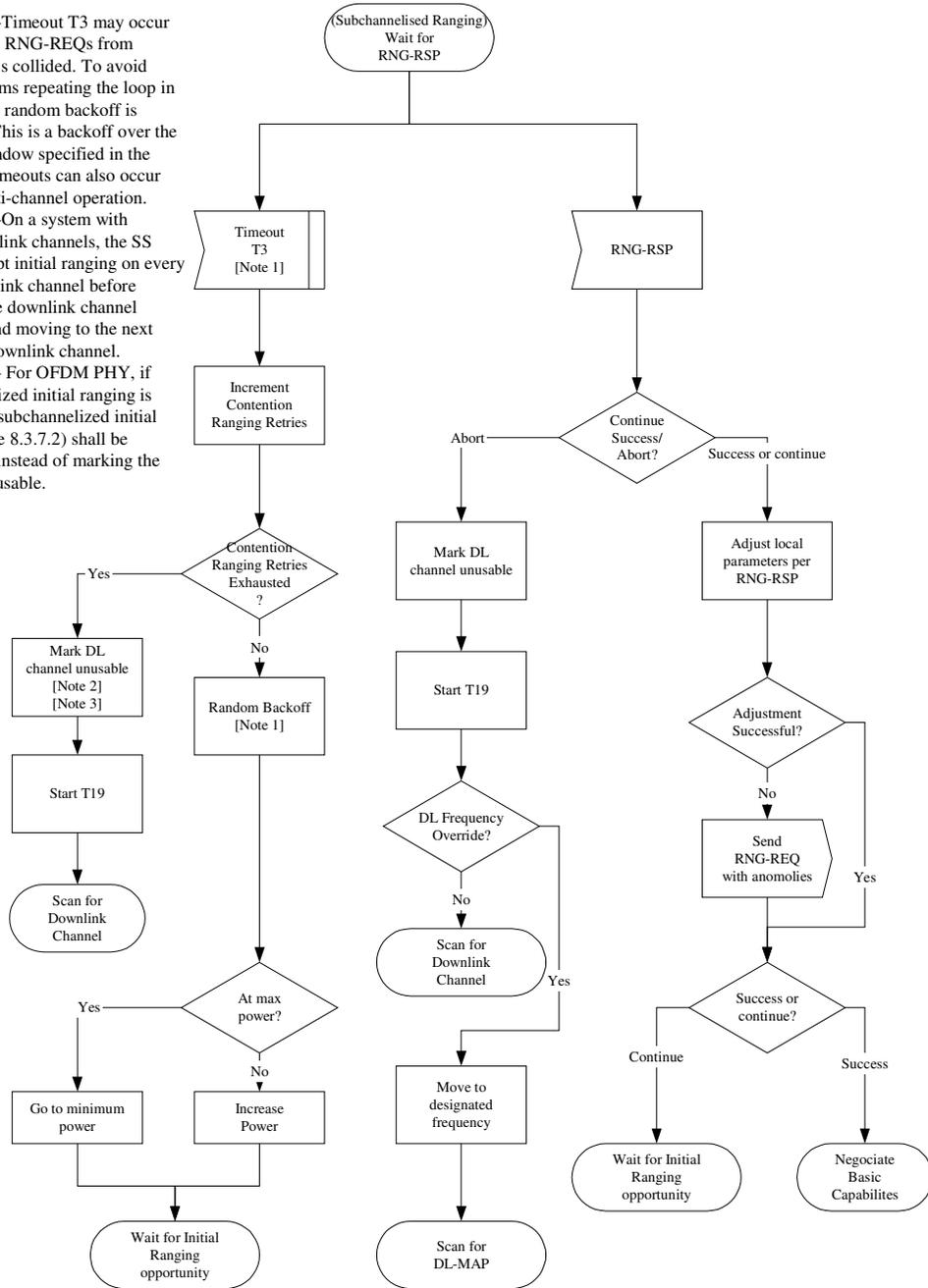
Figure 61 – Initial Ranging – SS (part 2)

3

Either add note in section 6.3.9.6:

For a BS implementing the OFDM PHY mode and supporting subchannelization, the case "Wait for RNG-REQ in Initial Ranging Contention Slot" in Figure 62 shall also be taken to mean "Wait for RNG-REQ in either Initial Ranging Contention Slot or in a slot identified in the UL-MAP by the Subchannelized_Network_Entry_IE (see 8.3.5.3.3)."

Or in section 8.3.7.2 (at page 479, line 55) as:

For a BS that supports subchannelized uplinks, the case "Wait for RNG-REQ in Initial Ranging Contention Slot" in Figure 62 shall also be taken to mean "Wait for RNG-REQ in either Initial Ranging Contention Slot or in a slot identified in the UL-MAP by the Subchannelized_Network_Entry_IE (see 8.3.5.3.3)."

Alter section 8.3.7.2 as follows, and insert STL diagrams describing behaviour of SS (BS?) during sub-channelised initial ranging:
Add at page 479, line 38:
SSs which compute their PTX_IR_max to exceed their maximum power level and SSs which have attempted initial ranging with the maximum power level using RNG-REQ may, if they have exhausted their maximum number of retries during initial ranging and if the BS supports subchannelization, attempt initial ranging in an initial ranging slot using the following burst format, and as indicated in Figure 210a and Figure 210b:
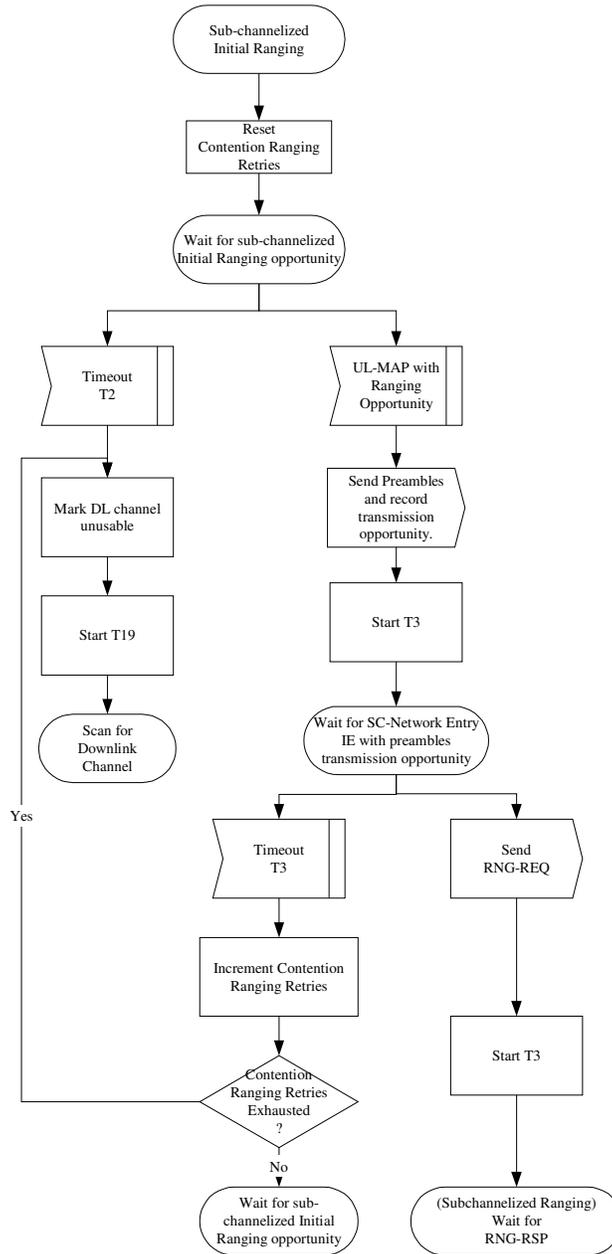
Figure 210a – Subchannelized Initial Ranging – SS (part 1)

NOTE 1 —Timeout T3 may occur because
the RNG-REQs from multiple SSs collided.
To avoid these modems repeating the loop
in lock-step, a random backoff is required.
This is a backoff over the ranging window
specified in the UCD. T3 timeouts can also
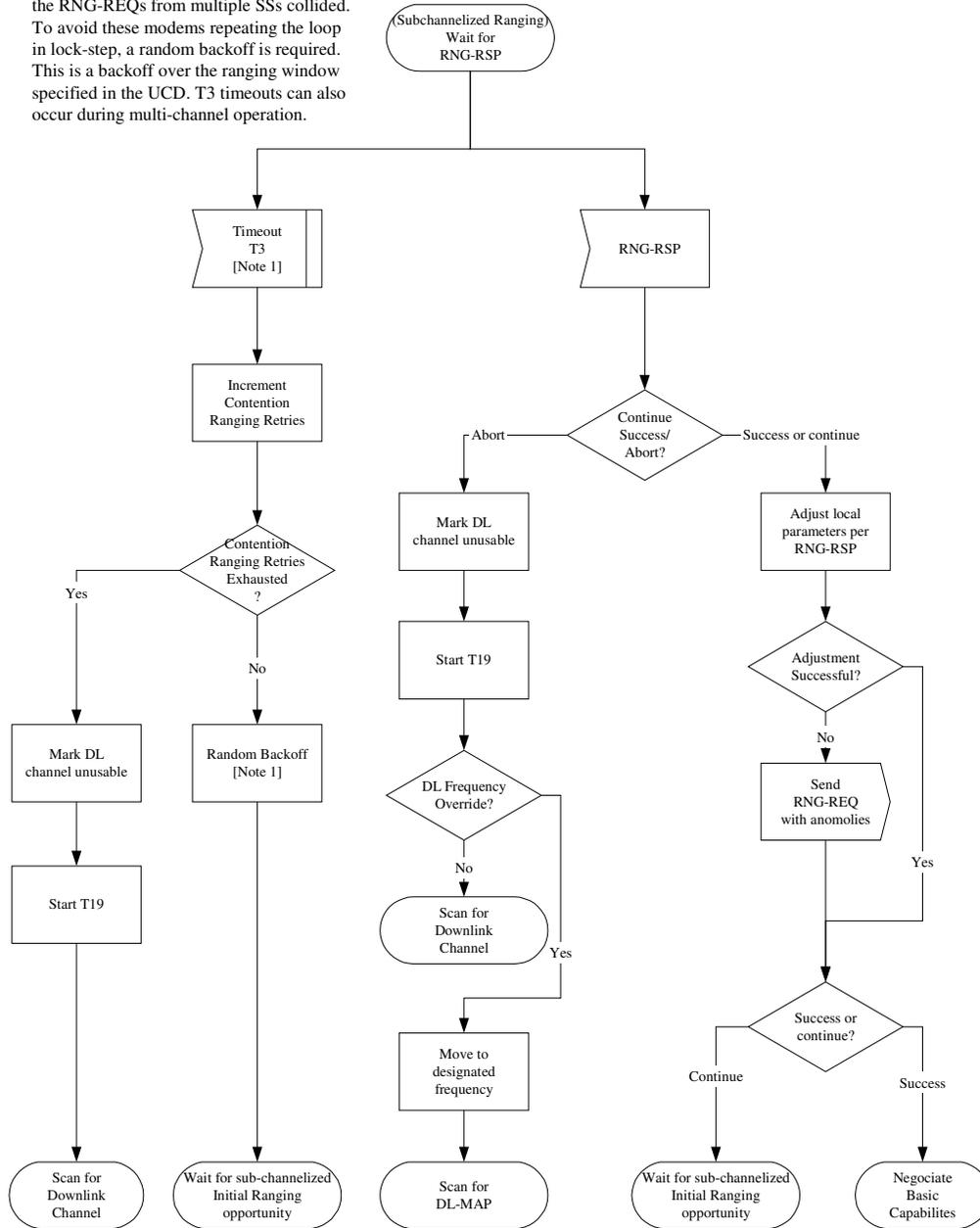occur during multi-channel operation.

(Subchannelized Ranging)
Wait for
RNG-RSP

Timeout
T3
[Note 1]

RNG-RSP

Increment
Contention
Ranging Retries

Continue
Success/
Abort?

Abort

Success or continue

Contention
Ranging Retries
Exhausted
?

Yes

No

Mark DL
channel unusable

Adjust local
parameters per
RNG-RSP

Mark DL
channel unusable

Random Backoff
[Note 1]

Start T19

Adjustment
Successful?

No

Start T19

DL Frequency
Override?

Send
RNG-REQ
with anomolies

Yes

No

Scan for
Downlink
Channel

Yes

Success or
continue?

Move to
designated
frequency

Continue

Success

Scan for
Downlink
Channel

Wait for sub-channelized
Initial Ranging
opportunity

Scan for
DL-MAP

Wait for sub-channelized
Initial Ranging
opportunity

Negotiate
Basic
Capabilites

Figure 210b – Subchannelized Initial Ranging – SS (part 2)

Alter section 10.1 to include a minimum public value for timer T19.

System	Name	Time reference	Minimum value	Default value	Maximum value
SS	T19	Time DL-channel remains unusable.	T4	5 min???	1 day???

Alter section 11.3 as follows to add the following capability descriptor to Table 350 – UCD PHY-specific channel encodings – WirelessMAN-OFDM:

11.3 UCD management message encodings
11.3.1 UCD channel encodings

[Insert new channel encoding at end of table 350:]

Name	Type (1 byte)	Length	Value
Subchannelized Initial Ranging capable BS	152	1	Indicator that the BS is capable of receipt of subchannelized Initial Ranging requests (see 8.3.7.2). Value 0 (default) indicates the BS is not capable of receiving subchannelized Initial Ranging Request. Value 1 indicates the BS is capable of receiving subchannelized Initial Ranging Request. All subchannelization capable BSs shall be capable of receiving the subchannelized Initial Ranging Request. Values 2-255 reserved.