Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Initial Ranging**
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Re:	Call for contribution IEEE 802.16d-03/02
Abstract	This contribution proposes an enhancement to the initial ranging procedure
Purpose	For inclusion in the 802.16d amendment document
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Initial Ranging

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1. References

[1] IEEE 802.16a

2. Problem statement and Discussion

Section 6.2.9.5 of [1] states:

“The SS shall send the RNG-REQ at minimum power level. If the SS does not receive a response, it shall resend it at the next Initial Maintenance transmission opportunity at one step higher power level.”

The maximum time between initial ranging opportunities is 2 seconds. The transmitter shall support power level control over at least 45 dB in steps of 1 dB (8.4.8.1 of [1]). Therefore it may take up to 90 seconds before an initial ranging request from a SS is received. In fact there is enough information available for the BS and SS to speed up the initial ranging.

In the DCD message, the BS provides the EIRP in signed units of 1 dBm. The SS knows the received signal strength (RSS) at the antenna connector from the RSSI measurement with an accuracy of +/- 4dB. Therefore the SS can calculate the signal strength loss, including its own antenna gain, fairly accurately. If the BS could indicate a maximum received signal strength, the SS can calculate it’s required transmit power taking into account implementation losses due to connectors, cables, etc. and the inaccuracy of setting it’s transmit power. This way the SS can transmit with a sufficiently strong signal so that the number of retries for initial ranging is minimized.

The proposal is to add in the DCD a field for “Initial Ranging Maximum Received Signal Strength (IR_MRSS)”. The SS calculates the signal strength loss (SSL) from:

$$SSL = BS\_EIRP - RSS \quad \{1\}$$

Then the SS calculates it’s required transmit signal strength (P_{TX}) at the antenna connector:

$$P_{TX} = IR\_MRSS + SSL \quad \{2\}$$

The BS shall take into account variations due to e.g. difference in path losses between DL and UL in FDD, as well as the difference in antenna gain if separate transmit and receive antennas are used.

The SS shall take into account the accuracy of the RSSI measurement. In case of an absolute accuracy of +/- 4 dB, the SS shall calculate RSS by subtracting 4 db from the RSSI. Otherwise the signal strength loss may be calculated too low. If the manufacturer of an SS knows that the RSSI measurements are more accurate, the SSL can be calculated more accurately. In this case the SS can start to transmit at a higher level, so that the initial ranging can happen faster.

The SS shall also take into account it’s absolute accuracy of the setting of the transmit power. The SS has to make sure never to transmit a higher level than calculated from the IR-MRSS, BS_EIRP and the RSSI.

3. Proposal

3.1. Add IR_MRSS to Table 124 of [1]:

Table 124: DCD Channel Encoding

Name	Type	Length	Value
....	...	...	.....
IR_MRSS Initial Ranging Maximum Received Signal Strength at BS	13	2	Signed in units of 1 dBm

3.2. Change the first part of 6.2.9.5 of [1] to:

"The SS shall calculate the maximum transmit signal strength for initial ranging from:

$P_{TX\_IR\_MAX}$ = IR_MRSS + BS_EIRP – RSS

When determining the IR_MRSS, the BS shall take into account variations due to e.g. difference in path losses between DL and UL in FDD, as well as the difference in antenna gain if separate transmit and receive antennas are used. The SS shall take into account the accuracy of the RSSI measurement and accuracy of the implementation of the transmit power control.

The SS shall send the RNG-REQ at a power level below $P_{TX\_IR\_MAX}$, measured at the antenna connector. If the SS does not receive a response, it shall resend it at the next Initial Maintenance transmission opportunity at one step higher power level. ..... "