TN006: Effect of reflections from distant objects

Version 1.1

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DOCUMENT INFORMATION

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1 OVERVIEW

1.1 Introduction

With the operation of the DW1000, reflections can enter the chip in different ways and at different times.

In the Non Line of Sight (NLOS) application notes[3][4][5] we have dealt with reflections, which typically have greater amplitude than the first path and which arrive after the first path in time. This is as would be expected.

This application note explains how, due to the specific operation of the DW1000, a reflection can appear in the Accumulator which looks like it has occurred before the first path.

2 EFFECT OF REFLECTIONS FROM DISTANT OBJECTS

Due to the specific operation of the DW1000, It is possible for a reflection to appear to arrive before the first path. Figure 1 shows the resulting Accumulator from a scenario where two DW1000 ICs are communicating in TWR mode, at a typical distance of say 80 meters and the first path is detected correctly. However also present in Figure 1 is a reflection from a distant object. This is a reflection of the first path transmission, where the reflecting surface is at a distance of 150meters to 200meters from the receiving DW1000.

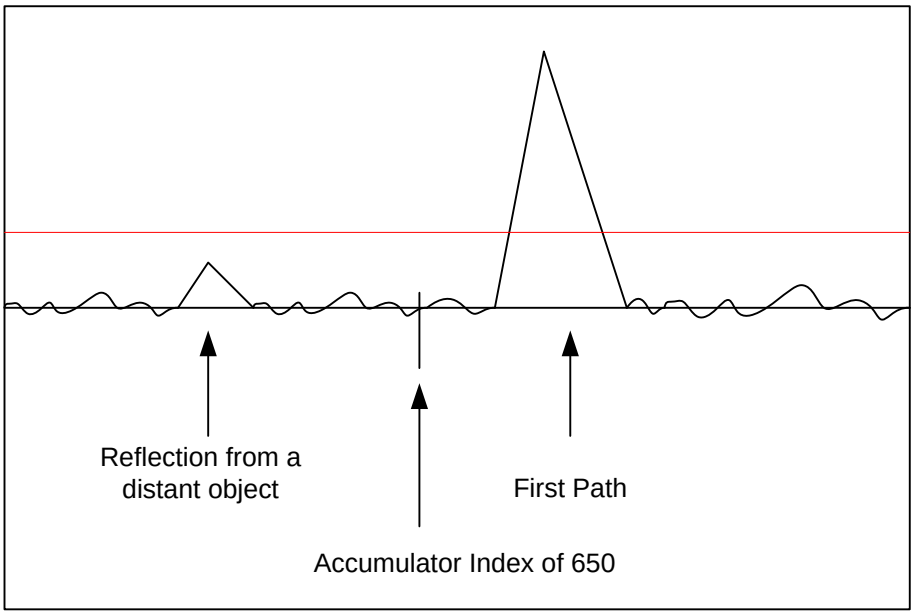

Figure 1: Shows the effect of a reflection from a distant object.

This scenario occurs with the DW1000 because of the way it operates. The DW1000 opens its receiver for one microsecond which equates to 300 meters. The accumulator is one microsecond long, with one thousand taps of one nano second each. The period of one microsecond starts when the first path is detected so the radio is still receiving when a reflection arrives from an object at 150 meters to 200 meters away. In theory the reflecting object could be up to 300 meters away from the receiver, however signal attenuation makes receiving anything beyond about 200 meters, impractical. The Accumulator memory wraps around so the received reflection, in this instance, appears to arrive before the first path.

In practice this scenario is difficult to reproduce and is very site specific. However if the preamble length is sufficiently long or the detection threshold is at a suitable level, then this reflection can be incorrectly received as the first path. In practice this will equate to the reported distance being much less than the correct distance.

There are two three approaches to working around this problem. Ensuring the preamble length is not excessively long, as long preambles make the DW1000 more sensitive to weak paths. Another possible option is to use a filter which filters out rogue readings, which show large jumps in position. This is easy to do if redundancy is built into the system, for example if there are more anchors than the minimum required for location, then the anchor producing rogue readings can be easily identified. Another option is to filter out first path indications occurring in the accumulator before an index of around 650 or 700.

3 REFERENCES

Reference is made to the following documents in the course of this document: -

Table 1: Table of References

Ref	Author	Date	Version	Title
[1]	Decawave		Current	DW1000 Data Sheet
[2]	Decawave		Current	DW1000 User Manual
[3]	Decawave		Current	APS0006 Part 1: Channel Effects on Communications Range and Time Stamp Accuracy in DW1000 Based Systems.
[4]	Decawave		Current	APS0006 Part 2: Non Line of Sight Operation and Optimizations to Improve Performance in DW1000 Based Systems
[5]	Decawave		Current	APS0006 Part 3: DW1000 Metrics for Estimation of Non Line Of Sight Operating Conditions.

4 DOCUMENT HISTORY

Table 2: Document History

Revision	Date	Description
1.0	26th April 2017	Initial release.

5 MAJOR CHANGES

v1.0

Page	Change Description
All	Initial release

V1.1

Page	Change Description
All	Logo Update

6 FOR FURTHER INFORMATION

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