Investigation of the Bragg Scattering of UWB Signal from the Window Blind : (2) Experimental Investigation

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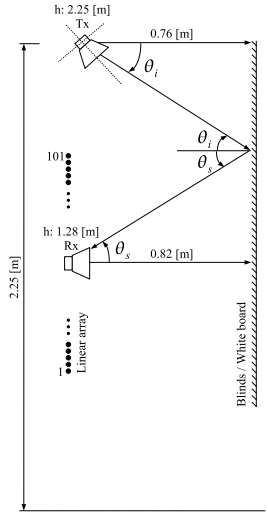
1 Introduction

This paper shows the scattering characteristics of Ultra Wideband (UWB) indoor measurements by using window blinds acting as periodic rough surfaces to determine Bragg scattering [1]. The objective is to compare the theoretical Bragg scattering angle with the measurement data. Also, to compare the difference between the periodic surface and a flat surface, 2 experiment setups were made.



θ_i: Incident angle
θ_s: Scattered angle

Figure 1 Experiment setup

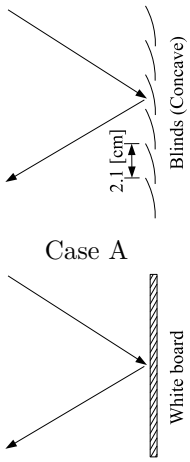


Figure 2 Target objects

2 Experiment setup

Figure 1 shows the measurement setup of these experiments. The measurements have been performed with a vector network analyzer to determine the complex radio channel transfer function $H(f) = S_{21}(f)$. Some indispensable parameters are shown in Table 1. The Tx antenna was mounted on a pole and its position was fixed. While the Rx antenna was mounted on the arm of the scanner to measure the DOA. To compare what's the difference between the periodic surface and the flat surface, we measured 2 experiments (Cases A and B). The details are shown in Figs. 2.

3 Experiment results

For data processing, Beamforming and Windowing function (Hanning) were used. Figs. 3 show the results of each experiment. We can find that Bragg scattering in case A appeared consequently for frequecncy greater 8 [GHz]. For case B, no Bragg scattering appeared since the reflection object (white board) is a flat surface. The specular reflection and LOS regions appeared in both cases.

Table 1 Specifications of the experiment

Bandwidth	3.1 to 10.6 [GHz]
Frequency sweeping points	751
Spatial sampling in the Rx position	101 points in vertical linear array whose element spacing is 1 [cm]
Power spectrum	DOA (θ_s) and frequency.
Type of antennas	Double-ridged guide horn
Polarization	Vertical-Vertical
Calibration	Function of VNA
IF bandwidth of VNA	100 [Hz]
SNR at receiver	about 50 [dB]

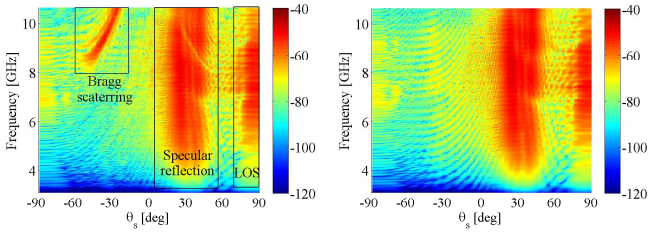


Figure 3 Angular frequency spectrum

4 Conclusions

In this paper, UWB Bragg scattering experiments and its characteristics are shown. The results of these experiments correspond with the theoretical value in [2]. It verified that the frequency dispersive effects of UWB cannot be ignored.

References

[1] M. Born and E. Wolf, "Scattering from inhomogeneous media," in Principles of Optics 7th (expanded) edition," Cambridge University Press, pp.705–708, 2001,

[2] N. Lertsirisopon, H. Tsuchiya, M. Ghoraishi, J. Takada, and T. Kobayashi , " Investigation of the Bragg Scattering of UWB Signal from the Window Blind : (1) Theoretical Investigation," 2006 IEICE General Conference, Mar. 2006.