

## Basic study of Next-Generation Digital Terrestrial Broadcasting transmission system for handheld and mobile reception

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### 1. Introduction

In Japan, Digital Terrestrial Television Broadcasting (DTTB) started in December 2003. The DTTB system used in Japan is called integrated services digital broadcasting – terrestrial (ISDB-T) and it uses OFDM modulation method. The ISDB-T transmission signal of one channel consists of 13 OFDM segments. The center one segment can be assigned as a special segment for the handheld/mobile reception broadcasting service One-Seg, and the other 12 segments are assigned for the fixed reception service. Thus, One-Seg for handheld/mobile reception and HDTV for fixed reception can be transmitted simultaneously in one channel.

NHK Science and Technology Research Laboratories is developing a next-generation digital terrestrial broadcasting transmission system. This paper describes core technologies for handheld and mobile reception of Next Generation Broadcast Television (NGBT).

### 2. Targets of NGBT

Targets of NGBT are sending Super Hi-Vision for fixed reception and sending Hi-Vision for handheld and mobile reception. We have been studying two technologies, ultra-multilevel OFDM and dual polarized MIMO, for sending Super Hi-Vision for fixed reception.

On the other hand, we examine to use two transmission antennas and one receiving antenna (Multiple-Input Single-Output: MISO) for handheld and mobile reception. The two technologies of MISO are described as follows.

### 3. Core technologies for handheld and mobile reception

#### 3.1. Space Frequency Block coding(SFBC)

SFBC is the transmission data encoding method. Audio and Video signals are source coded, and them,

transmission coded. Transmission coded data are distributed to two transmission antennas. The data distributed to one transmission antenna (Tx#1) are transmitted as it is, and the data distributed to the other antenna (Tx#2) are SFBC encoded and transmitted.

#### 3.2. Channel estimation

The channel responses are needed to estimate before SFBC decoding. There are two channel responses which are from two transmission antennas to one receiving antenna. They are estimated using reference signal (scattered pilot: SP). SP of Tx#1 is the same as ISDB-T. SP of Tx#2 is reversed sign of Tx#1 SP.

We study 3 types of estimation method.

Type A: paired with SP in the frequency domain

Type B: paired with SP in the time domain

Type C: paired with SP in the frequency and time domain

Each type has merits and demerits which are strong in time fluctuation and weak in frequency ruggedness and so on.

### 4. Laboratory experiments

We carried out laboratory experiments with a prototype transmitter and receiver. We used typical urban 6-path model as a channel model. The results show that Type A is the most robust to mobile reception environment.

### 5. Conclusion

This paper describes two technologies of MISO for handheld and mobile reception. One is SFBC that is transmission data encoding method. The other is channel estimation method. We think that the most desirable system is one that can transmit data both for fixed and mobile reception in one channel as well as ISDB-T. Thus, we will study a hierarchical transmission system in the future.