New preamble structure for AGC in a MIMO-OFDM system

Tsuguhide Aoki, Daisuke Takeda, Takahiro Kobayashi and Kazuaki Kawabata
Corporate R&D center, TOSHIBA corporation
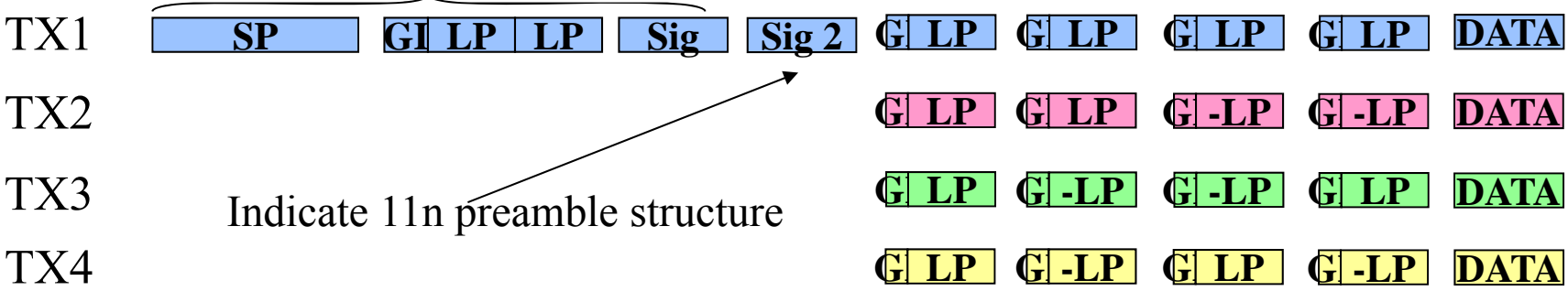
tsuguhide.aoki@toshiba.co.jp

Main scope of TGn

- "Achieve 100Mbps measured at MAC SAP" (PAR & FR)

  ⇒MIMO-OFDM is one of the possible candidates.

- "Some of the modes shall be backwards compatible and interoperable with 802.11a and/or 802.11g" (PAR & FR)

- Backward compatibility between legacy 11a and MIMO-OFDM is one of the main issues.

- Preamble structure of 11a should be maintained in a MIMO-OFDM system.

  Alternatively, use protection mechanisms as defined in 11g (RTS-CTS, CTS self)

Example of preamble structure for MIMO system
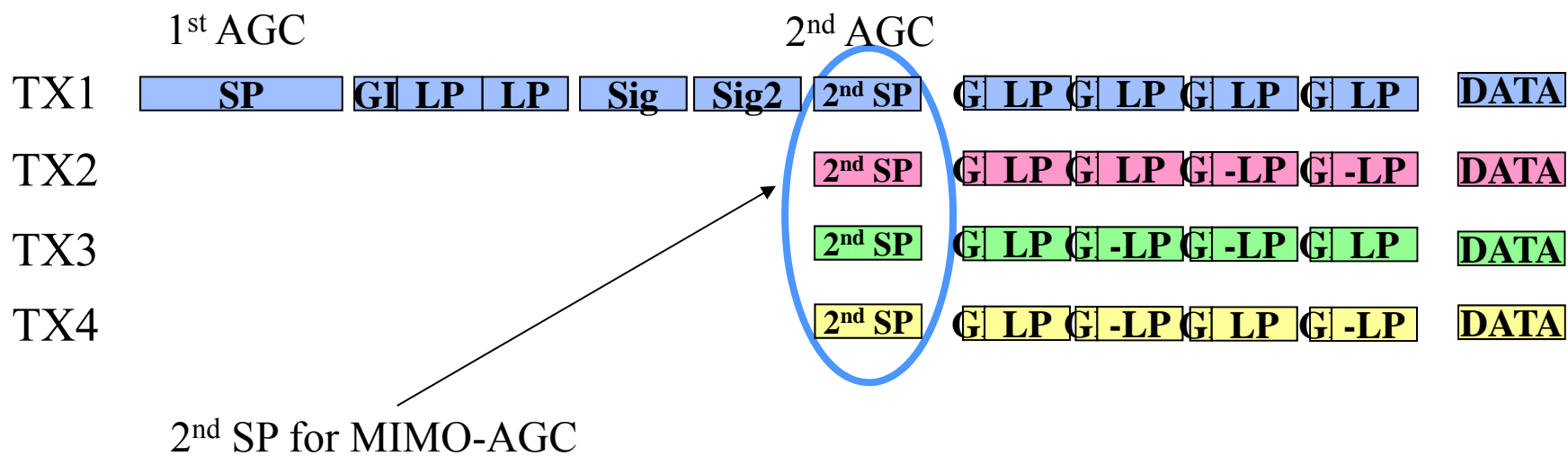

Same as 11a
→Backward compatibility

Channel estimation for MIMO signals

| TX1 | SP | GI LP LP | Sig | Sig 2 | G LP | G LP | G LP | G LP | DATA |

Indicate 11n preamble structure

TX2	G LP	G LP	G -LP	G -LP	DATA
TX3	G LP	G -LP	G -LP	G LP	DATA
TX4	G LP	G -LP	G LP	G -LP	DATA

*Similar structure is presented in 03/714r0

- AGC for Tx1 could be performed by using the legacy SP.
- It is difficult to adjust the gain control for Tx2-Tx4 during MIMO signals because of the insufficient information for other antennas.

  →This causes a severe saturation or quantization error in ADC.

New preamble structure with 2ⁿᵈ SPs for MIMO system
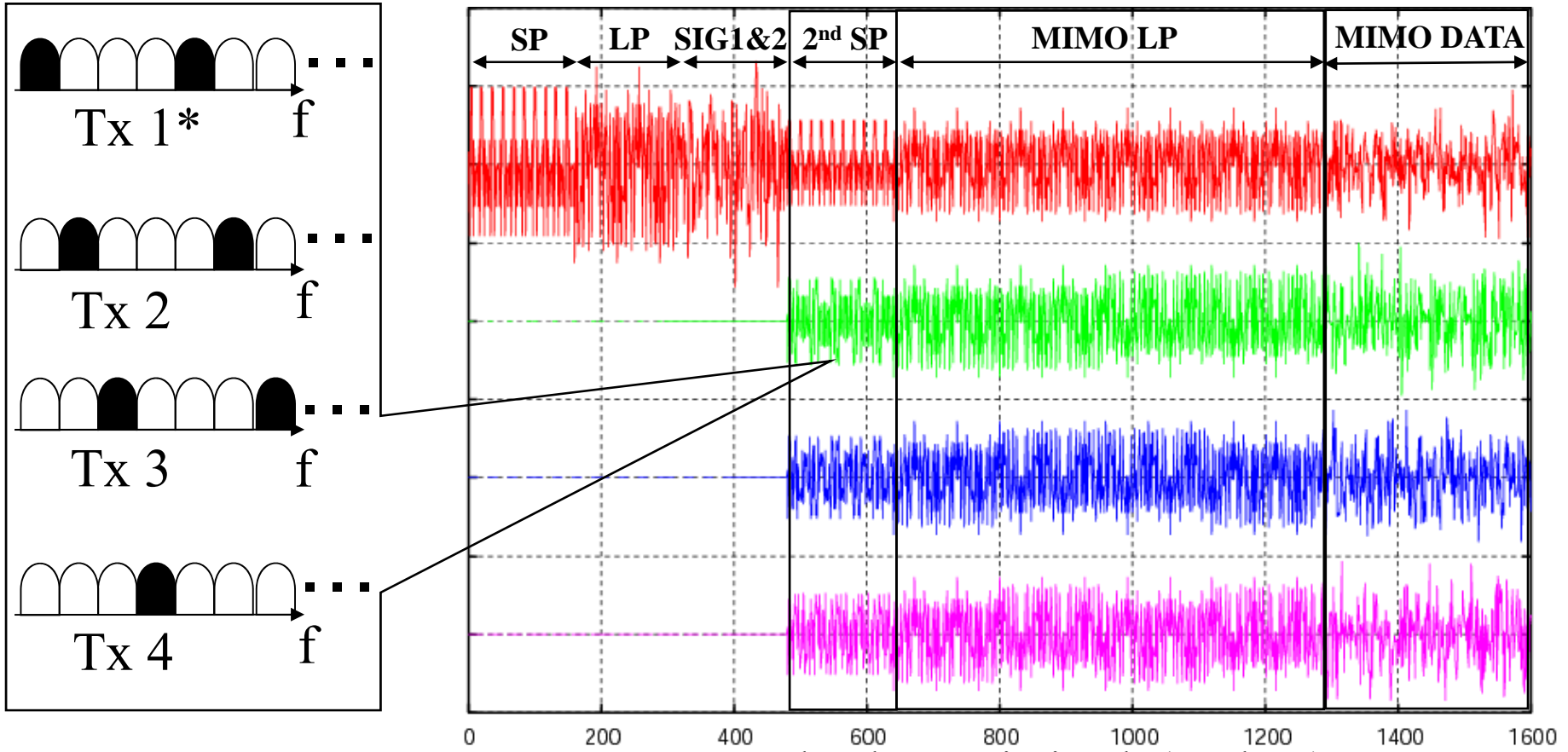
1ˢᵗ AGC   2ⁿᵈ AGC

TX1 [SP] [GI LP LP] [Sig Sig2] [2ⁿᵈ SP] [G LP G LP G LP G LP] [DATA]

TX2 [2ⁿᵈ SP] [G LP G LP G -LP G -LP] [DATA]

TX3 [2ⁿᵈ SP] [G LP G -LP G -LP G LP] [DATA]

TX4 [2ⁿᵈ SP] [G LP G -LP G LP G -LP] [DATA]

2ⁿᵈ SP for MIMO-AGC

- The 1ˢᵗ AGC for Tx 1 could be performed by using legacy SP.
- The 2ⁿᵈ AGC for MIMO signals could be performed by using the 2ⁿᵈ SPs.
- The 2ⁿᵈ SP with same sequence for Tx1-Tx4 causes a Null (beamforming) effect.

   -->Different sequence should be used for the 2ⁿᵈ SP on each antenna.

Simulated transmit signals with 2nd SP

Total transmission power is always the same.

Base-band transmit signals (In-phase)

Tx 1 transmits same sequence of legacy SP.

DOCKET ALARM

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts

Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research

With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips

Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS
Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS
Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS
Sync your system to PACER to automate legal marketing.

fastcase®
Smarter legal research.