LTE Downlink Physical Layer Behavioural Model

An end-to-end behavioural model for the LTE Physical layer downlink (eNodeB to UE) in accordance with the 3GPP Release-8 specifications.

Abstract

Roke has developed an end-to-end behavioural model for the 3GPP Release-8 LTE Physical layer downlink.
The model can be run as a simulation tool to test the performance of the Physical layer algorithms. TThe model supports simulation capability through implementation of the Physical Downlink Shared Channel (PDSCH) and the Physical HARQ Indicator Channel (PHICH) for integrity validation.

Introduction

Roke Manor Research Ltd (Roke) has developed an end-to-end behavioural model for the LTE Physical layer downlink (eNodeB to UE) in accordance with the 3GPP Release-8 specifications.
The model uses the (C, floating point) libraries developed by Roke for the eNodeB transmit and UE receive algorithms. The model also incorporates a C++ framework which enables each physical channel to be simulated separately. This simulation capability can be used to test the implementation margin and performance of the Physical layer algorithms under different conditions. This enables the algorithms to be ported to the target platform with confidence.

Behavioural Model

The LTE downlink is based on Orthogonal Frequency Division Multiplexing (OFDM). All the key modules for the LTE Physical layer have been implemented in the Roke downlink behavioural model. The model implements:

- Physical Downlink Shared Channel (PDSCH)
- Physical HARQ Indicator channel (PHICH)

Figure 1 shows the eNodeB transmit chain. Figure 2 shows the UE receive chain.

Data Channels (PDSCH)

The Roke downlink behavioural model implements the downlink data channels for all supported bandwidths and cyclic prefix lengths for FDD.

Control Channels

The Roke downlink behavioural model implements the Physical HARQ Indicator Channel (PHICH) which carries the HARQ ACK/NACK indications from eNodeB to UE. The HARQ ACK/NACK indicates whether the eNodeB has correctly received a transmission on the PUSCH. The PHICH has been implemented for all supported bandwidths and cyclic prefix lengths for FDD. The model can be updated on request to include the other two control channels, Physical Downlink Control Channel (PDCCD), and Physical Control Format Indicator Channel (PCFICH).

Summary

Roke has in-depth knowledge of the LTE Physical layer (through involvement in the 3GPP RAN1 working group since 2005) and extensive experience in developing baseband solutions for wireless communications. This knowledge and experience has been used to develop a library of LTE Physical layer transmit and receive algorithms and an end-to-end downlink behavioural model. For further details please contact mobile@roke.co.uk or visit www.roke.co.uk.

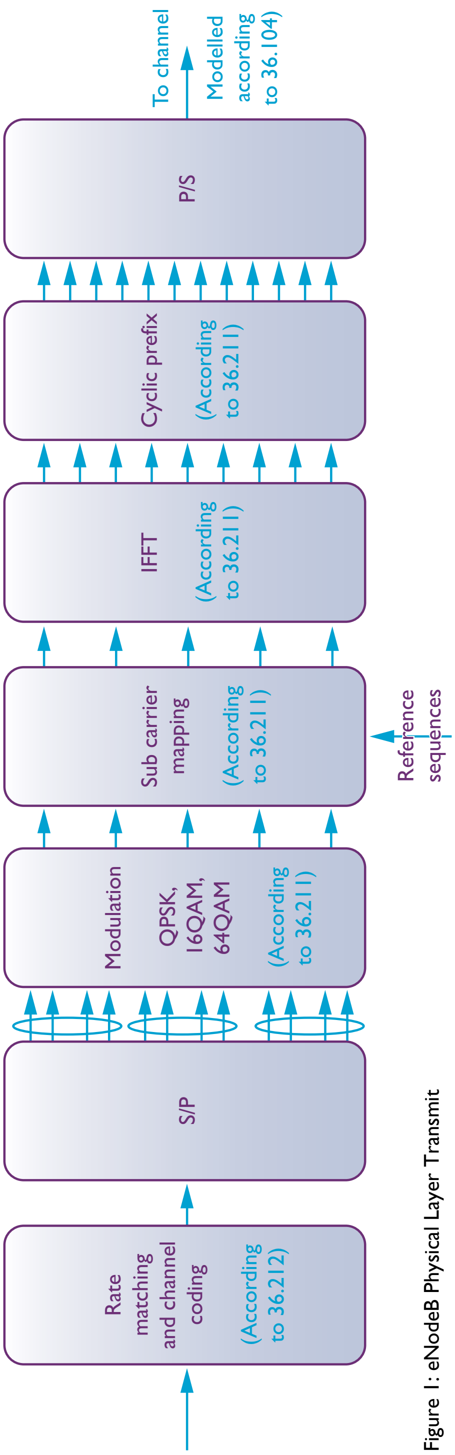

Figure 1: eNodeB Physical Layer Transmit

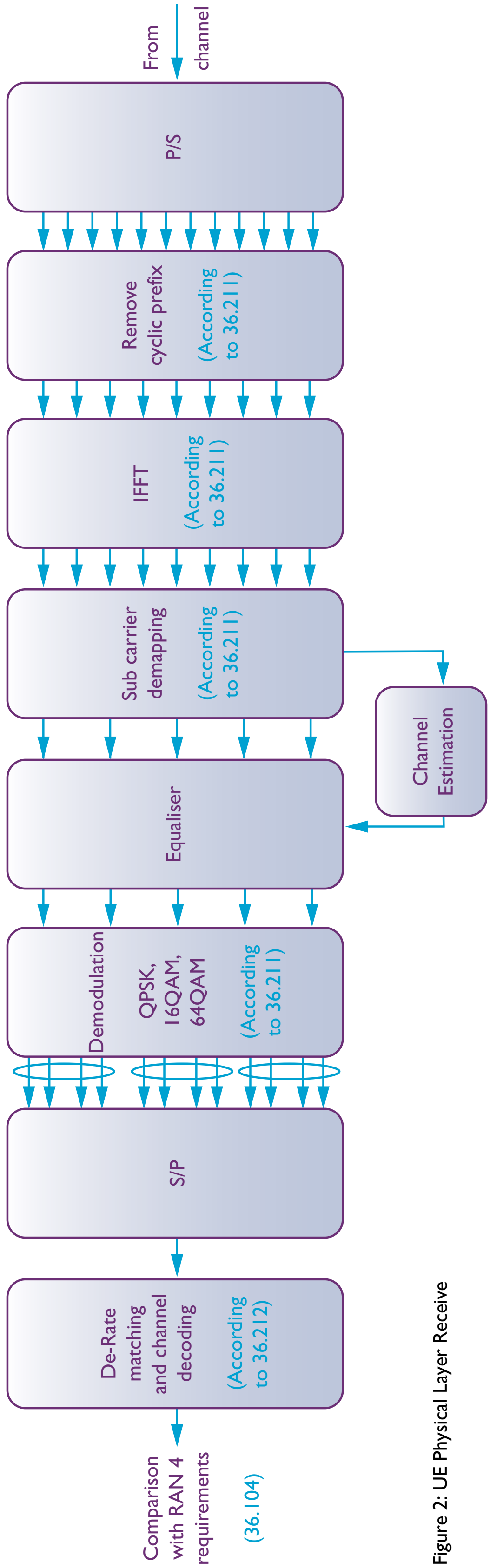

Figure 2: UE Physical Layer Receive

For further information please contact:

Ben Toner
Roke Manor Research Limited
Roke Manor, Romsey, Hampshire, SO51 0ZN, UK
T +44 (0)1794 833000
F +44 (0)1794 833433
ben.toner@roke.co.uk
www.roke.co.uk/lte
Part of the Chemring Group

0110.2