TSG-RAN Meeting #22 **RP-030714**
Maui, Hawaii, USA, 9 - 12 December 2003

Agenda Item: 8.9
Source: Nortel Networks
Title: Node-B testing over Iub
Document for: Discussion

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1. Introduction

Means to perform Node-B testing over the Iub interface have been discussed in RAN WG4.

This document proposes some enhancements to the proposal made in RAN4 based on some extra signaling capability in the NBAP protocol. Nortel Networks believes that this extra signaling would be beneficial if the activity in RAN4 is concluded positively.

Nortel will contribute in later RAN3 and RAN4 meetings, and this document is provided for information to RAN Plenary so that comments can be sent to the contact persons.

2. Background

When testing the conformance of a BS transmitter, the BS shall transmit a test signal, referred as "Test Model" in the specification 25.141.

A test models is defined as a set of several channels. The main characteristics and use of the 5 tests models are summarized in the table below. In case several variant of a test model exist, the conformance test shall be performed using the largest of these options that can be supported by the equipment under test.

Test Model	Number of DPCH	Usage
Test Model 1	16 @ SF=128 32 @ SF=128 64 @ SF=128	• Occupied bandwidth • spectrum emission mask • ACLR, Spurious emission • Transmit intermodulation • Base station maximum output power • Total power dynamic range (at Pmax) • Frequency error (at Pmax) • Error Vector, Magnitude (at Pmax) • IPDL time mask
Test Model 2	3 @ SF=128	• Output power dynamic • CPICH Power accuracy

Test Model 3	16 @ SF=128	• Peak Code Domain Error
	32 @ SF=128	
Test Model 4	0 (common channels only)	• EVM measurement (at Pmax -18 dB) • Total power dynamic range (at Pmax – 18 dB) • Frequency error (at Pmax – 18 dB)
Test Model 5	30 @ SF=128 2 HS-SCCH 8 HS-PDSCH	• EVM for base stations supporting HS-PDSCH transmission using 16QAM modulation (at Pmax)
	14 @ SF=128 2 HS-SCCH 4 HS-PDSCH	
	6 @ SF=128 2 HS-SCCH 2 HS-PDSCH	

The test models are used for downlink tests: hence the information content is not used. For simplicity, for each code, the aggregated data section of the 15 slots of a frame is filled with a fragment of a PN9 sequence. The parameters for each code (seed of the PN generator, timing offset, power…) were selected to ensure the test signal resulting of the combination of all the code channels are representative of a real signal (test model1, 5) or suitable for the characteristics to be measured (Test model 2, 3, 4).

The mean to activate the transmission of the test models is not specified in 25.141. Each BS manufacturer may use a proprietary tool to enable the transmission of the test models for its BS. It shall be noted that:

- Support of the test model 1 is mandatory to prove compliance to European Harmonized Standard (ETSI EN 301 908-3)
- Conformity of the test models radiated by a BS with the definition of the 25.141 may be easily checked with a transmitter analyzer.

From an operator perspective, it seems that having a standard mean (independent from the tool used by the BS manufacturer) to activate the transmission of the test models would be helpful.

The document is a proposal for new optional information element to be introduced in the Iub definition that would permit to trigger the activation of the transmission of a code according to the test model definition.

3. Proposal

Impact on NBAP messages

The proposal consists to activate the test model at the BS by sending over the Iub NBAP messages with an optional test flag set to one.
The new IE shall be added for three messages:

- Cell setup request
- Common channel transport setup request

- Radio link setup request

Cell Setup request

When receiving the cell setup request message with the optional 'testflag', the Node-B is instructed that the P-CCPCH shall be transmitted according to the section 6.1.1.6.1 of the 25.141:

> The aggregate 15 x 18 = 270 P-CCPCH bits per frame are filled with a PN9 sequence generated using the primitive trinomial $x^9 + x^4 + 1$. Channelization code of the P-CCPCH is used as the seed for the PN sequence at the start of each frame.
> The generator shall be seeded so that the sequence begins with the 8 bit channelization code starting from the LSB, and followed by a ONE.

The power of the P-CCPCH shall be set according to the NBAP message parameter. SCH and CPICH are transmitted according to the NBAP message parameters.

Common channel transport setup request

When receiving the cell setup request message with the optional 'testflag', the Node-B is instructed that the S-CCPCH and PICH shall be transmitted according to the sections 6.1.1.6.2 and 6.1.1.6.4 of the 25.141:

> PICH carries 18 Paging Indicators (Pq) sent in the following sequence from left to right [1 0 1 1 0 0 0 1 0 1 1 0 0 0 1 0 1 0]. This defines the 288 first bits of the PICH. No power is transmitted for the 12 remaining unused bits.

> The aggregate 15 x 20 = 300 S-CCPCH bits per frame are used. Data bits are filled with a PN9 sequence generated using the primitive trinomial $x^9 + x^4 + 1$. In case there are less data bits/frame needed then the first bits of the aggregate shall be selected.. Channelization code of the S-CCPCH is used as the seed for the PN sequence at the start of each frame. For test purposes, any one of the four possible slot formats 0,1, 2 and 3 can be supported. The support for all four slot formats is not needed..
> The generator shall be seeded so that the sequence begins with the 8 bit channelization code starting from the LSB, and followed by a ONE. The test on S-CCPCH has a frame structure so that the pilot bits are defined over 15 timeslots to the relevant columns of TS 25.211. The TFCI bits are filled with ONEs whenever needed.

The power and timing offsets of the S-CCPCH and PICH shall be set according to the NBAP message parameters.

Radio Link Setup request

When receiving the radio link setup request message with the optional 'testflag', the Node-B is instructed that the content of the DPCH shall be generated by the Node-B The optional test flag shall support several value to allow support of the Test Model 5 and HSDPA channels. Three values are needed as described below.
Timing offsets and powers are set according to the NBAP message parameters.

NON_HSDPA_DPCH:
When the IE is set to this value the content of the DPCH shall be generated by the Node-B according to the section 6.1.1.5 of the 25.141:

> The aggregate 15 x 30 = 450 DPDCH bits per frame are filled with a PN9 sequence generated using the primitive trinomial $x^9 + x^4 + 1$. In case there are less data bits/frame needed then the first bits of the aggregate shall be selected. To ensure non-correlation of the PN9 sequences, each DPDCH shall use its channelization code as the seed for the PN sequence at the start of each frame, according to its timing offset. The sequence shall be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage, and the result is fed back to the input of the first stage. The generator shall be seeded so that the sequence begins with the channelization code starting from the LSB, and followed by 2 consecutive ONEs for SF=128 and 1 consecutive ONE for SF=256.

HS_PDSCH:
When the IE is set to this value the content of the DPCH shall be generated by the Node-B according to the section 6.1.1.7 of the 25.141:

> There are 640 bits per slot in a 16QAM-modulated HS-PDSCH. The aggregate 15 x 640 = 9600 bits per frame are filled with repetitions of a PN9 sequence generated using the primitive trinomial $x^9 + x^4 + 1$. To ensure non-correlation of the PN9 sequences, each HS-PDSCH shall use its channelization code multiplied by 23 as the seed for the PN sequence at the start of each frame.
> The generator shall be seeded so that the sequence begins with the channelization code starting from the LSB.

HS_SCCH:
When the IE is set to this value the content of the DPCH shall be generated by the Node-B according to the section 6.1.1.8 of the 25.141:

> There are 40 bits per time slot in a HS-SCCH. The aggregate 15 x 40 = 600 bits per frame are filled with repetitions of a PN9 sequence generated using the primitive trinomial $x^9 + x^4 + 1$. Channelization code of the HS-SCCH is used as the seed for the PN sequence at the start of each frame. The generator shall be seeded so that the sequence begins with the channelization code starting from the LSB, and followed by 2 consecutive ONEs.

4. Conclusion

A method to trigger the test model activation at the Node-B is described. This implies the addition of an optional Information Element in three NBAP messages.

The main characteristics of this approach is listed below:

- Compliance with existing test method:

By sending the right sequence of NBAP messages with the parameters set according to the Test Model definition, the signal radiated by the BS is fully compliant with the existing test model: there is no impact on the 25.141 specification and on others conformance specifications based on this document.

- Flexibility

It is possible to change most of the physical parameters of the radio link in order to test the Node-B with some combinations that differ from the existing test models.

- Complexity of the test set-up

The complexity of the “RNC emulator” that is needed to send the message sequence is low since only NBAP messages are to be sent over the Iub (no user plane that would imply real time operation). This test mode can also be triggered over a low capacity Iub interface, even test model 1 or 5 with a large number of channels (for instance single PCM)