3GPP TR 25.803 V6.0.0 (2005-09)

Technical Report

3rd Generation Partnership Project;
Technical Specification Group Radio Access Network;
S-CCPCH performance for MBMS;
(Release 6)

Keywords

UMTS, radio, broadcast

3GPP

Postal address

3GPP support office address

650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Internet

http://www.3gpp.org

Contents

Foreword

This Technical Report has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The scope of this technical report is to capture simulation results for S-CCPCH operation in the context of MBMS as defined in [1].

It is important to note that the results presented in this report are raw simulation results and as such do not include any implementation margins which are typically considered when defining UE performance requirements and would have to be considered when dimensioning network resource required for MBMS deployment.

2 References

[1] 3GPP TR 25.992: "Multimedia Broadcast/Multicast Service (MBMS); UTRAN/GERAN requirements".

[2] 3GPP TS 21.905: "Vocabulary for 3GPP Specifications".

[3] 3GPP TS 21.101: "UE Radio transmission and reception (FDD)"

[4] 3GPP TR 30.03U: "Selection procedures for the choice of radio transmission technologies of the UMTS"

[5] 3GPP TR 25.942 v6.1.0: "Radio frequency (RF) system scenarios"

[6] 3GPP TR 25.996: "Spatial channel model for multiple-input multiple output simulations"

[7] R1-031275 "MBMS Coverage in the Macrocellular Environment (FDD)"

[8] 3GPP TS 25.346: "Introduction of the Multimedia Broadcast Multicast Service (MBMS) in the Radio Access Network"

[9] 3GPP TS25.306: "UE Radio Access Capabilities"

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in [2] and the following apply.

Block Error Rate*: error rate of the transport (data) blocks passed by the physical layer to MAC layer for a given transport channel (i.e. physical layer error rate).*

Transmission Time Interval*: interval of time over which a transport block is transmitted; multiple transport blocks may be transmitted in a transmission time interval per transport channel.*

3.2 Abbreviations

BLER	Block Error Rate
SCTD	Space Code Transmit Diversity
STTD	Space Time Transmit Diversity
TSTD	Times Switched Transmit Diversity
TTI	Transmission Time Interval

4 S-CCPCH performance for FDD

4.1 Simulation Assumptions

Table 4.1.1 presents parameters which are commonly used in the subsequent sections. Note that the case 1 and Pedestrian A channel models are not representative of urban macrocellular environments, and the applicability of these models to other environments is FFS.

Table 4.1.1: Simulation parameters

Parameter	Value
S-CCPCH Slot format	6 (16 kbps) 8 (32 kbps) 10 (64 kbps) 12 (128 kbps) 11 (for VA30 results) 15 (256 kbps)
Transport Block Size & number of transport blocks per TTI	Varied according to information rate (16, 32, 64 or 128 kbps) and TTI value.
CRC	16 bits
Transmission interval (TTI)	20 ms, 40ms and 80ms
CPICH Ec/Ior	-10 dB (10%)
P-SCH Ec/Ior	-15 dB (3%) -16 dB for 256 kbps
S-SCH Ec/Ior	-15 dB (3%) -16 dB for 256 kbps
Tx Ec/Ior	Varied
OCNS	Used to sum the total Tx Ec/Ior to 0 dB (100%)
Geometry (Iôr/Ioc)	-3 dB -6 dB
Channel estimation	Enabled
Power Control	Disabled
Channel	Case 1, 3 kmh [3] Case 2, 3kmh [3] Pedestrian A, 3 km/h [4] Pedestrian B, 3 km/h [4] Vehicular-A. 3 kmh [4] Vehicular-A, 30 kmh [4]

Results are presented in terms of Ec/Ior [dB] representing the fraction of cell transmit power necessary to achieve the corresponding BLER performance graduated on the vertical axis. Examples of conversion of Ec/Ior [dB] to cell power fraction [%] are shown in table 4.1.2.

Table 4.1.2: Conversion of Ec/Ior [dB] to fraction of cell transmit power [%]

Ec/Ior	%Tx	Ec/Ior	%Tx	Ec/Ior	%Tx
0.0	100.0%	-5.5	28.2%	-11.0	7.9%
-0.5	89.1%	-6.0	25.1%	-12.0	6.3%
-1.0	79.4%	-6.5	22.4%	-13.0	5.0%
-1.5	70.8%	-7.0	20.0%	-14.0	4.0%
-2.0	63.1%	-7.5	17.8%	-15.0	3.2%
-2.5	56.2%	-8.0	15.8%	-16.0	2.5%
-3.0	50.1%	-8.5	14.1%	-17.0	2.0%
-3.5	44.7%	-9.0	12.6%	-18.0	1.6%
-4.0	39.8%	-9.5	11.2%	-19.0	1.3%
-4.5	35.5%	-10.0	10.0%	-20.0	1.0%
-5.0	31.6%				

4.2 Performance using Release-5 functionality

Two main parameters can be used in Release-5 to influence the S-CCPCH performance. They are the TTI value and the transmit diversity. The following sections capture performance results with various combination of TTI values and transmit diversity.

4.2.1 Performance using various TTI values

Figure 4.2.1-4.2.3 show the S-CCPH power requirement as a fraction of the Node B power when transmitting at 16, 32, 64 and 128 kbps with various TTI values. The results are without transmit diversity.

4.2.1.1 Results for Case 1 – 3 kmh

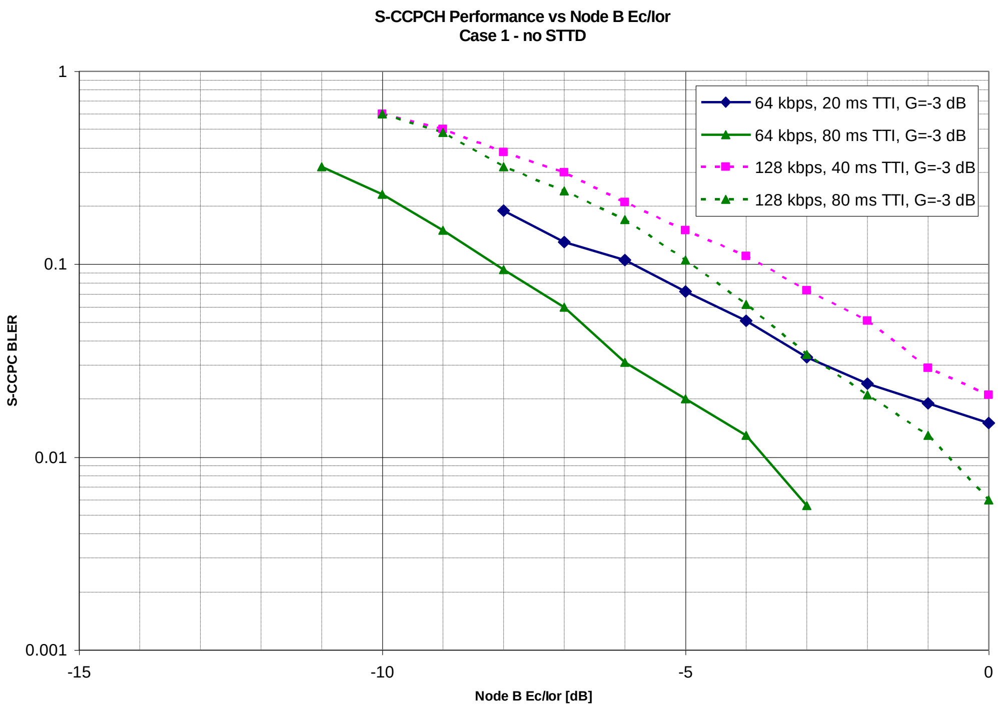

Figure 4.2.1: BLER vs. Tx Power - Case 1 (3 kmh)

4.2.1.2 Results for Case 2 – 3 kmh

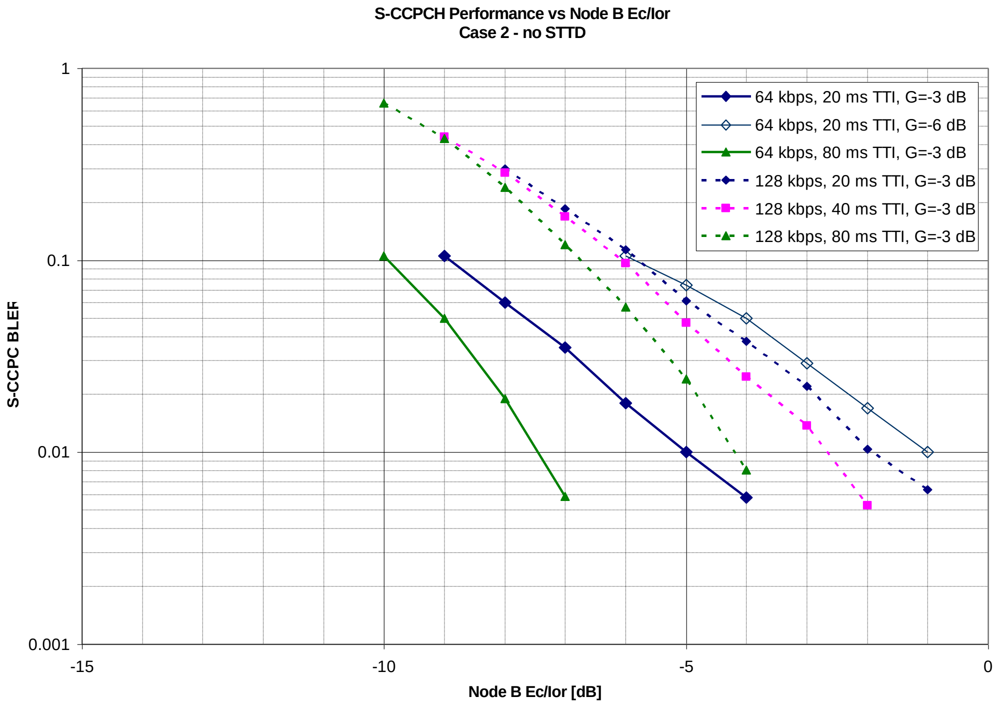

Figure 4.2.2: BLER vs. Tx Power - Case 2 (3 kmh)

4.2.1.3 Results for Vehicular – A (3 kmh)

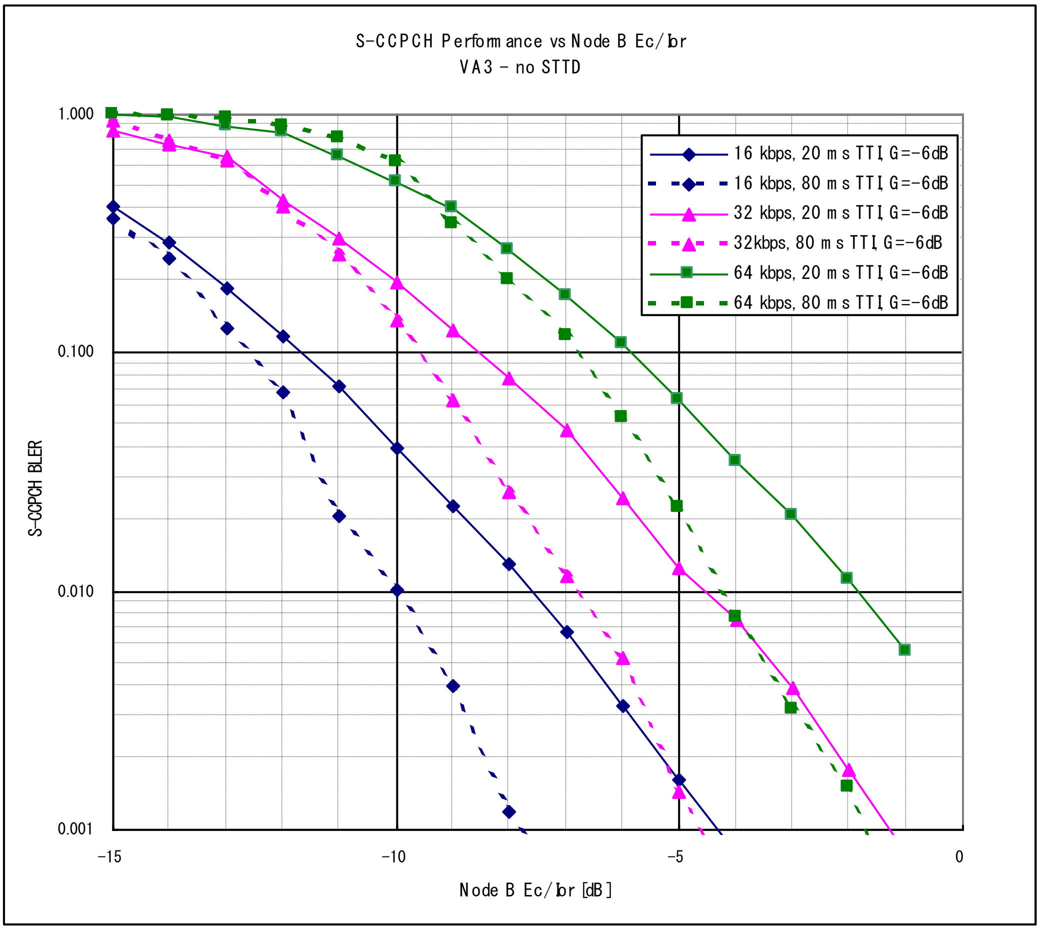

Figure 4.2.3: BLER vs. Tx Power – VA3

It should be noted that reference UE configurations labelled with a particular data rate (e.g. 64 kbps class) may not support that particular rate when operating with TTI values higher than 10 ms as defined in [TS 25.306]

4.2.2 Performance using open loop transmit diversity

Figures 4.2.4-4.2.9 show the S-CCPH requirement when transmitting at 16, 32, 64 and 128 kbps with various TTI values and STTD enabled.

4.2.2.1 Results for Case 1 – 3 kmh

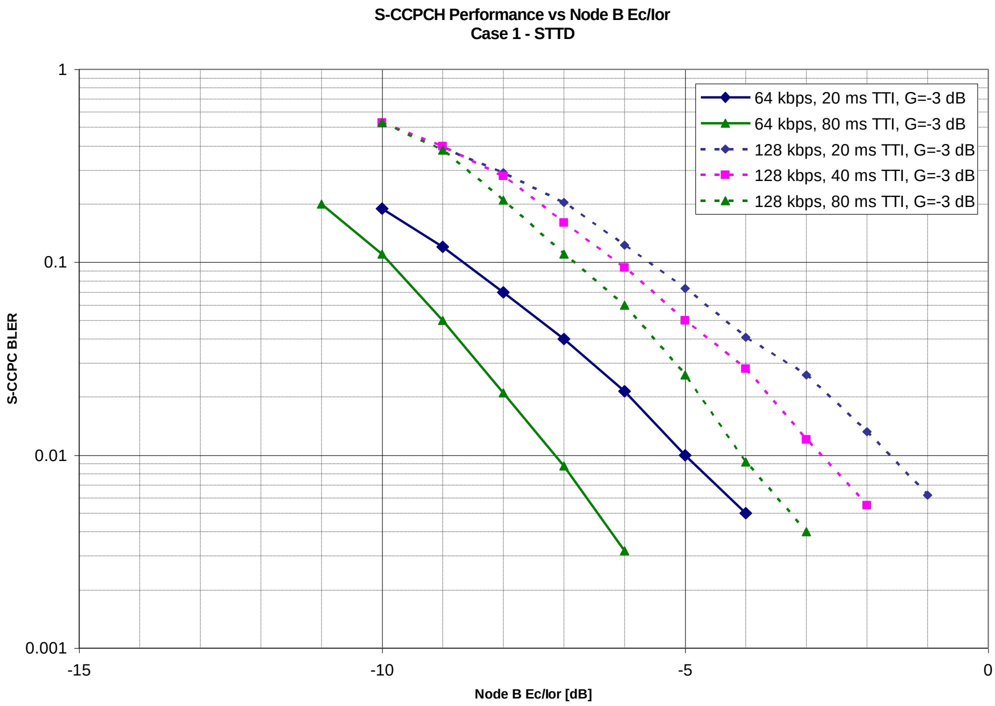

Figure 4.2.4: BLER vs. Tx Power – case 1

4.2.2.2 Results for Case 2 – 3 kmh

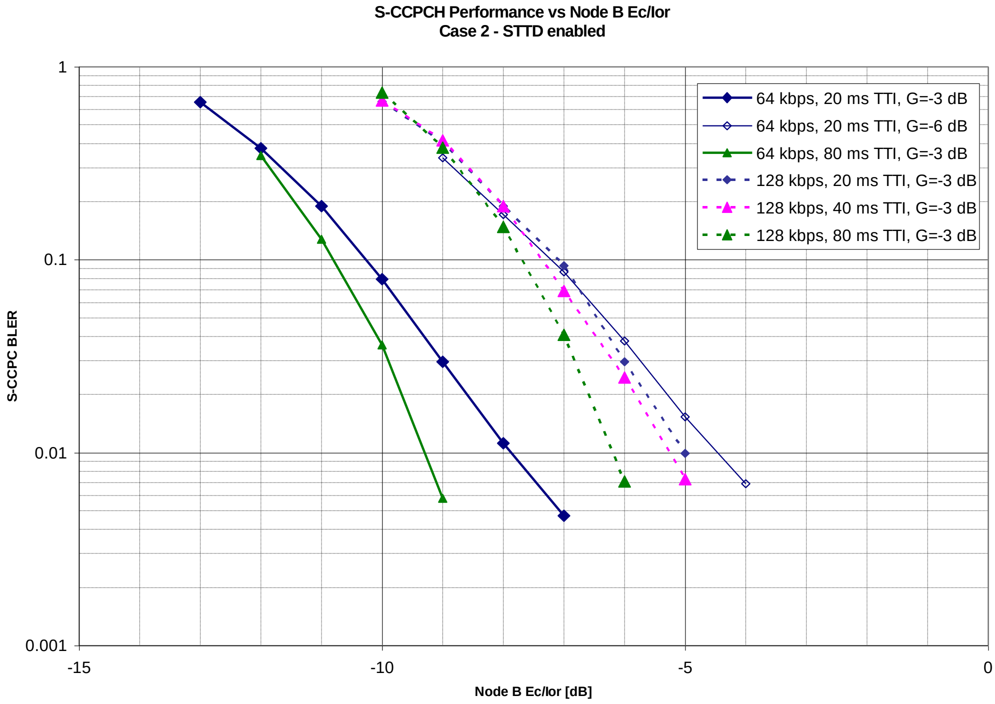

Figure 4.2.5: BLER vs. Tx Power – case 2

4.2.2.3 Results for Vehicular A (3 kmh)

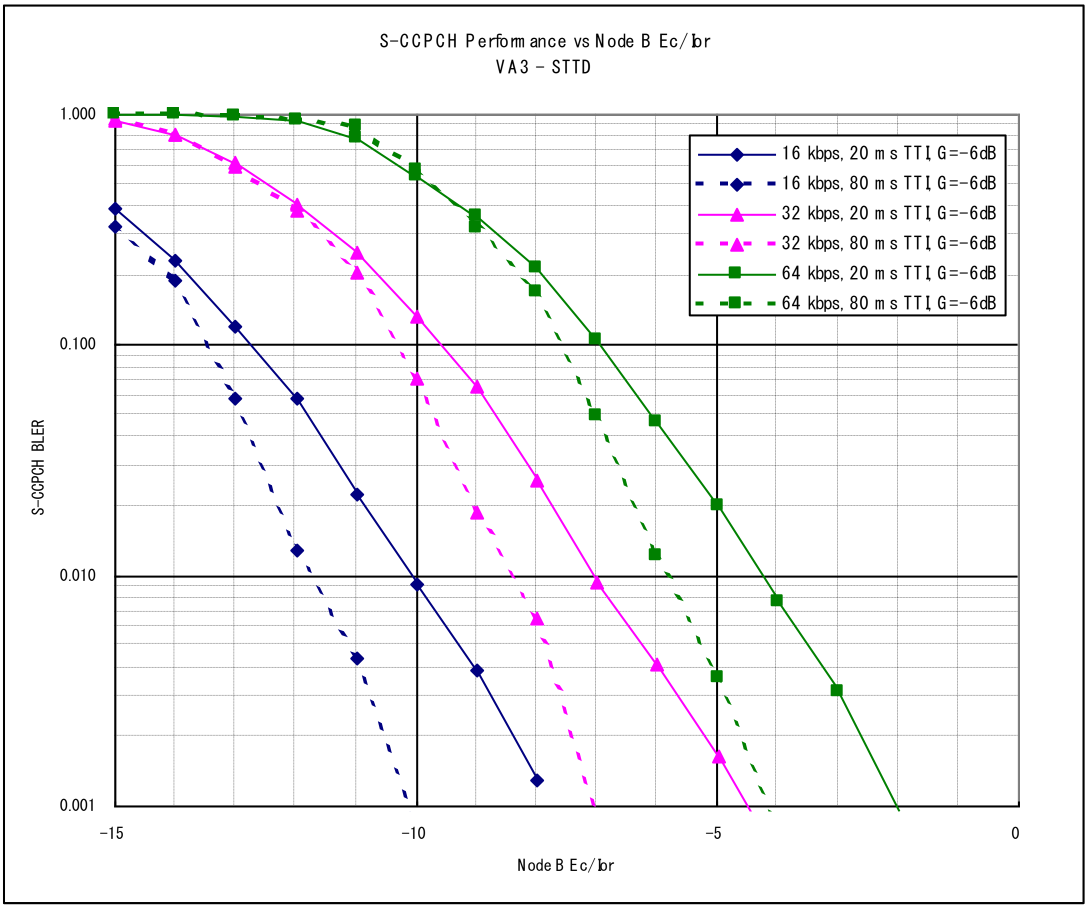

Figure 4.2.6: BLER vs. Tx Power – case 2

4.2.2.4 Results for Pedestrian A (3 kmh)

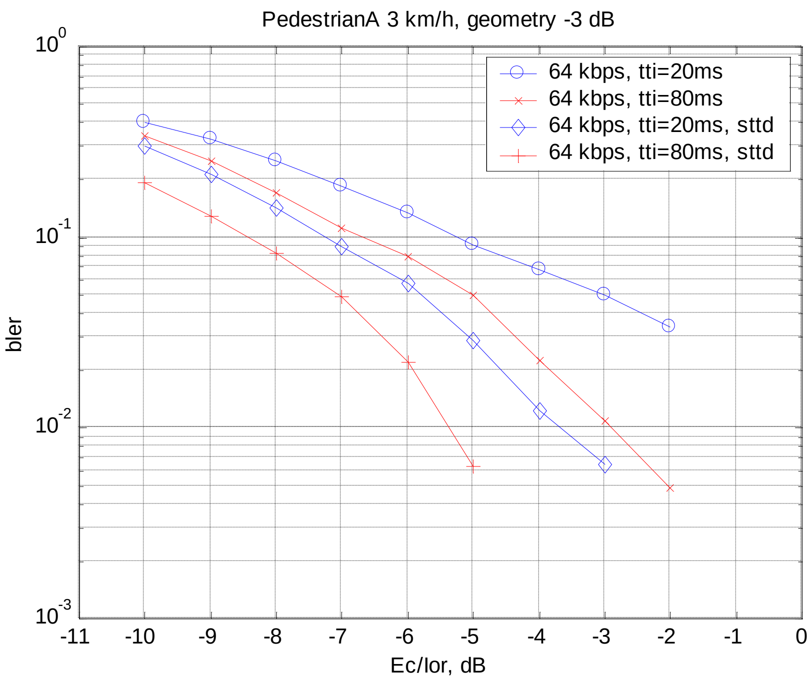

Figure 4.2.7: BLER vs. Tx Power – Pedestrian A (3kmh)

4.2.2.5 Results for Pedestrian B (3 kmh)

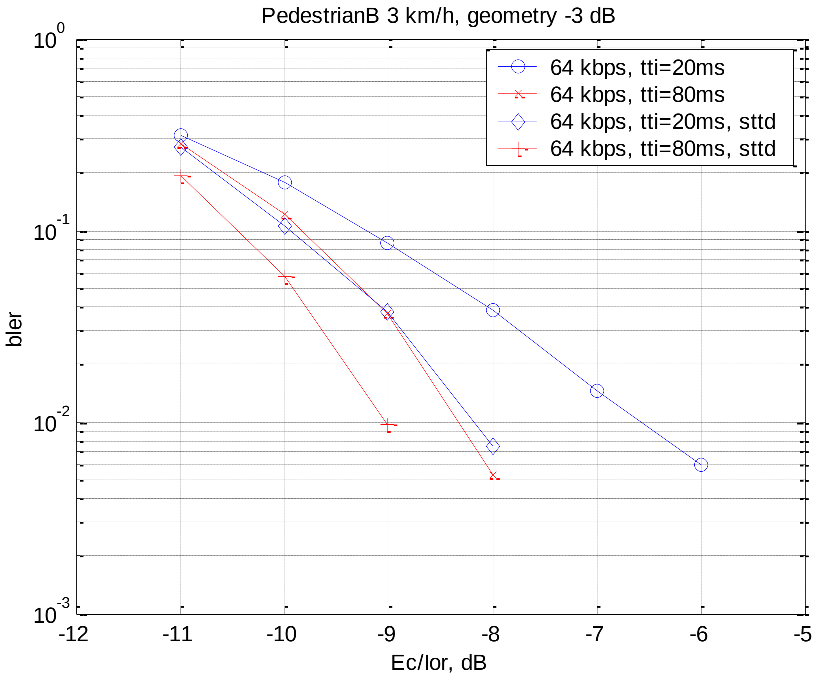

Figure 4.2.8: BLER vs. Tx Power – Pedestrian B (3 kmh)

4.2.2.6 Results for Vehicular - A (30 kmh)

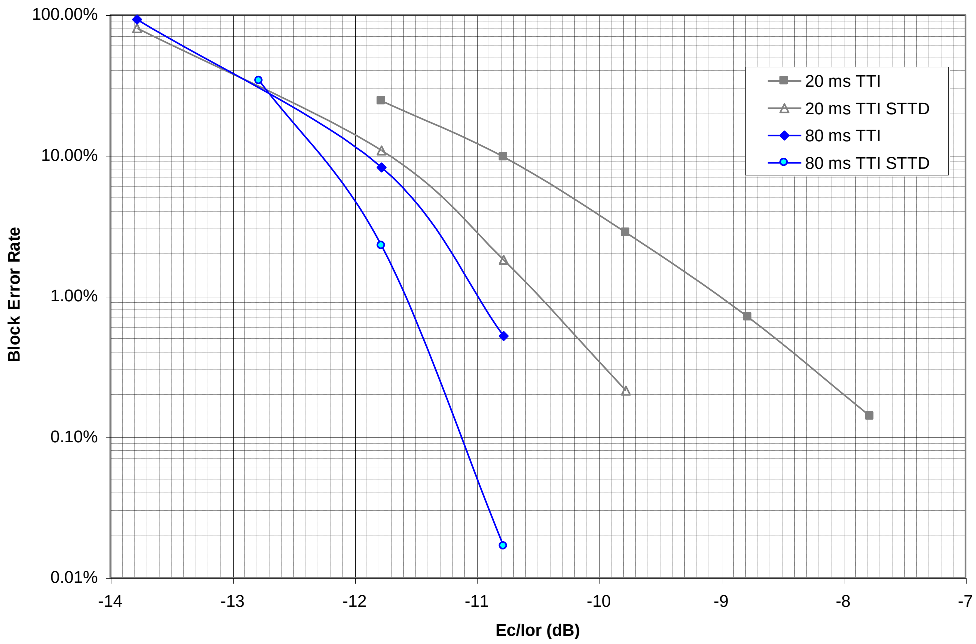

Figure 4.2.9: BLER vs. Tx Power – VA30

Figure 4.2.9 shows the performance of 64 kbps S-CCPCH for Vehicular-A channel model at 30 kph. It may be observed from the figure that by increasing the TTI from 20 to 80 ms the power allocation is reduced by approximately 1.5 dB and 0.5 dB for the no STTD and STTD case respectively.

4.2.2.7 256 kbps Results for Vehicular A – 3 and 30 kmph

Figure 4.2.10 shows 256 kbps results for Vehicular A and various geometries

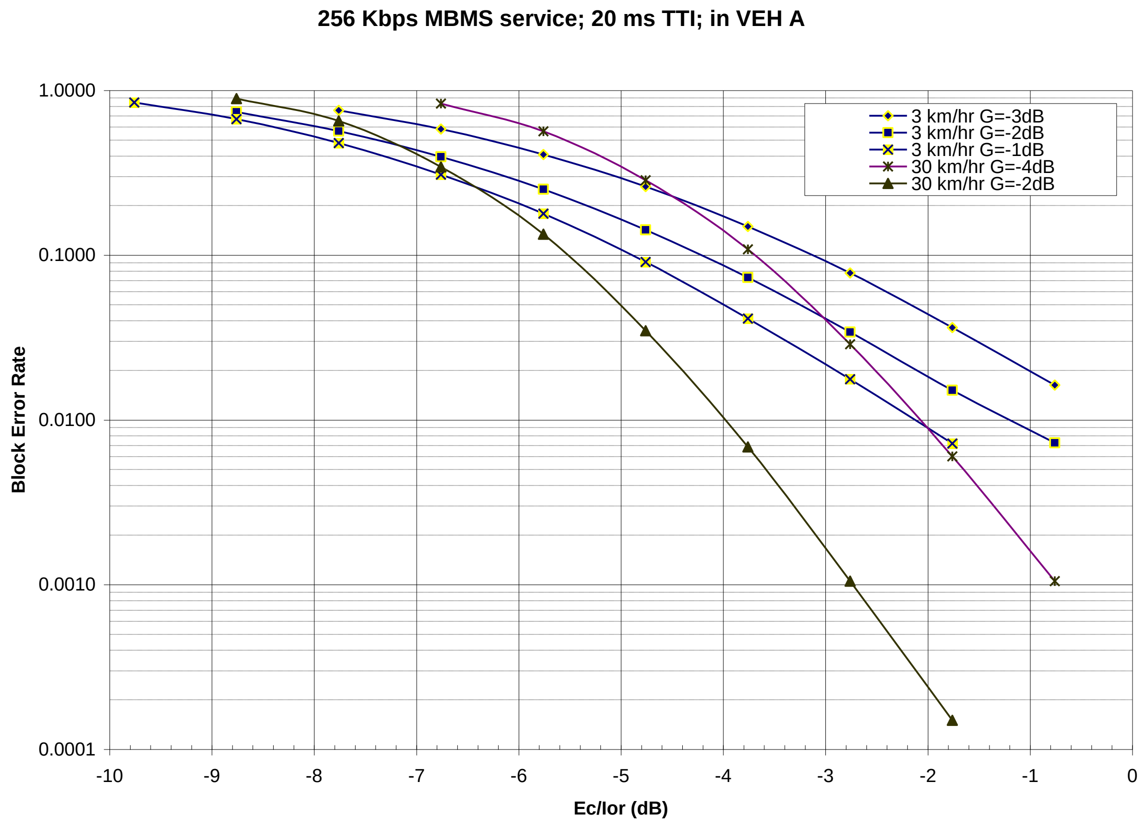

Figure 4.2.10 : Block error rate versus Ec/Ior, 256 kbps MBMS service, Vehicular A, Geometries; -4, -3,-2, and -1 dB

4.2.2.8 256 kbps results for Pedestrian B – 3km

Figure 4.2.11 shows 256 Kbps results for Pedestrian B for various Geometries.

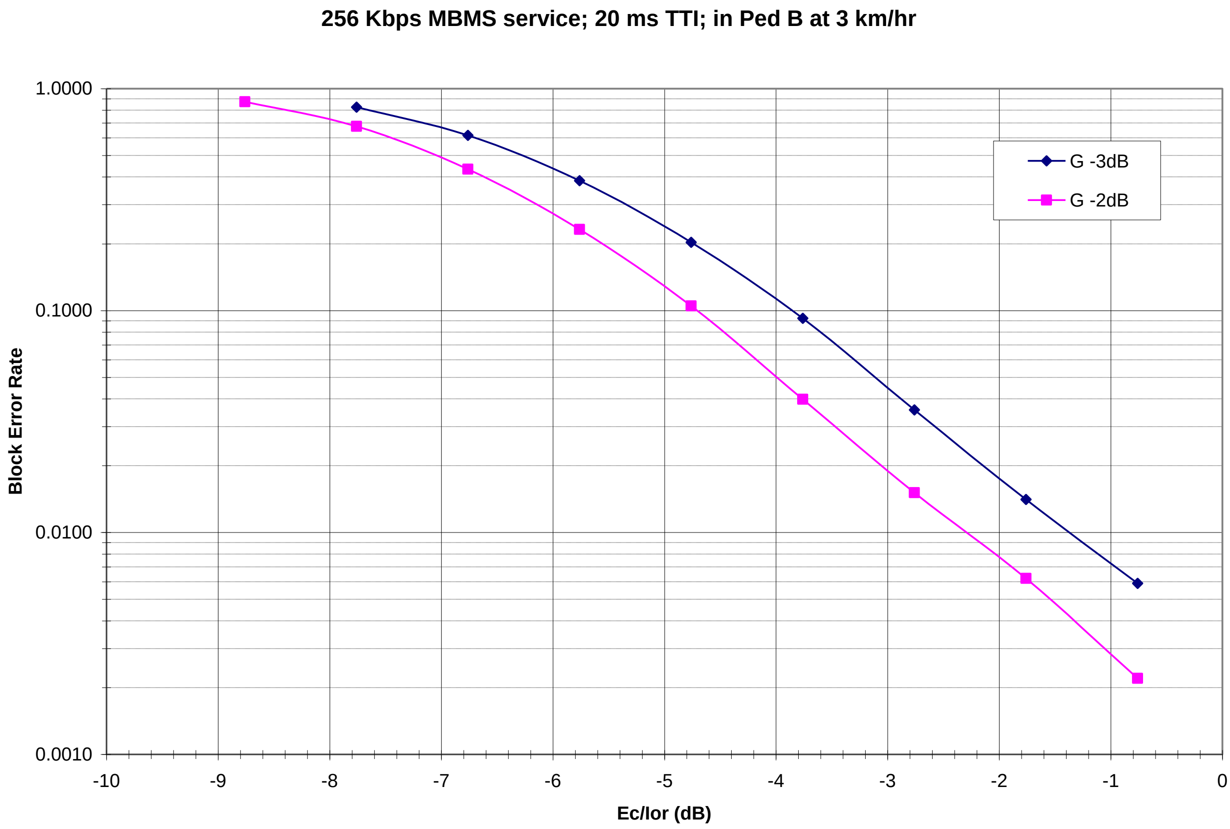

Figure 4.2.11: Block error rate versus Ec/Ior for 256 MBMS Pedestrian B 3kmph

4.3 Performance using new functionality

4.3.1 Selective Combining

Selective Combining (SC) is an enhancement for Release-6 PtM MBMS. In this section, the system level performance of Selective Combining for MBMS is presented. In Figures 4.3.2-4.2.10, the 1% BLER coverage vs MBMS channel power (Node-B Tx Ec/Ior) with Selective Combining over 2 and 3 radio links (RLs) are shown for various path models and TTI lengths. In Tables 4.3.4-4.3.6, the required percentage Node-B power for 90% and 95% coverage of 1%BLER is summarized. In these figures and tables, the performance of the conventional 1 radio link (RL) reception is also illustrated for comparison. Finally, in the UE impact analysis the least needed Rel. 99 UE capability class for an MBMS with 64 kbps is shown considering different number of radio links and different TTI lengths.

4.3.1.1 General Description

Selective Combining for MBMS is illustrated in Figure 4.3.1 below. The network is to simulcast PtM MBMS contents on the S-CCPCH, and the UE is to receive and decode the MBMS data from multiple radio links simultaneously. Selection of the radio link is to be performed on a transport block basis at the RLC, based on CRC results and sequence numbers.

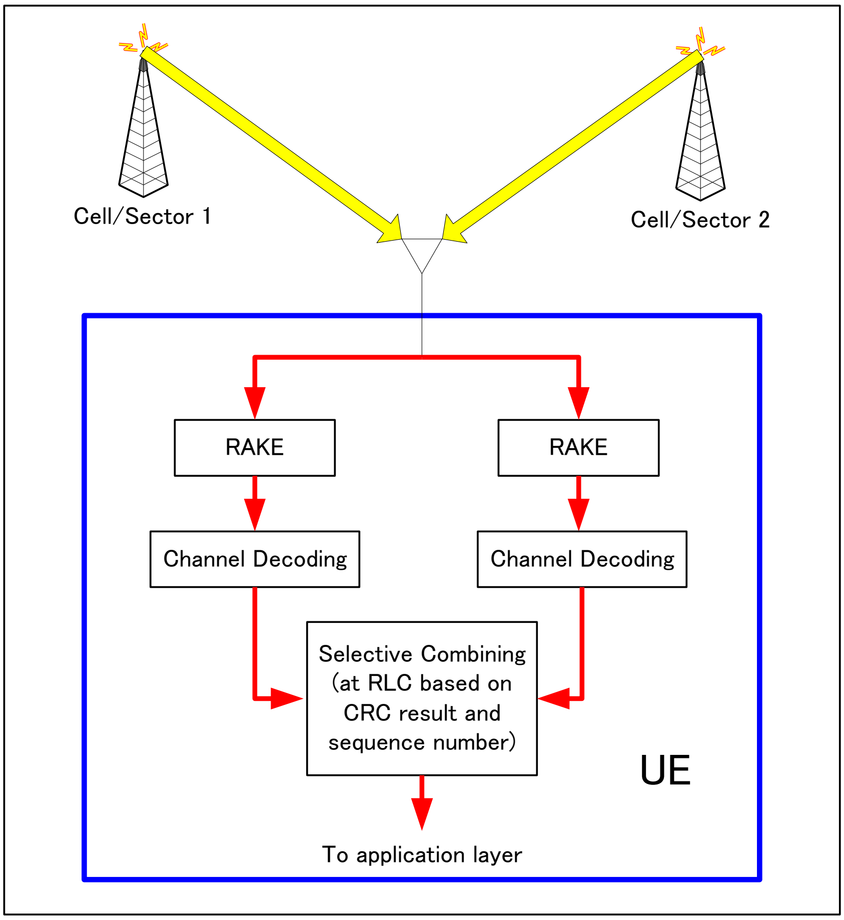

Figure 4.3.1: Selective Combining

4.3.1.2 Simulation Assumptions

In section 4.3.1.3, the system level performance of Selective Combining obtained from simulations is provided. Table 4.3.1 shows MBMS QoS assumptions, Table 4.3.2 shows the link level assumptions, and Table 4.3.3 shows the system level assumptions used for the simulations.

Table 4.3.1: MBMS QoS assumptions

Parameter	Value
MBMS data rate	64kbps
BLER	1%

Table 4.3.2: Link level assumptions

Parameter	Value
S-CCPCH slot format	10
Transmission interval (TTI)	BLER <= 1%
CPICH Ec/Ior	-10 dB (10%)
P-SCH Ec/Ior	-15 dB (3%)
S-SCH Ec/Ior	-15 dB (3%)
Tx Ec/Ior	Varied
Channel estimation	Enabled
Power Control	Disabled
Open loop transmit diversity	Disabled
Channel	Case 2, 3kmh [3] Pedestrian A, 3 km/h [4] Pedestrian B, 3 km/h [4]

Table 4.3.3: System level assumptions

Parameter	Value
Cellular Layout	19 Hexagonal cells, 3-sector sites
Site to site distance	2800 m (1.6 km cell radius)
Node-B antenna gain + cable loss	14 dBi
Antenna front-to-back ratio	20 dB
Horizontal antenna pattern	70 degrees (-3dB) beamwidth
Vertical antenna pattern loss	Considered
Propagation model	Path loss = 128.1 + 37.6*log(R)
Standard deviation of slow fading	8.0 dB
Corrleation b/w sites for slow fading	0.5
Node-B total transmit power	43 dBm
Thermal noise	-174 dBm/Hz
UE noise figure	9 dB
HHO hysterisis	3dB (only for no Selective Combining)

4.3.1.3 Results for Pedestrian A (3km/hr)

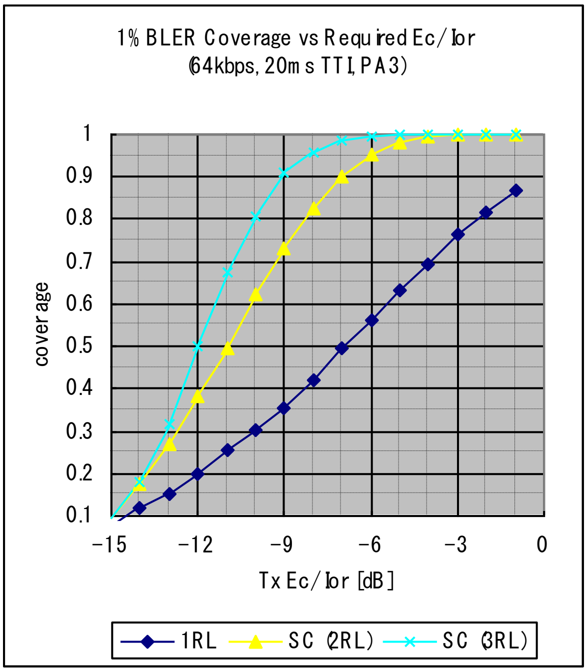

Figure 4.3.2 – 64kbps, 1%BLER, PA3, 20ms TTI

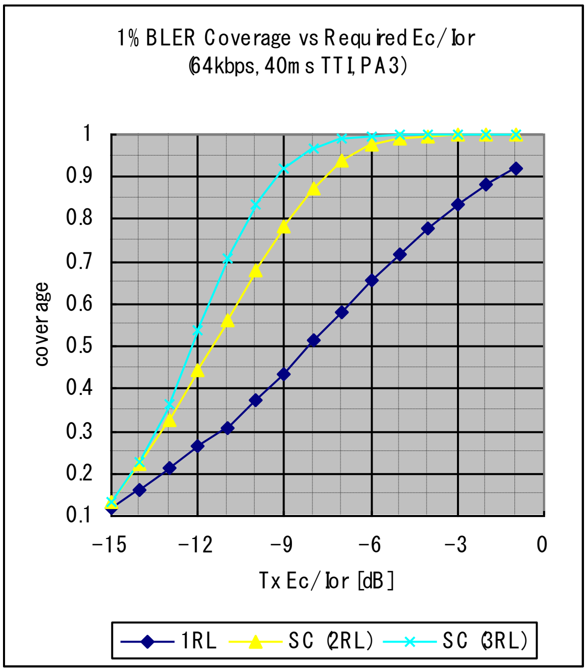

Figure 4.3.3 – 64kbps, 1%BLER, PA3, 40ms TTI

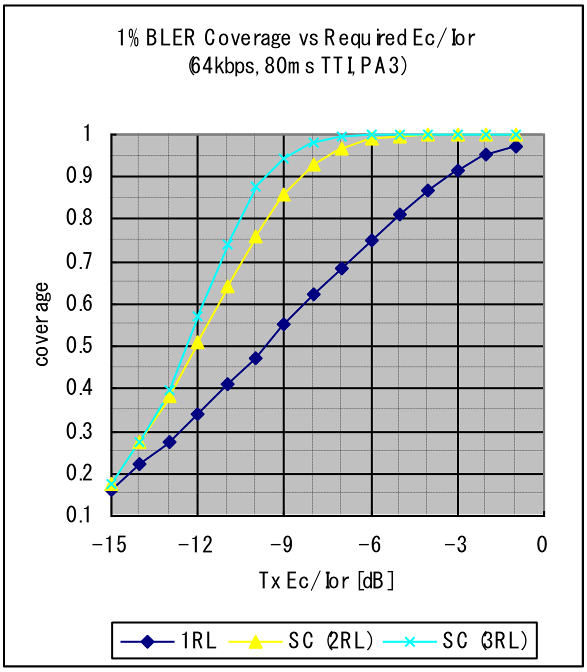

Figure 4.3.4 – 64kbps, 1%BLER, PA3, 80ms TTI

4.3.1.4 Results for Case 2 - 3km/hr

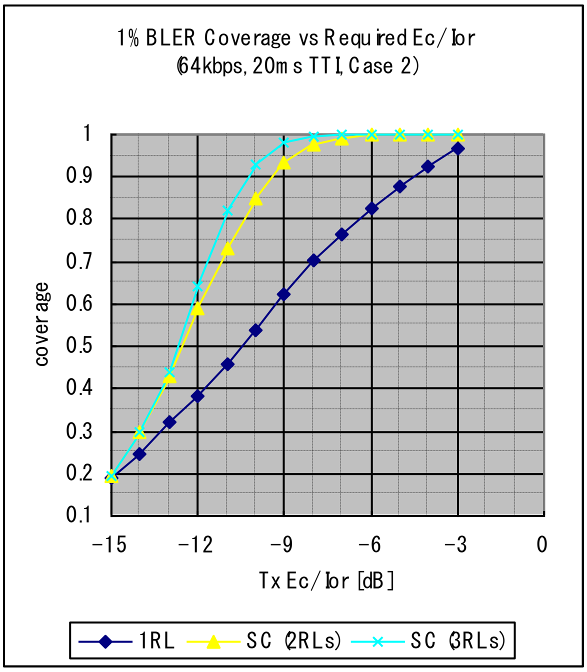

Figure 4.3.5 – 64kbps, 1%BLER, Case 2, 20ms TTI

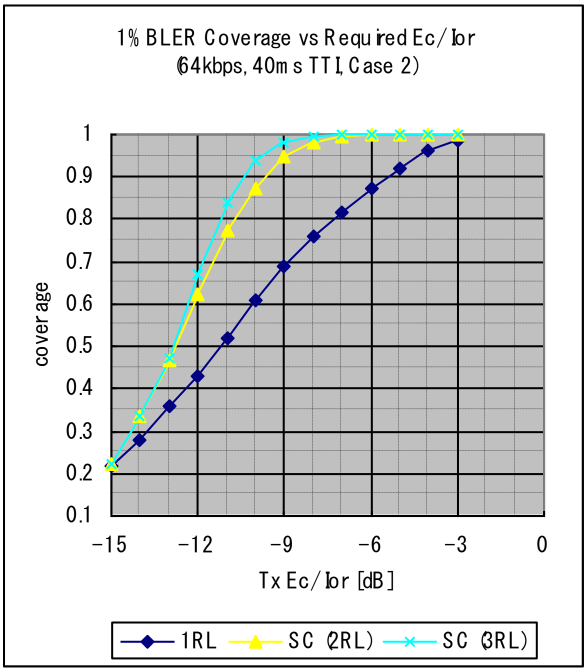

Figure 4.3.6 – 64kbps, 1%BLER, Case 2, 40ms TTI

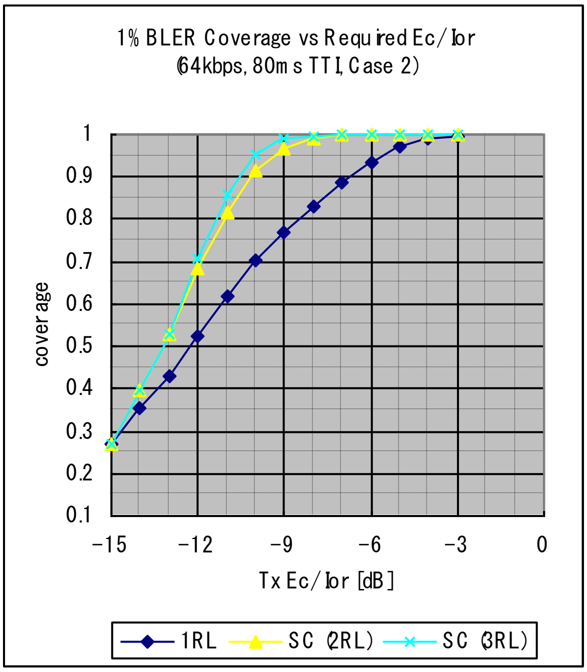

Figure 4.3.7 – 64kbps, 1%BLER, Case 2, 80ms TTI

4.3.1.5 Results for Pedestrian B (3km/hr)

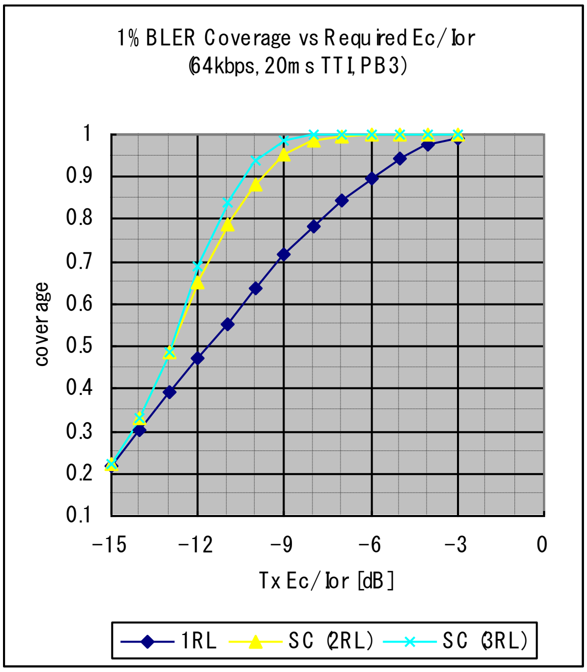

Figure 4.3.8 – 64kbps, 1%BLER, PB3, 20ms TTI

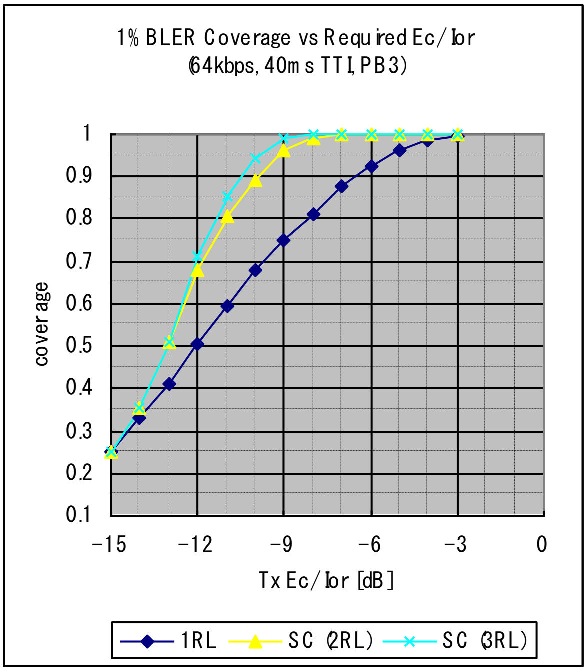

Figure 4.3.9 – 64kbps, 1%BLER, PB3, 40ms TTI

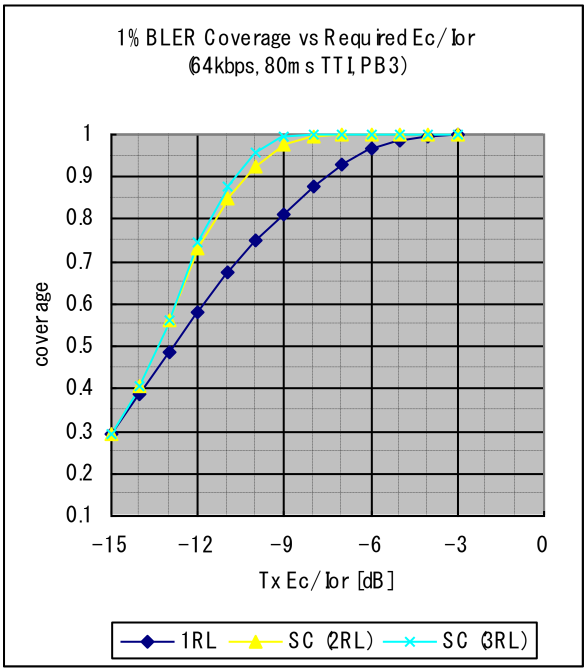

Figure 4.3.10 – 64kbps, 1%BLER, PB3, 80ms TTI

4.3.1.6 Summary of Required Node-B power for 90% and 95% coverage of 1% BLER

Table 4.3.4 – Required Node-B power for 90% and 95% coverage of 1% BLER of a 64kbps MBMS channel (PA3)

Coverage @ 1% BLER	TTI length	1 RL	SC (2RL)	SC (3 RL)
90%	20ms	cannot support	-7.0dB (20.0%)	-9.1dB (12.3%)
	40ms	-1.6dB (69.2%)	-7.6dB (17.4%)	-9.2dB (12.0%)
	80ms	-3.3dB (46.8%)	-8.4dB (14.5 %)	-9.7dB (10.7%)
95%	20ms	cannot support	-6.1dB (24.5%)	-8.2dB (15.1 %)
	40ms	cannot support	-6.7dB (21.4%)	-8.3dB (14.8%)
	80ms	-2.1dB (61.7%)	-7.5dB (17.8%)	-8.8dB (13.2%)

Table 4.3.5 – Required Node-B power for 90% and 95% coverage of 1% BLER of a 64kbps MBMS channel (Case 2)

Coverage @ 1% BLER	TTI length	1 RL	SC (2RL)	SC (3 RL)
90%	20ms	-4.6dB (34.7%)	-9.4dB (11.5%)	-10.3dB (9.3%)
	40ms	-5.4dB (28.8%)	-9.7dB (10.7%)	-10.4dB (9.1%)
	80ms	-6.7dB (21.4%)	-10.2dB (9.5%)	-10.6dB (8.7%)
95%	20ms	-3.4dB (45.7%)	-8.6dB (13.8%)	-9.6dB (11.0%)
	40ms	-4.3dB (37.2%)	-9.0dB (12.6%)	-9.7dB (10.7%)
	80ms	-5.6dB (27.5%)	-9.4dB (11.5%)	-10.0dB (10.0%)

Table 4.3.6 – Required Node-B power for 90% and 95% coverage of 1% BLER of a 64kbps MBMS channel (PB3)

Coverage @ 1% BLER	TTI length	1 RL	SC (2RL)	SC (3 RL)
90%	20ms	-5.9dB (25.7%)	-9.7dB (10.7%)	-10.4dB (9.1%)
	40ms	-6.5dB (22.4%)	-9.9dB (10.2%)	-10.5dB (8.9%)
	80ms	-7.6dB (17.4%)	-10.3dB (9.3 %)	-10.7dB (8.5%)
95%	20ms	-4.8dB (33.1%)	-9.0dB (12.6%)	-9.7dB (10.7%)
	40ms	-5.4dB (28.8%)	-9.2dB (12.0%)	-9.9dB (10.2%)
	80ms	-6.5dB (22.4%)	-9.5dB (11.2%)	-10.1dB (9.8%)

4.3.1.7 UE impact analysis

In Selective Combining, complexities at the UE for receiving and decoding multiple radio links must be considered. The TTI length should be addressed jointly as it also impacts the buffering and processing requirements at the UE.

Concerning Layer 1 buffer sizes, the values shown in [9] define the limits for the different UE capabilities. They are defined for the frame buffer (size=K *words*), the TTI buffer (size=A*6.6 *words*), and the decoded TrBlks buffer (size=A *bits*). The number *A* is related to the "maximum sum of number of bits of all transport blocks being transmitted at an arbitrary time instant" and the number *K* is the "maximum number of physical channel bits received in any 10 ms interval (DPCH, PDSCH, S-CCPCH)" [9].

In table 4.3.7, the memory requirements for Selective Combining are shown, and the minimum required Release-99 UE capability class is presented. As is the minimum requirement of MBMS UEs, one S-CCPCH with SF 128 used for FACH is assumed as an additional channel to the SCCPCH carrying the MBMS. Furthermore, for each MBMS transport block of length 320 bits, an overhead of 16 bits (CRC bits) is assumed.

Table 4.3.7 – Buffer requirements and needed Release-99 UE capability class for Selective Combining over different numbers of radio links and TTI lengths for a 64 kbps MBMS

-	channel	SF	TTI	No. of S-CCPCH	frame buffer size	TTI buffer size	Total decoded data size per TTI	Minimum UE class
R99 S-CCPCH	PCH, 24 kbps	128	10	1	600	600	240	32 kbps
MBMS RLs=1	MTCH 64 kbps, 1 RL	32	20	2	3000	5400	1584	128 kbps *1)
			40	2	3000	10200	2928	128 kbps *1)
			80	2	3000	19800	5616	384 kbps
MBMS RLs=2	2 RLs	32	20	3	5400	10200	2928	384 kbps *1)
			40	3	5400	19800	5616	384 kbps
			80	3	5400	39000	10992	2048 kbps *2)
MBMS RLs=3	3 RLs	32	20	4	7800	15000	4272	384 kbps
			40	4	7800	29400	8304	768 kbps
			80	4	7800	58200	16368	2048 kbps

Note *1): The required UE capability class is assumed for a UE that does not support PDSCH.

Note *2): The total decoded data size is nearly the limit of 10240 for the 768 kbps class.

Remarks:

- Selective Combining of 2 RLs with 40ms TTI can be performed by a 384kbps Release-99 reference UE class.
- Selective Combining of 3 RLs with 40ms TTI and Selective Combining of 2RLs with 80ms can be performed by a 384kbps Release-99 reference UE class, if the total decoded data size per TTI would be increased or if a higher internal UE scheduling effort for the decoding with memory sharing would be applied (there is enough headroom concerning the frame buffer size and the TTI buffer size).
- It is FFS if the 384kbps UE capability class is the relevant reference class for Release 6 MBMS (Higher UE capability class is under consideration).

4.3.2 Soft Combining

4.3.2.1 General Description

For TTIs that can be soft combined, the UE receiver combines the signal from multiple cells either in the RAKE receiver or after the RAKE receiver in the receiver chain prior to the decoding of the soft combined transport channel. The conditions under which the UE is required to soft combine S-CCPCHs from multiple cells are specified in TS 25.306.

4.3.2.2 Simulation Assumptions

In section, 4.3.2.3 the system level performance of Soft Combining obtained from simulations is provided. Table 4.3.8 shows MBMS QoS assumptions and Table 4.3.9 shows the link level assumptions used for the simulations. The system level simulation assumptions are as defined in section 4.5. Note that the handover margin for the 'no soft combining' case in figure 4.5.2 is set to 0 dB.

Table 4.3.8: MBMS QoS assumptions

Parameter	Value
MBMS data rate	64kbps
BLER	1%

Table 4.3.9: Link level assumptions

Parameter	Value
S-CCPCH slot format	10
Transmission time interval (TTI)	80 ms
CPICH Ec/Ior	-10 dB (10%)
Tx Ec/Ior	Varied
Channel estimation	Enabled
Power Control	Disabled
Open loop transmit diversity	Disabled
Channel	Vehicular A, 3km/h
Handover margin for no soft combining	0 dB

4.3.2.3 Simulation Results for Vehicular A (3km/h)

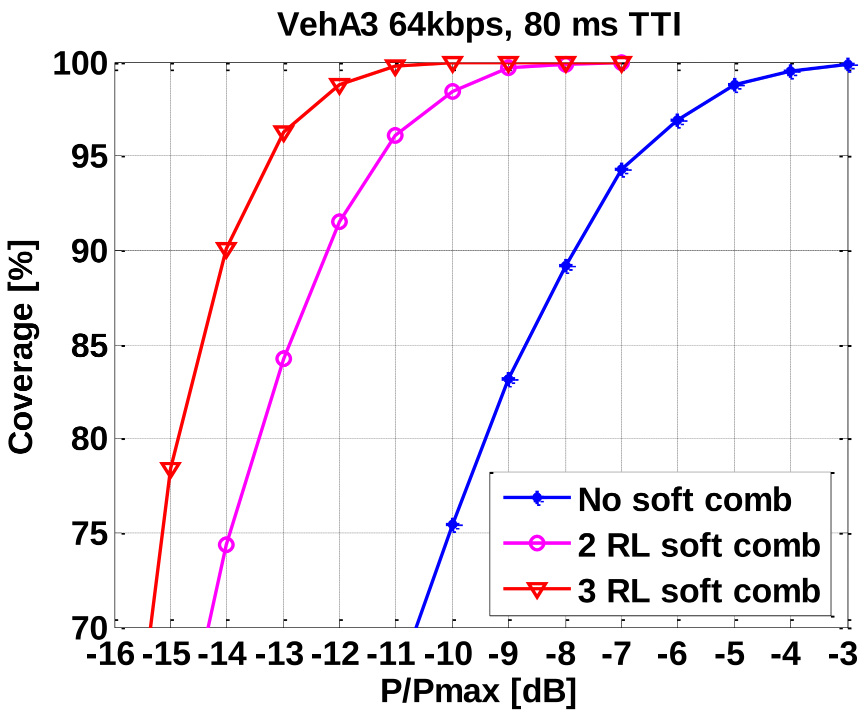

Figure 4.3.11: Estimated coverage vs. fraction of total Tx power with Soft Combining (64 kbps, 80ms TTI, STTD off, 1% BLER).

4.3.2.4 Summary of Required Node-B power for 90% and 95% coverage of 1% BLER

As shown in table 4.3.10 below, the use of Soft Combining with 3 radio links significantly reduces the transmit power requirement for one 64kbps MBMS channel to 4.8% of the Node-B power in order to achieve 95% coverage at 1% BLER.

Thus, assuming 80% of the cell power being available for MBMS, a total of 16 MBMS channels of 64kbps each could be allocated, allowing for a total MBMS cell capacity of around 1Mbps.

Table 4.3.10: Required Node-B power for 90% and 95% coverage of 1% BLER of a 64kbps MBMS channel (VA3)

Coverage @ 1% BLER	TTI length	No Combining (1 RL)	Soft Combining (2RL)	Soft Combining (3 RL)
90%	80ms	-7.9dB (16.2%)	-12.2dB (6.0 %)	-14.0dB (4.0%)
95%	80ms	-6.8dB (20.9%)	-11.2dB (7.6%)	-13.2dB (4.8%)

4.4 Summary with Release-5 functionality

This section provides a summary of the results for the baseline physical layer functionality as available in Release 5. The performance enhancement with physical layer enhancements introduced for MBMS in Release 6 (Selection Combining and Soft Combining) are documented in their respective subsections 4.3.1 and 4.3.2 of this technical report.

Tables 4.4.1-4.4.6 show the SCCPCH power requirement as a fraction of the cell power for different data rates, geometries (i.e. cell coverage) and error rate targets and as a function of physical layer configurations (TTI value & transmit diversity mode) and propagation environment (i.e. radio channel models). Note that the case 1 and Pedestrian A channel models are not representative of urban macrocellular environments, and the applicability of these models to other environments is FFS.

4.4.1 Results with Case 1 (3 kmh)

Table 4.4.1: Required fraction of cell Tx power -- Case 1 channel – 3 kmh

Data Rate	TTI	Geometry	Fraction of cell Tx power for 1% BLER	
			Tx diversity disabled	Tx diversity enabled
64 kbps	20 ms	-3 dB	>100%	31.6%
64 kbps	80 ms	-3 dB	42.7%	19.5%
128 kbps	20 ms	-3 dB	>100%	69.2%
128 kbps	40 ms	-3 dB	>100%	53.7%
128 kbps	80 ms	-3 dB	87.1%	39.8%

4.4.2 Results with Case 2 (3 kmh)

Table 4.4.2: Required fraction of cell Tx power – Case 2 channel – 3kmh

Data Rate	TTI	Geometry	Fraction of cell Tx power for 1% BLER	
			Tx diversity disabled	Tx diversity enabled
64 kbps	20 ms	-3 dB	31.6%	16.2%
64 kbps	20 ms	- 6 dB	79.4%	35.5%
64 kbps	80 ms	-3 dB	17.8%	11.7%
128 kbps	20 ms	-3 dB	63.1%	31.6%
128 kbps	40 ms	-3 dB	53.7%	29.5%
128 kbps	80 ms	-3 dB	38.0%	24.0%

4.4.3 Results with Pedestrian-A (3 kmh)

Table 4.4.3: Required fraction of cell Tx power – Pedestrian A – 3kmh

Data Rate	TTI	Geometry	Fraction of cell Tx power for 1% BLER	
			Tx diversity disabled	Tx diversity enabled
64 kbps	20 ms	-3 dB	>63.1%	42.7%
64 kbps	80 ms	-3 dB	51.3%	29.5%

4.4.4 Results with Pedestrian-B (3 kmh)

Table 4.4.4: Required Tx Ec/Ior for target BLER -- Pedestrian B – 3kmh

Data Rate	TTI	Geometry	Fraction of cell Tx power for 1% BLER	
			Tx diversity disabled	Tx diversity enabled
64 kbps	20 ms	-3 dB	22.4%	15.1%
64 kbps	80 ms	-3 dB	14.8%	12.6%

4.4.5 Results with Vehicular-A (3 kmh)

Table 4.4.5: Required fraction of cell Tx power – Vehicular A – 3 kmh

Data Rate	TTI	Geometry	Fraction of cell Tx power for 1% BLER	
			Tx diversity disabled	Tx diversity enabled
16 kbps	20 ms	-6 dB	17.4%	9.8%
16 kbps	80 ms	-6 dB	10.0%	6.6%
32 kbps	20 ms	-6 dB	34.7%	19.5%
32 kbps	80 ms	-6 dB	20.9%	14.5%
64 kbps	20 ms	-6 dB	66.1%	37.2%
64 kbps	80 ms	-6 dB	38.0%	26.3%

4.4.6 Results with Vehicular-A (30 kmh)

Table 4.4.6: Required fraction of cell Tx power - Vehicular A -30 kmh

Data Rate	TTI	Geometry	Fraction of cell Tx power for 1% BLER	
			Tx diversity disabled	Tx diversity enabled
64 kbps	20 ms	-3 dB	12.6%	8.9%
64 kbps	80 ms	- 3 dB	7.9%	6.9%

4.4.7 Results for 256 kbps with Vehicular A (3 kmph)

Table 4.4.7: Required Fraction of cell Tx power for 256 kbps – Vehicular A 3kmph

Data Rate	TTI	Geometry	Fraction of cell Tx power for 1% BLER	
			Tx diversity disabled	Tx diversity enabled
256 kbps	20 ms	-3 dB	>80%	-
256 kbps	20 ms	-2 dB	75%	-
256 kbps	20 ms	-1 dB	60%	-

4.4.8 Results for 256 kbps with Vehicular A (30 kmph)

Table 4.4.8: Required Fraction of cell Tx power for 256 kbps – Vehicular A 30kmph

Data Rate	**TTI**	**Geometry**	**Fraction of cell Tx power for 1% BLER**	
			Tx diversity disabled	**Tx diversity enabled**
256 kbps	20 ms	-4 dB	75%	-
256 kbps	20 ms	-2 dB	40%	-

4.4.9 Results for 256 kbps with Pedestrian B (3kmph)

Table 4.4.9: Required Fraction of cell Tx power for 256 kbps – Ped B 3kmph

Data Rate	**TTI**	**Geometry**	**Fraction of cell Tx power for 1% BLER**	
			Tx diversity disabled	**Tx diversity enabled**
256 kbps	20 ms	-3 dB	72%	-
256 kbps	20 ms	-2 dB	69%	-

4.5 Coverage Estimates

4.5.1 Urban Macrocell

This section provides coverage estimates for the urban macrocell scenario. The coverage was calculated based on the following two inputs [7]:

- Release-5 functionality link level curves present in this TR.
- The geometry CDF function specific to the macrocellular environment.

4.5.1.1 Macrocell Geometry Distribution

The geometry CDF was obtained using a typical set of simulation assumptions drawn from [4][5] and collected in table 4.5.1. The resulting geometry distribution is shown in figure 4.5.1.

Table 4.5.1 Simulation assumptions.

Parameter	Value
cellular layout	hexagonal grid
number of rings around central site	4
sectorisation	yes, 3 sectors/site
site to site distance	1000 m
NodeB antenna gain + cable loss	14 dBi
antenna front to back ratio	20 dB
horizontal antenna pattern	Gaussian
antenna beamwidth, -3 dB	70 degrees
propagation model	PL = 128.1 + 37.6*log(R) dB
std of shadow fading	10 dB
correlation between sites for slow fading	0.5
BS total transmit power	43 dBm
thermal noise	-174 dBm/Hz
UE noise figure	9 dB
HO threshold	3 dB

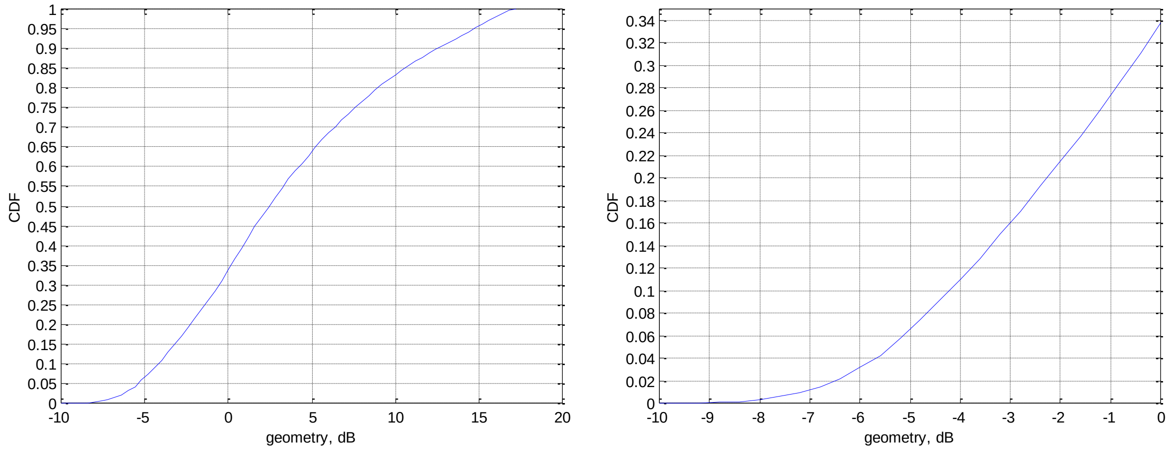

Figure 4.5.1 Geometry CDF for the macrocellular environment. (The right-hand plot shows the most relevant range of geometry values.)

4.5.1.2 Coverage Figures with Release-5 Functionality

The Vehicular A and Pedestrian B channel models are representative for the urban macrocellular scenario [6]. The coverage estimates for these channels are shown in figure 4.5.2 as a function of power dedicated to S-CCPCH, for a 64 kbps service, 80 ms TTI and 1% BLER target. As can be seen from figure 4.5.2, 90-95% coverage can be achieved with 12-30% of the total transmit power when STTD is disabled.

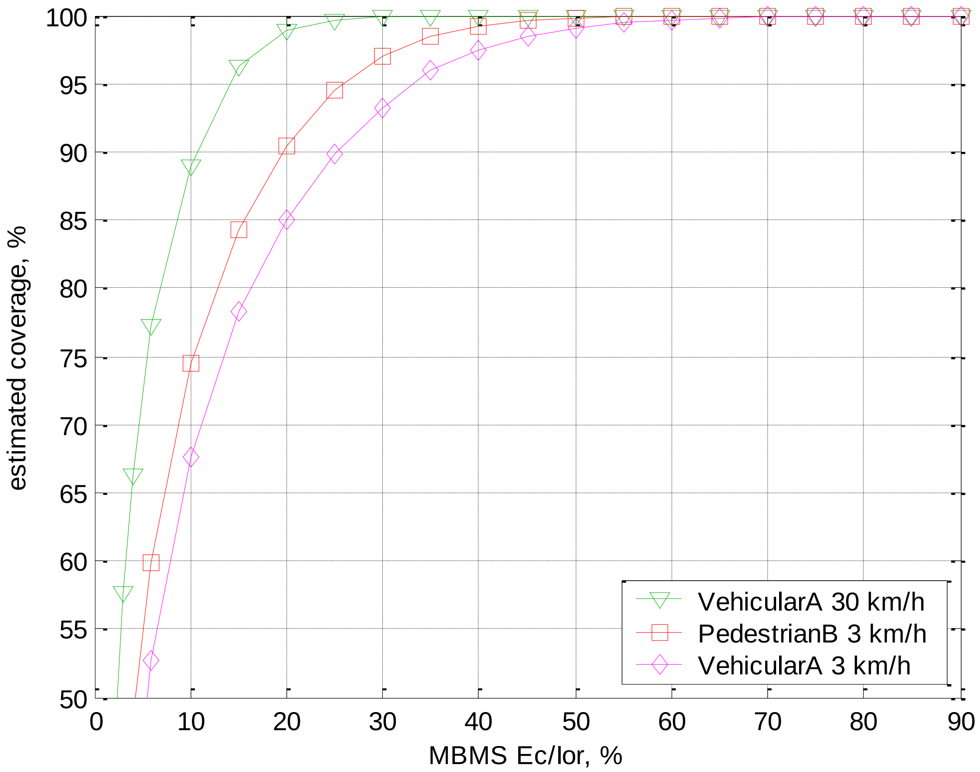

Figure 4.5.2: Estimated coverage vs. fraction of total Tx power (64 kbps, 80ms TTI, STTD off, 1% BLER).

5 S-CCPCH performance for 3.84 Mcps TDD

5.1 Simulation Assumptions

Table 5.1.1 presents simulation parameters that have been used in Section 5.2.

Table 5.1.1: Simulation parameters

Parameter	Value
S-CCPCH slot format	0 (32 kbps) 6 (64 & 128 kbps)
Transport block size	640 (32 kbps) 1280 (64 kbps) 2560 (128 kbps)
CRC length	16 bit
FEC coding	Turbo
TTI	20 ms, 80 ms
Spreading factor	16
MBMS timeslots per cell	1
$\sum DPCH\_Ec/Ior$	0 dB
Power control	None
Channel estimation	Realistic
Detection	JD-MMSE
Multipath channels	Case1 as per TS 25.102
Carrier frequency	2000 MHz
UE velocity	3 kmh

5.2 Performance using Release-5 functionality

In this Section the effects of TTI length upon the performance of S-CCPCH have been studied.

5.2.1 The effect of TTI length on MBMS performance

5.2.1.1 Results for Case 1 – 3kmph

Figure 5.2.1.1.1 indicates the effect of increasing the TTI length from 20ms to 80ms for data rates of 32 kbps, 64 kbps and 128 kbps.

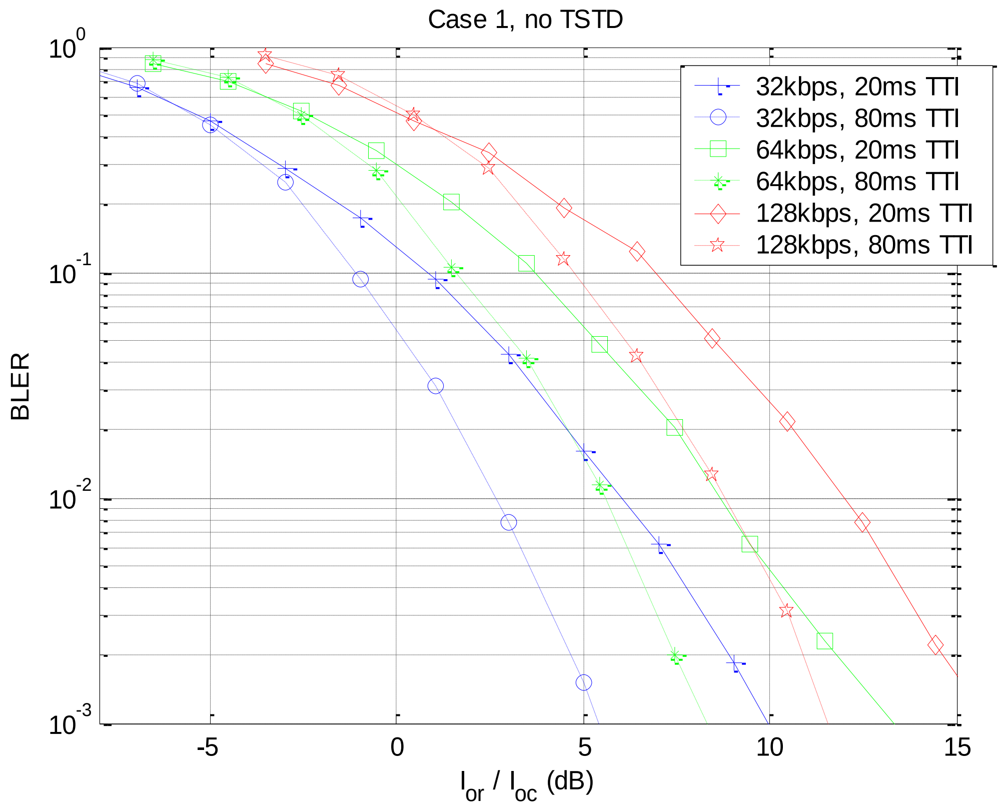

Figure 5.2.1.1.1

These results indicate that an increase of approximately 3 dB in performance is obtained at a 1% BLER through the use of a 80ms TTI rather than a 20ms TTI in the case 1 channel.

5.2.1.2 Results for Pedestrian A – 3kmph

Figure 5.2.1.2.1 indicates the effect of increasing the TTI length from 20ms to 80ms for data rates of 32 kbps, 64 kbps and 128 kbps.

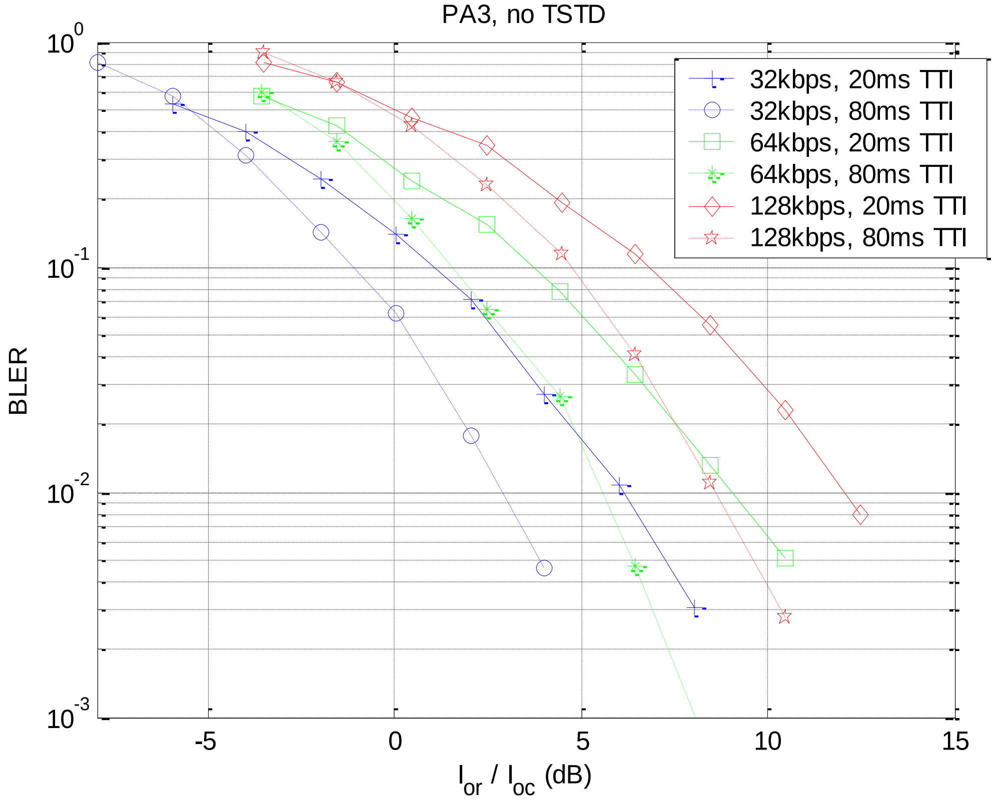

Figure 5.2.1.2.1

These results indicate that an increase of approximately 3.5 dB in performance is obtained at a 1% BLER through the use of a 80ms TTI rather than a 20ms TTI in the Pedestrian A channel.

5.2.1.3 Results for Pedestrian B – 3kmph

Figure 5.2.1.3.1 indicates the effect of increasing the TTI length from 20ms to 80ms for data rates of 32 kbps, 64 kbps and 128 kbps.

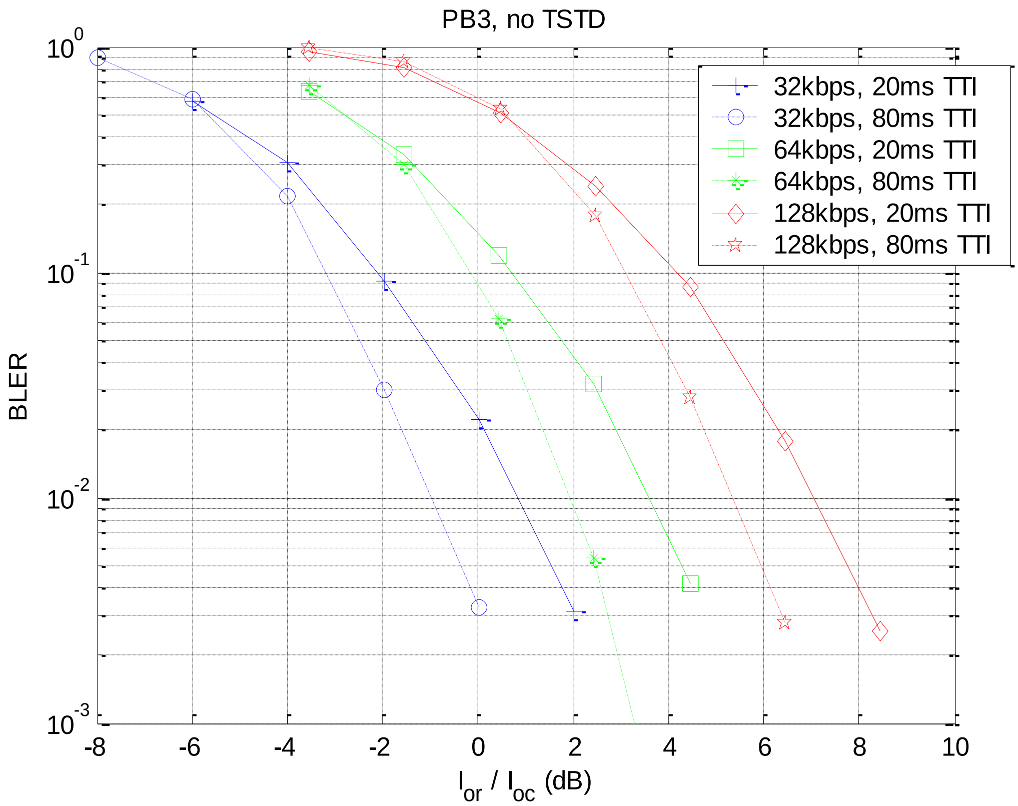

Figure 5.2.1.3.1

These results indicate that an increase of approximately 1.8 dB in performance is obtained at a 1% BLER through the use of a 80ms TTI rather than a 20ms TTI in the Pedestrian B channel.

5.2.1.4 Results for Vehicular A – 30kmph

Figure 5.2.1.4.1 indicates the effect of increasing the TTI length from 20ms to 80ms for data rates of 32 kbps, 64 kbps and 128 kbps.

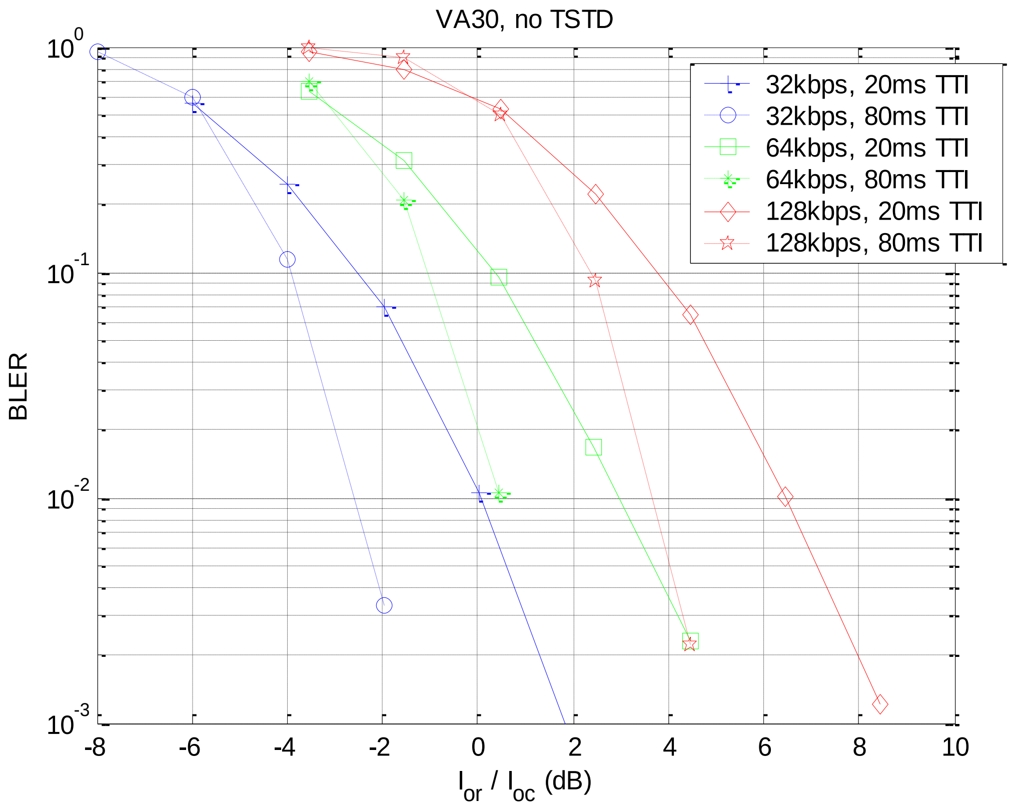

Figure 5.2.1.4.1

These results indicate that an increase of approximately 2.6 dB in performance is obtained at a 1% BLER through the use of a 80ms TTI rather than a 20ms TTI in the Vehicular A channel.

5.3 Performance using new functionality

5.3.1 The effect of Time Switched Transmit Diversity

Time Switched Transmit Diversity (TSTD) is currently not supported for S-CCPCH within HCR TDD release 5 specifications. The performance impact of the introduction of TSTD to S-CCPCH is addressed in this section in respect of MBMS services.

5.3.1.1 Results for Case 1 – 3kmph

Figure 5.3.1.1.1 indicates the performance with time switched transmit diversity for data rates of 32 kbps, 64 kbps and 128 kbps, and for TTI lengths of 20 ms and 80ms.

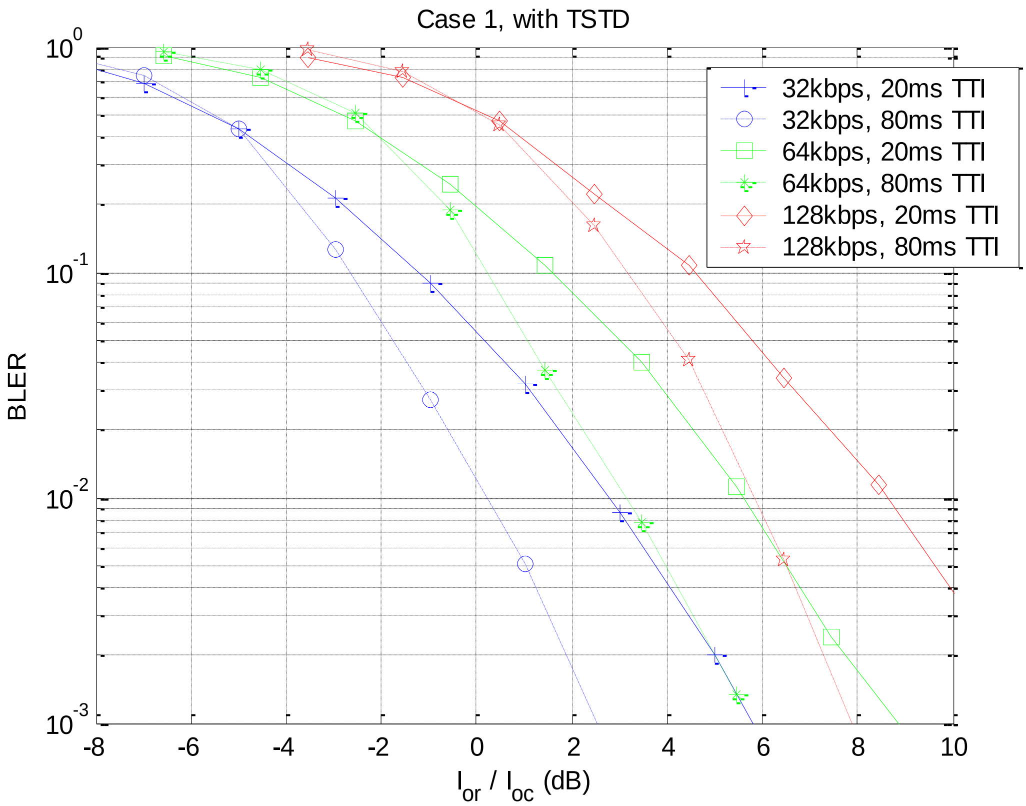

Figure 5.3.1.1.1

These results indicate that an increase of approximately 3 dB in performance is obtained at a 1% BLER through the use of time switched transmit diversity compared to no transmit diversity in the case 1 channel.

5.3.1.2 Results for Pedestrian A – 3kmph

Figure 5.3.1.2.1 indicates the performance with time switched transmit diversity for data rates of 32 kbps, 64 kbps and 128 kbps, and for TTI lengths of 20 ms and 80ms.

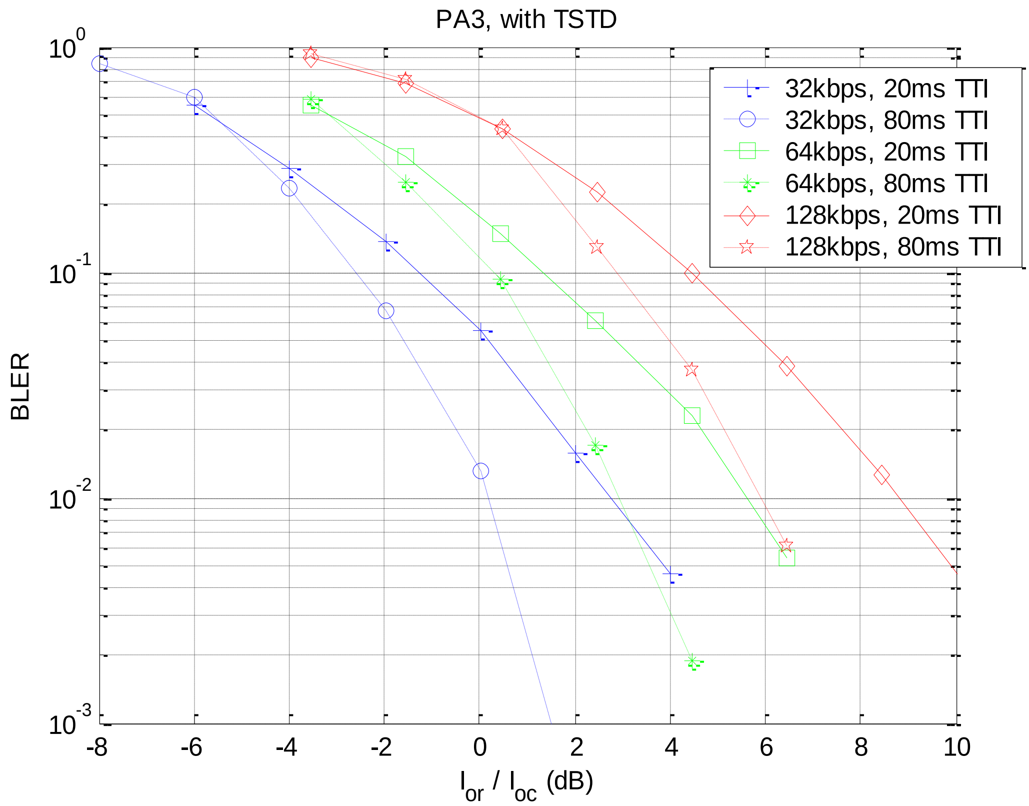

Figure 5.3.1.2.1

These results indicate that an increase of approximately 3dB in performance is obtained at a 1% BLER through the use of time switched transmit diversity compared to no transmit diversity in the Pedestrian A channel.

5.3.1.3 Results for Pedestrian B – 3kmph

Figure 5.3.1.3.1 indicates the performance with time switched transmit diversity for data rates of 32 kbps, 64 kbps and 128 kbps, and for TTI lengths of 20 ms and 80ms.

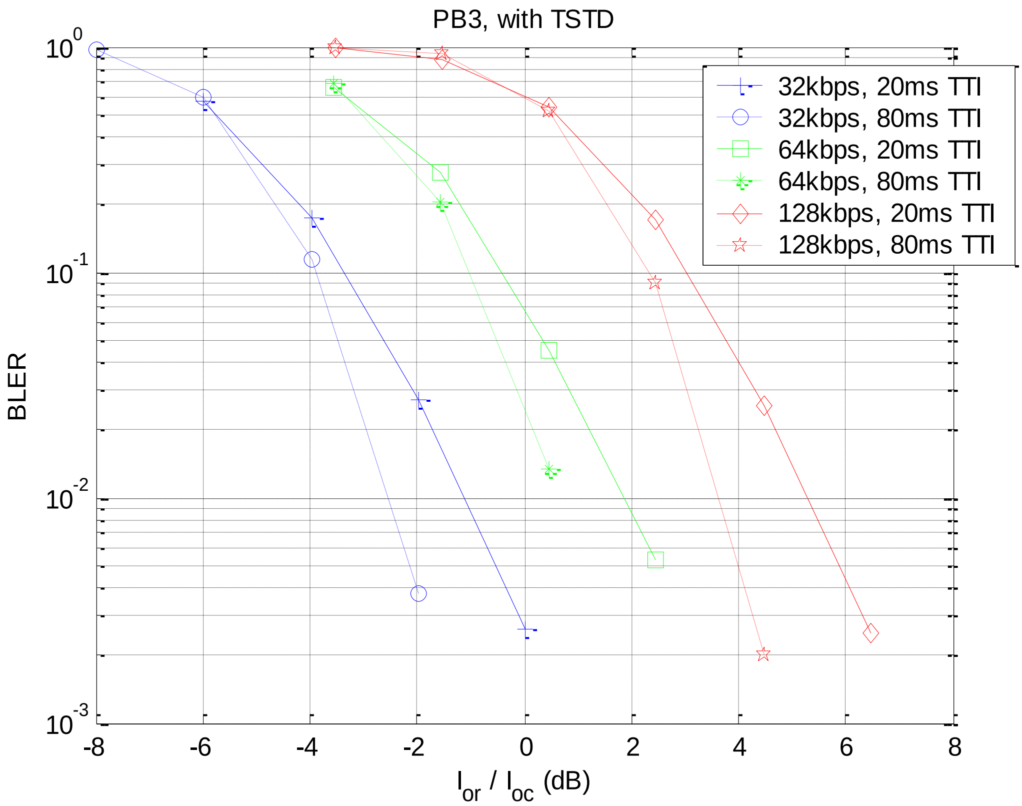

Figure 5.3.1.3.1

These results indicate that an increase of approximately 1.5dB in performance is obtained at a 1% BLER through the use of time switched transmit diversity compared to no transmit diversity in the Pedestrian B channel.

5.3.1.4 Results for Vehicular A – 30kmph

Figure 5.3.1.4.1 indicates the performance with time switched transmit diversity for data rates of 32 kbps, 64 kbps and 128 kbps, and for TTI lengths of 20 ms and 80ms.

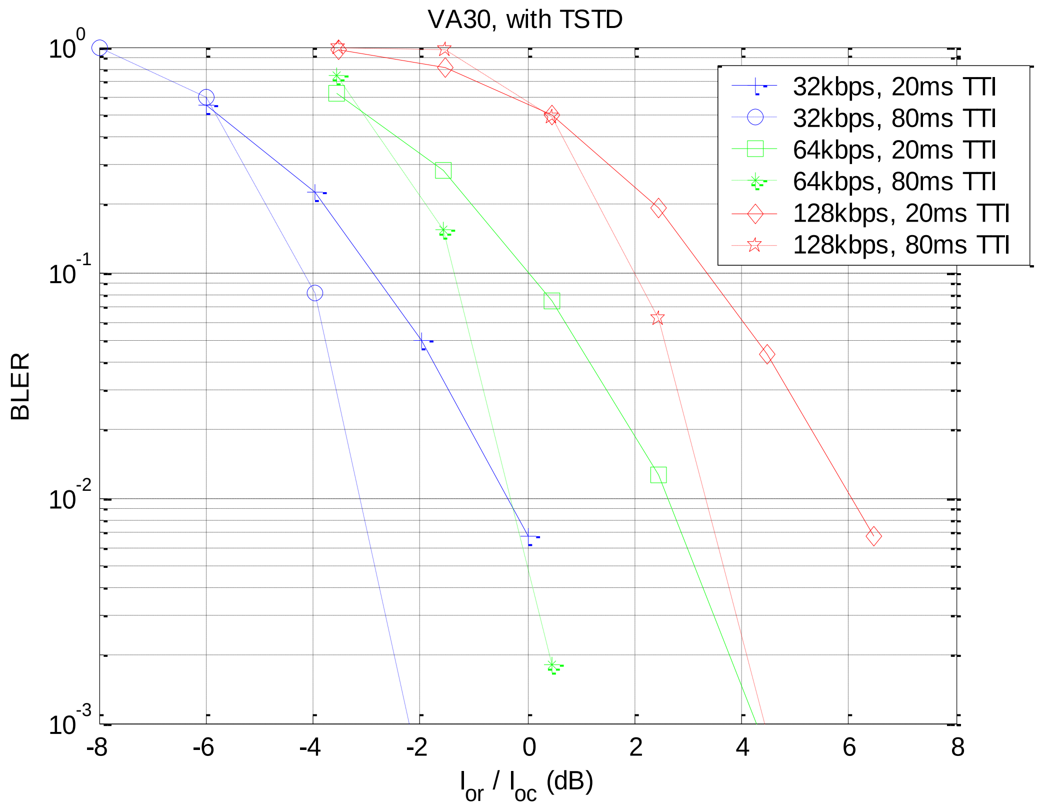

Figure 5.3.1.4.1

These results indicate that an increase of approximately 0.5dB in performance is obtained at a 1% BLER through the use of time switched transmit diversity compared to no transmit diversity in the Vehicular A channel.

5.4 Summary

5.4.1 Case 1 – 3kmph

This section provides a summary of the results for the TS25.102 Case 1 multipath channel at 3kmh. Table 5.4.1 shows the $\hat{I}_{or}/I_{oc}$ required to achieve a 1% BLER.

Table 5.4.1: Required $\hat{I}_{or}/I_{oc}$ for 1% BLER – Case 1, 3 kmph

Data rate	TTI	$\hat{I}_{or}/I_{oc}$ for 1% BLER	
		No TSTD	TSTD
32 kbps	20ms	6.0 dB	2.8 dB
32 kbps	80ms	2.6 dB	0.2 dB
64 kbps	20ms	8.7 dB	5.6 dB
64 kbps	80ms	5.6 dB	3.1 dB
128 kbps	20ms	12.0 dB	8.6 dB
128 kbps	80ms	8.8 dB	5.8 dB

5.4.2 Pedestrian A – 3kmph

This section provides a summary of the results for the Pedestrian A multipath channel at 3kmh. Table 5.4.2.1 shows the $\hat{I}_{or}/I_{oc}$ required to achieve a 1% BLER.

Table 5.4.2.1: Required $\hat{I}_{or}/I_{oc}$ for 1% BLER – Ped-A 3kmph

Data rate	TTI	$\hat{I}_{or}/I_{oc}$ for 1% BLER	
		No TSTD	TSTD
32 kbps	20ms	6.1 dB	2.7 dB
32 kbps	80ms	2.9 dB	0.2 dB
64 kbps	20ms	9.0 dB	5.6 dB
64 kbps	80ms	5.6 dB	2.9 dB
128 kbps	20ms	12.0 dB	8.8 dB
128 kbps	80ms	8.6 dB	5.9 dB

5.4.3 Pedestrian B – 3kmph

This section provides a summary of the results for the Pedestrian B multipath channel at 3kmh. Table 5.4.3.1 shows the $\hat{I}_{or}/I_{oc}$ required to achieve a 1% BLER.

Table 5.4.3.1: Required $\hat{I}_{or}/I_{oc}$ for 1% BLER – Ped-B 3kmph

Data rate	TTI	$\hat{I}_{or}/I_{oc}$ for 1% BLER	
		No TSTD	TSTD
32 kbps	20ms	0.8 dB	-1.1 dB
32 kbps	80ms	-1.0 dB	-2.6 dB
64 kbps	20ms	3.6 dB	1.9 dB
64 kbps	80ms	1.9 dB	0.6 dB
128 kbps	20ms	7.0 dB	5.3 dB
128 kbps	80ms	5.3 dB	3.6 dB

5.4.4 Vehicular A – 30kmph

This section provides a summary of the results for the Vehicular A multipath channel at 30kmh. Table 5.4.4.1 shows the $\hat{I}_{or}/I_{oc}$ required to achieve a 1% BLER.

Table 5.4.4.1: Required $\hat{I}_{or}/I_{oc}$ for 1% BLER – Veh-A 30kmph

Data rate	TTI	$\hat{I}_{or}/I_{oc}$ for 1% BLER	
		No TSTD	TSTD
32 kbps	20ms	0.1 dB	-0.4 dB
32 kbps	80ms	-2.6 dB	-3.1 dB
64 kbps	20ms	3.0 dB	2.6 dB
64 kbps	80ms	0.5 dB	-0.3 dB
128 kbps	20ms	6.5 dB	6.0 dB
128 kbps	80ms	3.6 dB	3.3 dB

5.5 Coverage Estimates

5.5.1 Urban Macrocell

Coverage estimates may be derived using link level performance curves (such as presented in sections 5.2 and 5.3) in conjunction with suitable geometry distributions.

5.5.1.1 Macrocell Geometry Distributions

The geometry CDFs were obtained using a typical set of simulation assumptions as listed in table 5.5.1.1. The resulting distributions are shown in figure 5.5.1.1.

For TDD there exists the possibility to deploy MBMS using timeslot re-use to improve coverage. As such, macro-cellular geometry distributions for the following timeslot re-use strategies have been derived:

1. No timeslot re-use
2. Simple 1-by-3 timeslot re-use

Table 5.5.1.1 Simulation assumptions.

Parameter	Value
cellular layout	hexagonal grid
sectorisation	yes, 3 sectors/site
timeslot re-use	both no re-use and 1-by-3 re-use
site to site distance	1000 m
NodeB antenna gain + cable loss	14 dBi
antenna front to back ratio	A_m = 20 dB
antenna beamwidth, -3 dB	θ_{3dB} = 70 degrees
horizontal antenna pattern	$A(\theta) = -\min\left[12\left(\frac{\theta}{\theta_{3dB}}\right)^2, A_m\right]$ where $-180 \le \theta \le 180$
propagation model	PL = 128.1 + 37.6*log(R) dB
std of shadow fading	10 dB
correlation between sites for slow fading	0.5
BS total transmit power	36 dBm
thermal noise	-174 dBm/Hz
UE noise figure	5 dB
handover threshold	3 dB

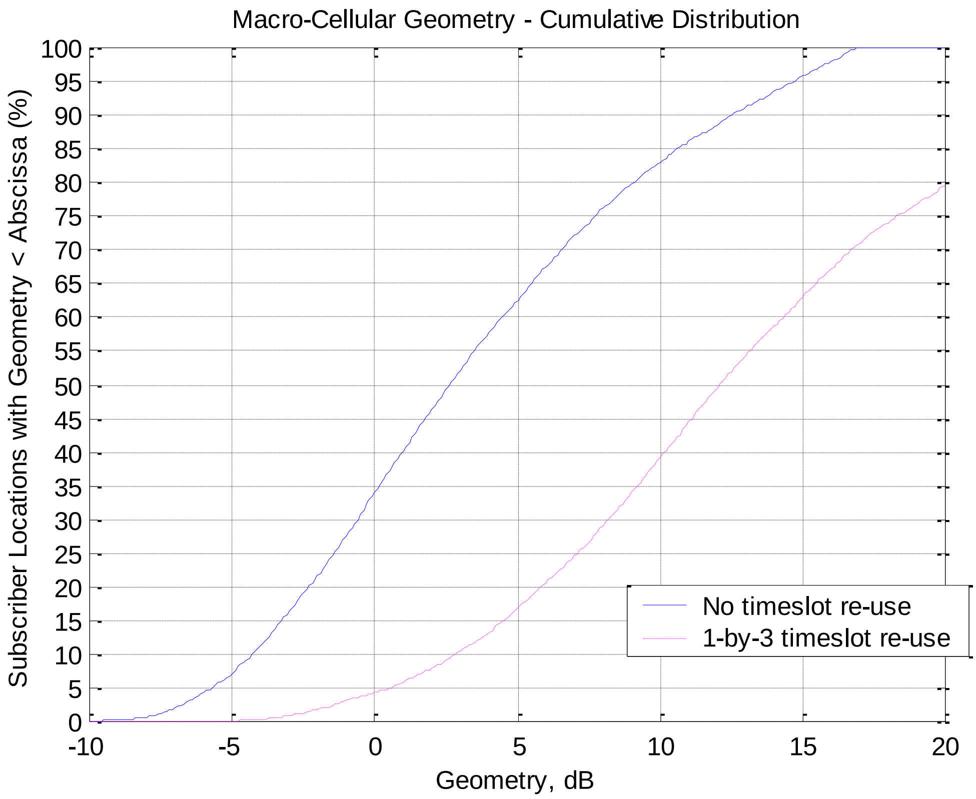

Figure 5.5.1.1 Geometry CDFs for the macrocellular environment.

5.5.1.2 Coverage Using Release 5 Functionality

Coverage estimates are calculated based on the following two inputs :

- Release-5 functionality link level curves (no TSTD) - (see section 5.2)
- The geometry CDF functions specific to the environments

Coverage is expressed as a function of the percentage of the Node-B power used *per timeslot* for a 64kbps MBMS service using a TTI of 80ms. It is assumed that a total of 3 such timeslots are reserved at the Node-B for the 64kbps MBMS transmission. The Ec/Ior value therefore applies only to the one active timeslot out of the three reserved; no transmission occurs in the other two timeslots.

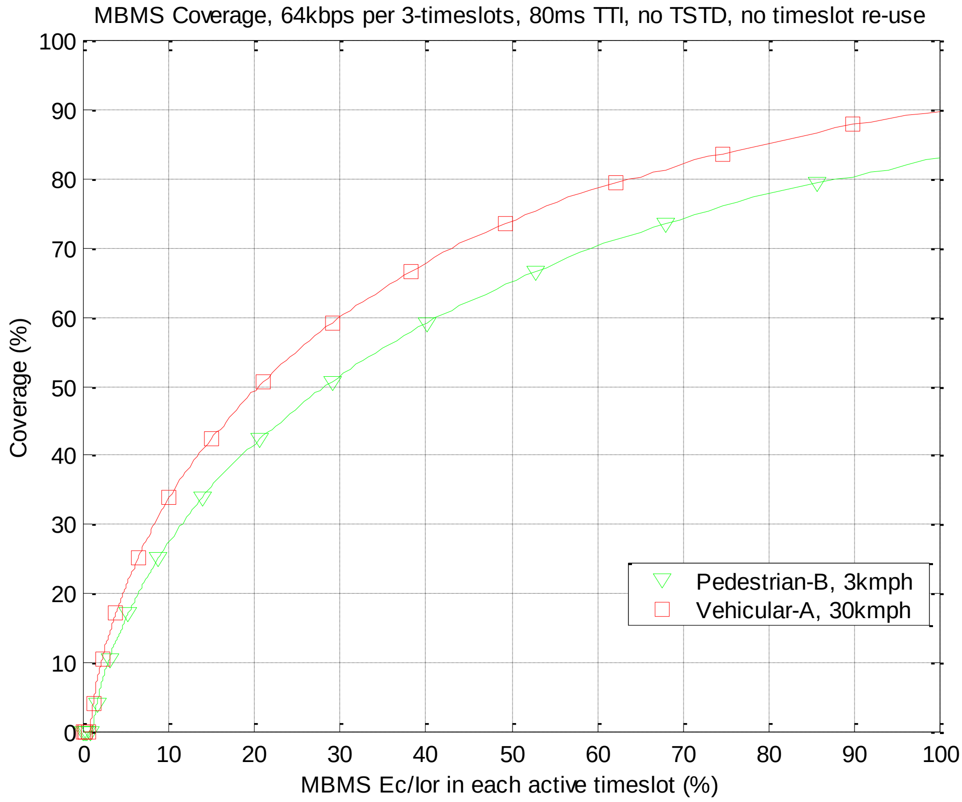

Figure 5.5.1.2: No timeslot reuse

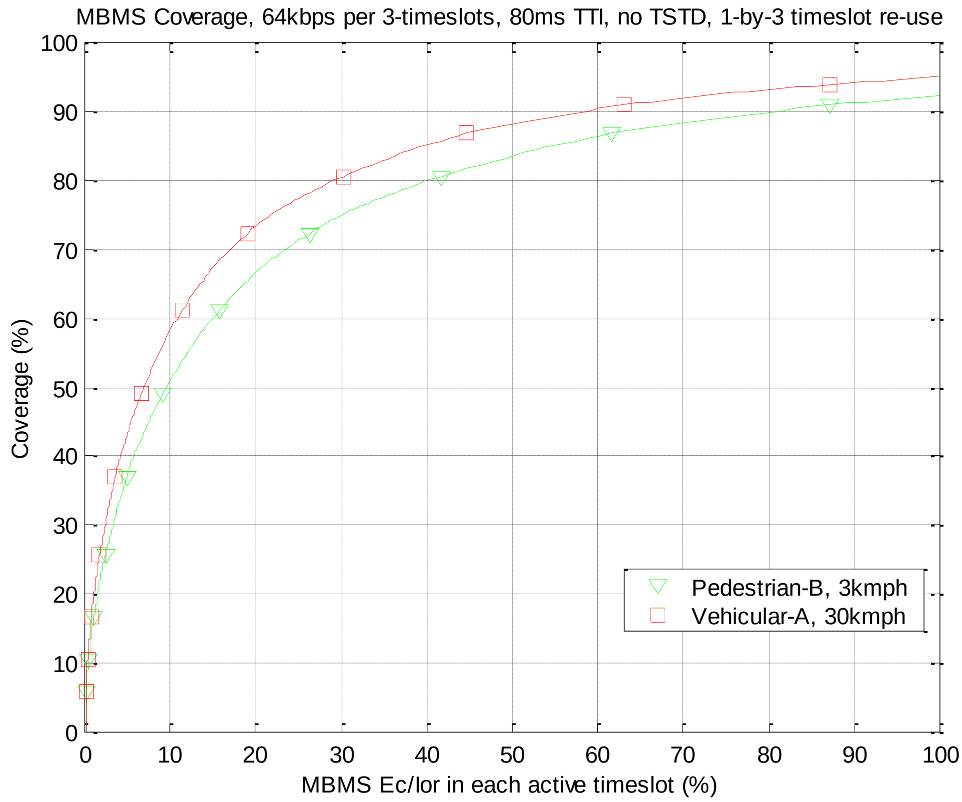

Figure 5.5.1.3: 1-by-3 timeslot reuse

5.5.1.3 Coverage Using New Functionality

5.5.1.3.1 Coverage with TSTD

Coverage estimates are calculated based on the following two inputs:

- Link level curves with TSTD - (see section 5.3)
- The geometry CDF functions specific to the environments

Coverage is expressed as a function of the percentage of the Node-B power used *per timeslot* for a 64kbps MBMS service using a TTI of 80ms. It is assumed that a total of 3 such timeslots are reserved at the Node-B for the 64kbps MBMS transmission.

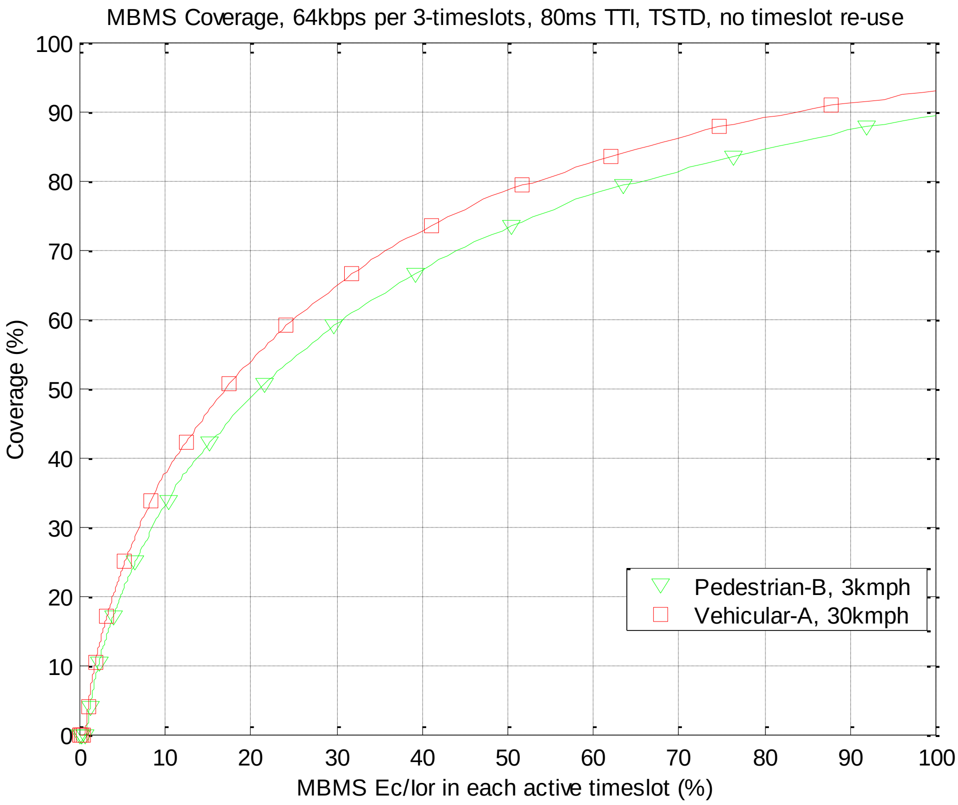

Figure 5.5.1.4: No timeslot re-use

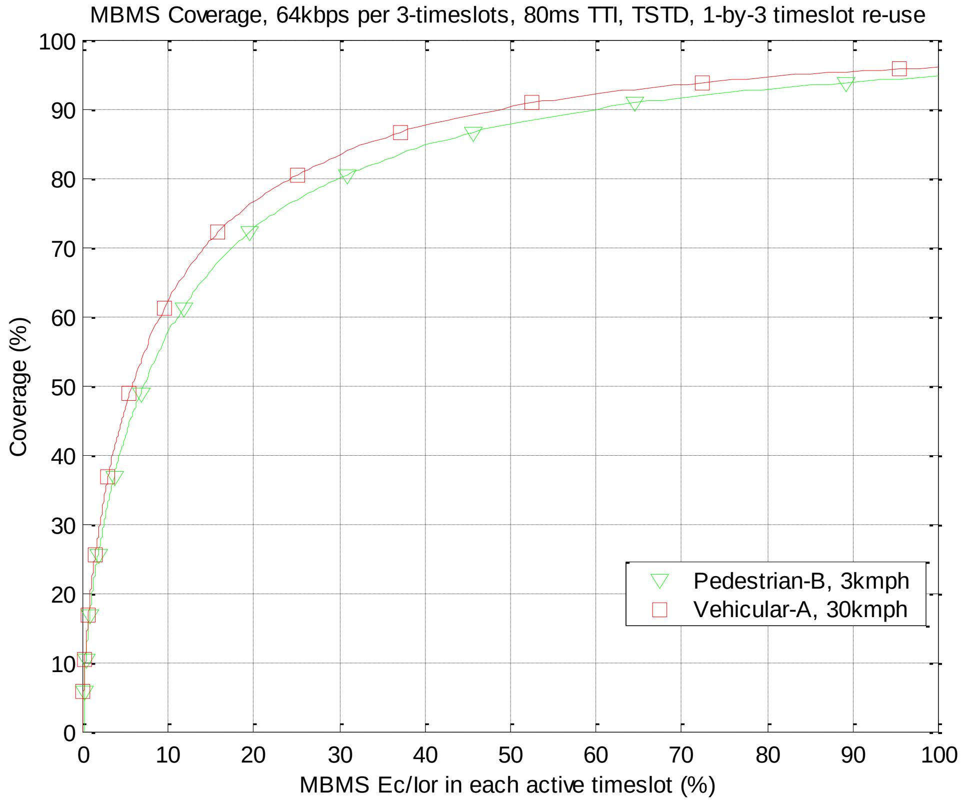

Figure 5.5.1.5: 1-by-3 timeslot re-use

5.5.1.3.2 Coverage with Macro-Diversity / Simulcast Combining

Macro diversity provides performance benefit in two ways:

a) radio channel diversity mitigates against fast fading and hence the link performance (Eb/No) is improved

b) downlink combining of signals from multiple cells improves the distribution of mean SNIR across the deployment area due to the additional signal energy collected by the UE receivers

The link performance gains are a function of geometry and as such the BLER curves of sections 5.2 and 5.3 may not be used directly to estimate coverage. Dynamic system simulations capable of modelling the link gains at various geometries are required to evaluate coverage for systems employing macro diversity and simulcast combining in the UE.

Simulcast combining techniques for TDD are described in detail in [8]. This section presents coverage results for the tri-sectored MBMS deployment parameters of table 5.5.1.1.1. Furthermore a 1-by-3 timeslot re-use scheme is assumed in which the UE is not required to receive transmissions from multiple cells within the same timeslot, thereby limiting the impact on UE receiver complexity. The following combining possibilities for the UE are considered:

a) No combining. Reception is from the best serving sector only. This is equivalent to the timeslot-reuse case only in which macro-diversity is not exploited.

b) Maximum Ratio Combining (MRC). Receptions from the strongest three cells are combined according to their received SNIR in each radio frame and the result is buffered. The buffered frames across the length of the TTI are then used for FEC decoding.

c) Selection combining method 1. Only the reception from the cell with the maximum SNIR per radio frame is selected and stored in a buffer. FEC decoding is then performed at the end of the TTI once the buffer is full.

d) Selection combining method 2. Three receptions are stored separately for each frame of the TTI. No combining is performed prior to FEC decoding. Sequential FEC decoding is performed for each of the three cells until any of these pass CRC.

Coverage is expressed as a function of the percentage of the Node-B power used *per timeslot* for a 64kbps MBMS service using a TTI of 80ms. It is assumed that a total of 3 such timeslots are reserved at the Node-B for the 64kbps MBMS transmission. The Ec/Ior value therefore applies only to the one active timeslot out of the three reserved; no transmission occurs in the other two timeslots.

The Pedestrian-B (figure 5.5.1.6) and Vehicular-A (figure 5.5.1.7) channels are representative of the macrocellular environment. Also shown is performance in a Pedestrian-A (figure 5.5.1.8) channel which may be more applicable to smaller-cell deployments.

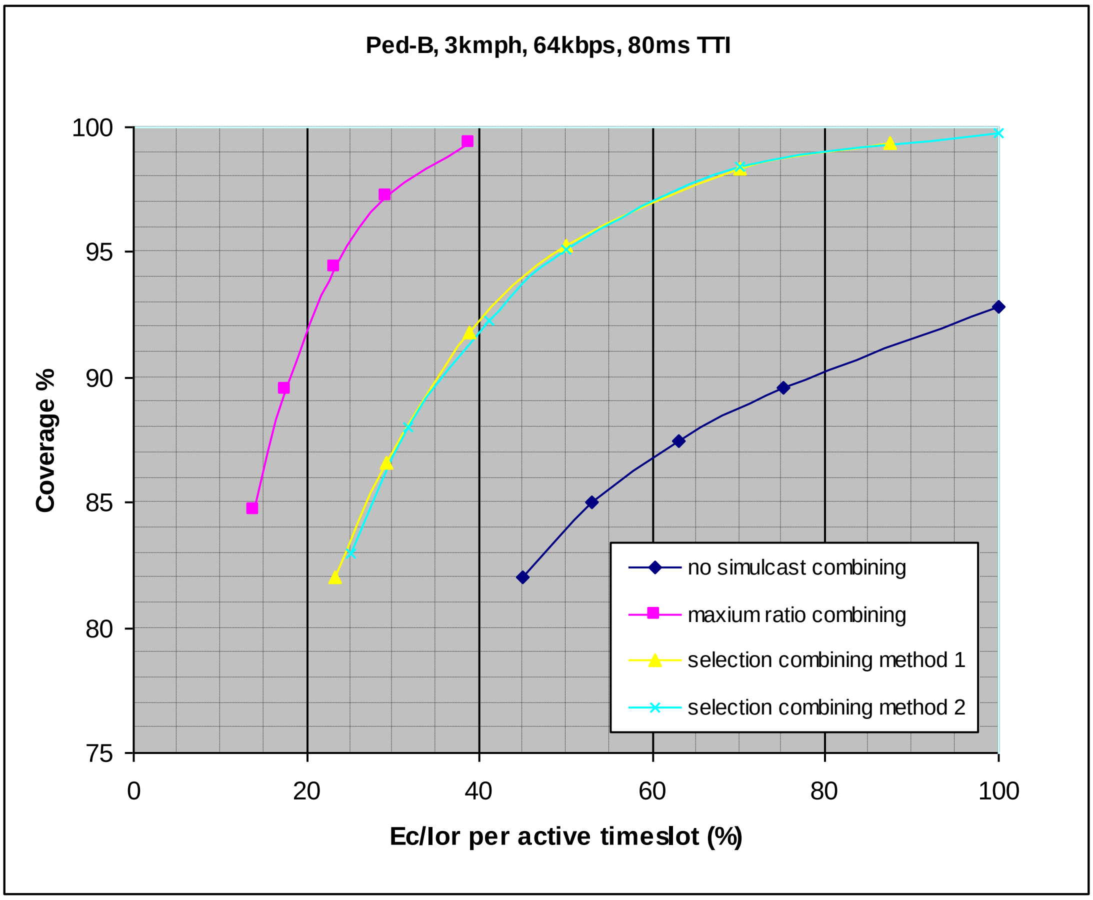

Figure 5.5.1.6

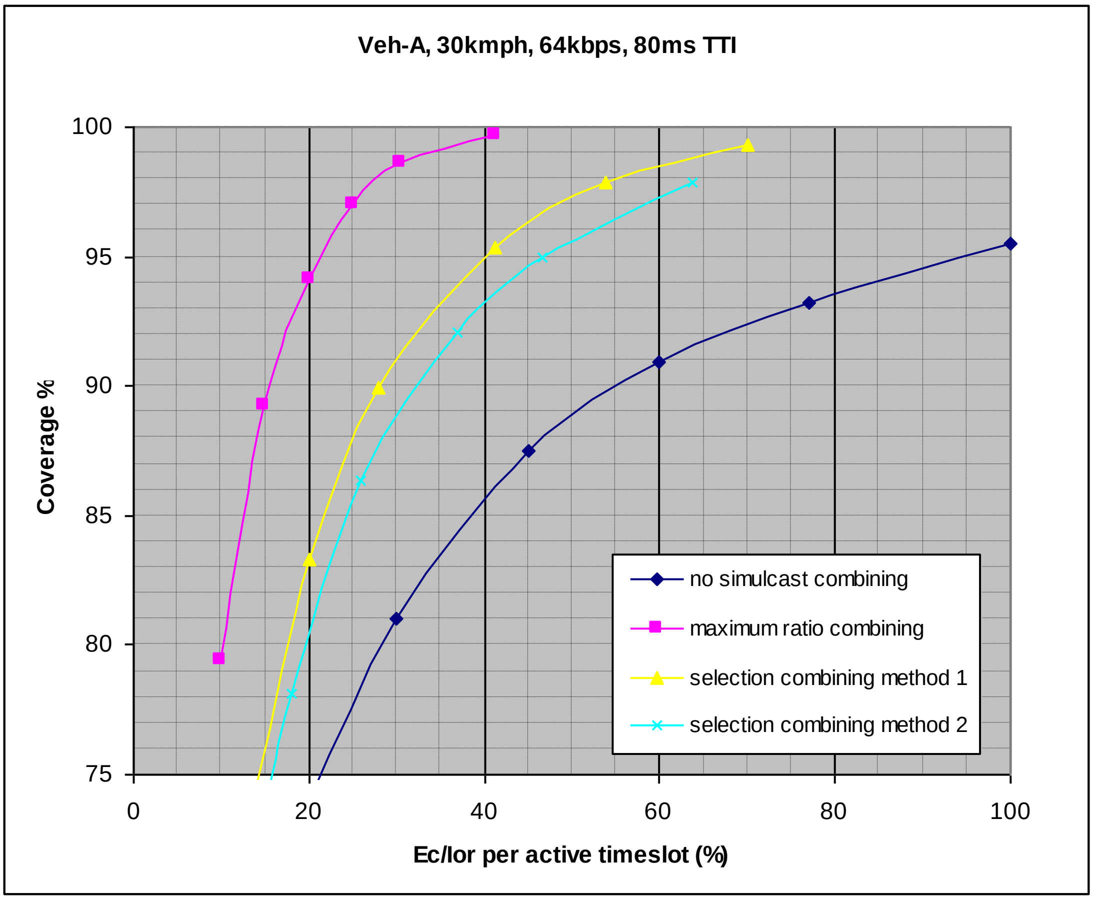
Veh-A, 30kmph, 64kbps, 80ms TTI
100
95
90
85
80
75
Coverage %
0
20
40
60
80
100
Ec/Ior per active timeslot (%)
no simulcast combining
maximum ratio combining
selection combining method 1
selection combining method 2

Figure 5.5.1.7

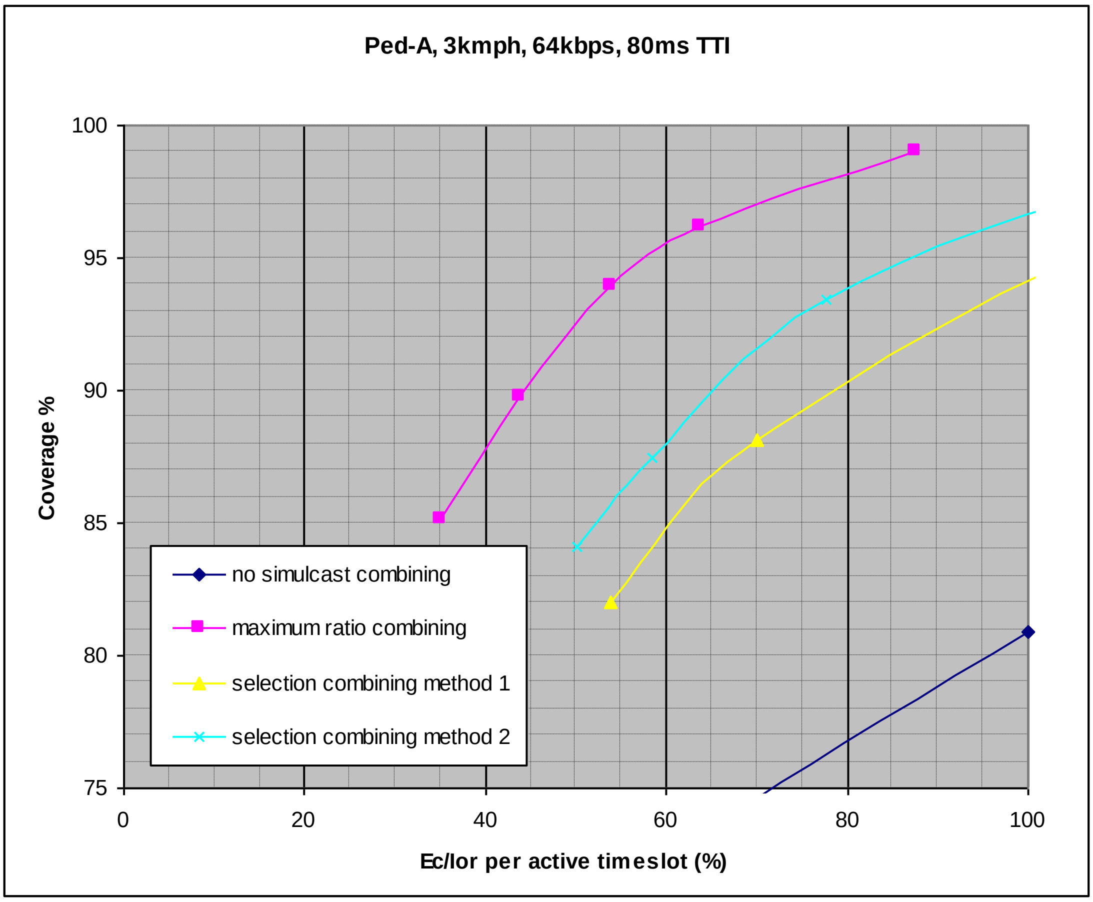

Figure 5.5.1.8

6 S-CCPCH performance for 1.28 Mcps TDD

6.1 Simulation assumptions

Table 6.1.1 presents simulation assumptions that have been used in deriving the performance estimates described in this chapter.

Table 6.1.1: Simulation parameters

Parameter	Assumption
Cellular layout	Hexagonal Grid
Re-use pattern	3 and 1
Propagation law	128.1-37.6log10(R)
Service, Bit rate	64, 32kbit/second, Data
FEC coding	Turbo
Transport Block Size	5120, 2560, 1280, 640 bits; 16 bit CRC
TTI	20, 80 ms
Allocated RUs	6*SF16 (32kbps); 11*SF=16(64kbps)
MBMS timeslots per base station	1
$\sum SCCPCH\_Ec/Ior$ in the MBMS timeslot	0 dB
Slot Format	No TPC, TFCI, SS
Power Control	None
Channel Estimation	Enabled - Realistic
Receiver Detection	JD-MMSE
Multipath Channels	Ped B 3km/h; Vech A 3km/h
Carrier Frequency	2000 MHz
UE Speed	3km/h

6.2 Performance using Release-5 functionality

The effects of two main parameters available in Release-5 on S-CCPCH performance have been investigated:

- TTI length (In Release 5, the TTI on FACH may be varied between 10 ms and 80 ms)
- Transmit diversity
  - TSTD

In the following sections, the results of simulation campaigns aimed at establishing MBMS performance and coverage limits are presented.

6.2.1 The effect of TTI length on MBMS performance

6.2.1.1 Results for Pedestrian B – 3kmph

The simulation results for PB 3kmph channel with different TTI length (20ms, 80ms) for 32kbps and 64kbps services are shown in Figure 6.2.1.1.

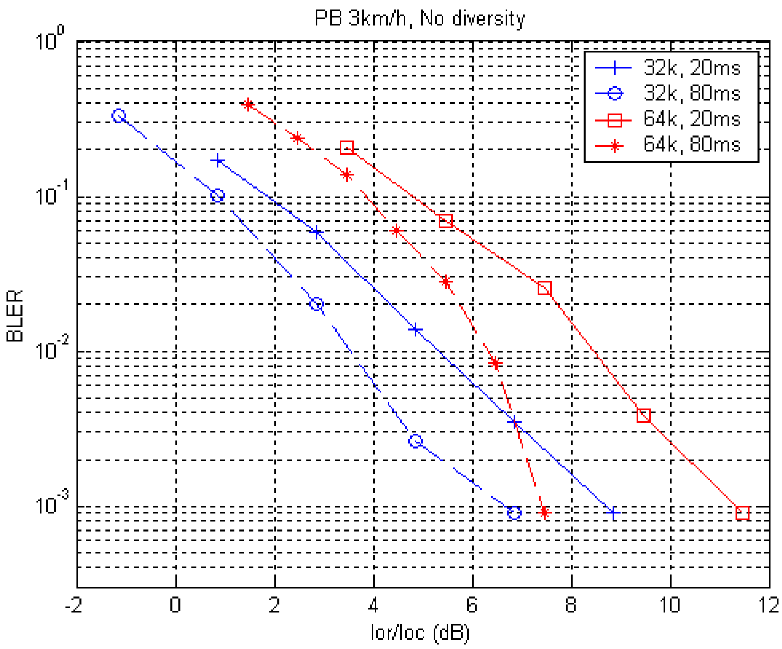

Figure 6.2.1.1 Simulation results for pedestrian B 3km/h model, no diversity

The figure indicates a gain of around 2 dB at BLER of 1% can be obtained by moving to the longer TTI length.

6.2.1.2 Results for Vehicular A – 3kmph

The simulation results for VA 3kmph channel with different TTI length (20ms, 80ms) for 32kbps and 64kbps services are shown in Figure 6.2.1.2.

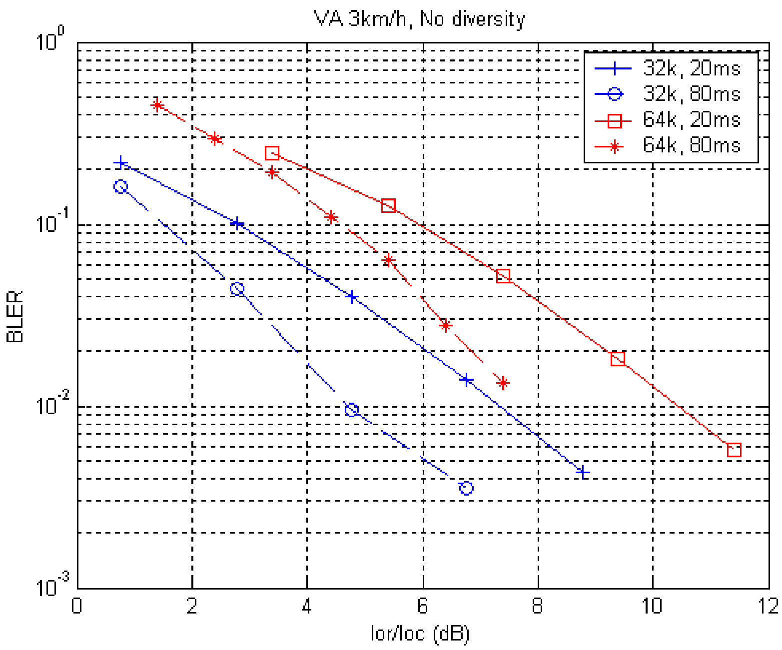

Figure 6.2.1.2 Simulation results for Vehicular A 3km/h model, no diversity

The figure indicates a gain of more than 2 dB at BLER of 1% can be obtained by moving to the longer TTI length.

6.2.2 The effect of open loop transmit diversity on MBMS performance

In Release 5, two types of open loop transmit diversity are available for S-CCPCH; TSTD and SCTD. Figures 6.2.3 to 6.2.6 indicate the effect of TSTD on 32 and 64 kbps MBMS services.

6.2.2.1 Results for Pedestrian B – 3kmph

Figure 6.2.2.1.1 and 6.2.2.1.2 indicate the effect of using TSTD diversity techniques for data rates of 32 kbps and 64 kbps.

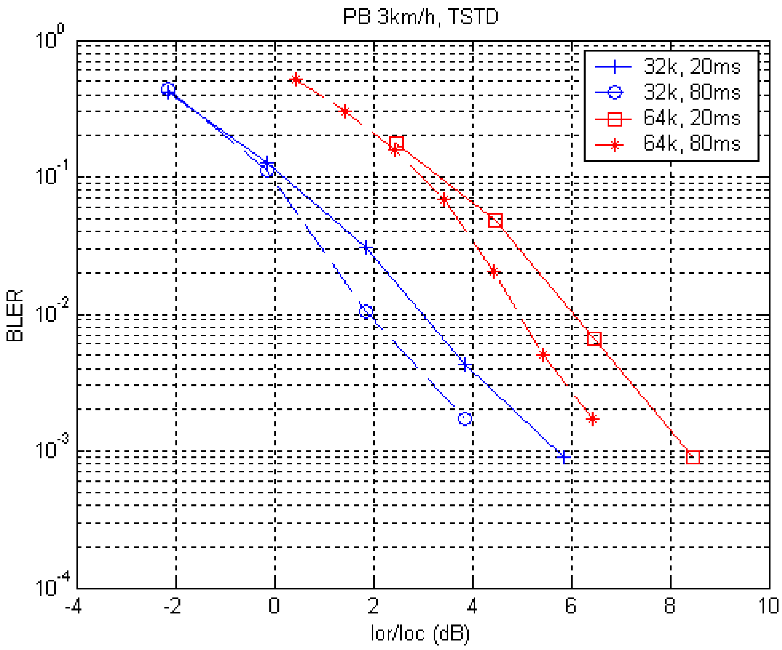

Figure 6.2.2.1.1 Simulation results for pedestrian B 3km/h model, with TSTD

6.2.2.1 Results for Vehicular A – 3kmph

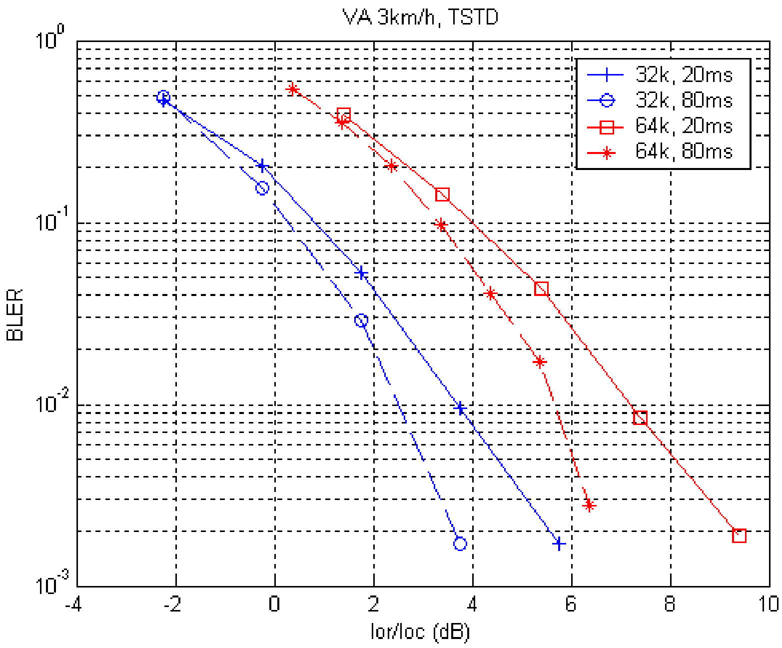

Figure 6.2.2.2.2: Simulation results for Vehicular A 3km/h model, with TSTD

These results indicate that an increase of about 2-3 dB in performance is obtained at a 1% BLER through the use of TSTD for Pedestrian B 3km/h and Vehicular A 3km/h channel.

6.3 Performance using new functionality

6.4 Summary

6.4.1 Pedestrian B – 3kmph

This section provides a summary of the results for the Pedestrian B multi-path channel at 3km/h. Table 6.4.1 shows the $\hat{I}_{or}/I_{oc}$ required to achieve a 1% BLER.

Table 6.4.1: Required $\hat{I}_{or}/I_{oc}$ for 1% BLER – Ped B 3km/h

Data rates	TTI	$\hat{I}_{or}/I_{oc}$ for 1% BLER	
		No TSTD	TSTD
32 kbps	20ms	5.3dB	3.0dB
32 kbps	80ms	3.5dB	1.9dB
64 kbps	20ms	8.4dB	6.0dB
64 kbps	80ms	6.3dB	4.9dB

6.4.2 Vehicular A – 3kmph

This section provides a summary of the results for the Vehicular A multi-path channel at 3km/h. Table 6.4.2 shows the $\hat{I}_{or}/I_{oc}$ required to achieve a 1% BLER.

Table 6.4.2: Required $\hat{I}_{or}/I_{oc}$ for 1% BLER – Vec A 3km/h

Data rates	TTI	$\hat{I}_{or}/I_{oc}$ for 1% BLER	
		No TSTD	TSTD
32 kbps	20ms	7.3dB	3.9dB
32 kbps	80ms	4.8dB	2.5dB
64 kbps	20ms	10.4dB	7.2dB
64 kbps	80ms	7.6dB	5.6dB

6.5 Coverage

6.5.1 Urban Macrocell

6.5.1.1 Macrocell Geometry Distribution

See section 4.5.1.1.

6.5.1.2 Coverage Figures with Release-5 Functionality

The coverage results for Vehicular A and Pedestrian B channel can be found in Figure 6.5.1.2.1, 6.5.1.2.2 in chapter 6.5.1.3.

6.5.1.3 Coverage with Macro-Diversity / Simulcast Combining

Maximum Ratio Combining (MRC), Selection combining method 1 (SC) and no combining method described in 5.5.2 are also applicable for 1.28Mcps TDD to improve the cell coverage. Results are given for all these three cases. In addition, cases of with and without diversity (TSTD) are also assumed in the simulation.

The link performance gains are a function of geometry and as such the BLER curves of sections 6.2 may not be used directly to estimate coverage. Dynamic system simulations capable of modelling the link gains at various geometries are required to evaluate coverage for systems employing macro diversity and simulcast combining in the UE.

This section presents coverage results for the tri-sectored MBMS deployment parameters of table 5.5.1.1.1.

Coverage is expressed as a function of the percentage of the Node B power used *per timeslot* for a 64kbps MBMS service using a TTI of 80ms. Both cases of with and without time slot reuse method are assumed in the simulation, i.e. in total 3 timeslots in one sub-frame are reserved at the Node B for the MBMS transmission, however consider 1.28Mcps TDD one carrier only use 1/3 of 5MHz bandwidth, this would mean that for equivalently each sub-frame, one time slot over 7 time slots is reserved for MBMS service if we take 5MHz frequency band resources for example. The Ec/Ior value applies only to the one active timeslot out of the three reserved; no transmission occurs in the other two timeslots.

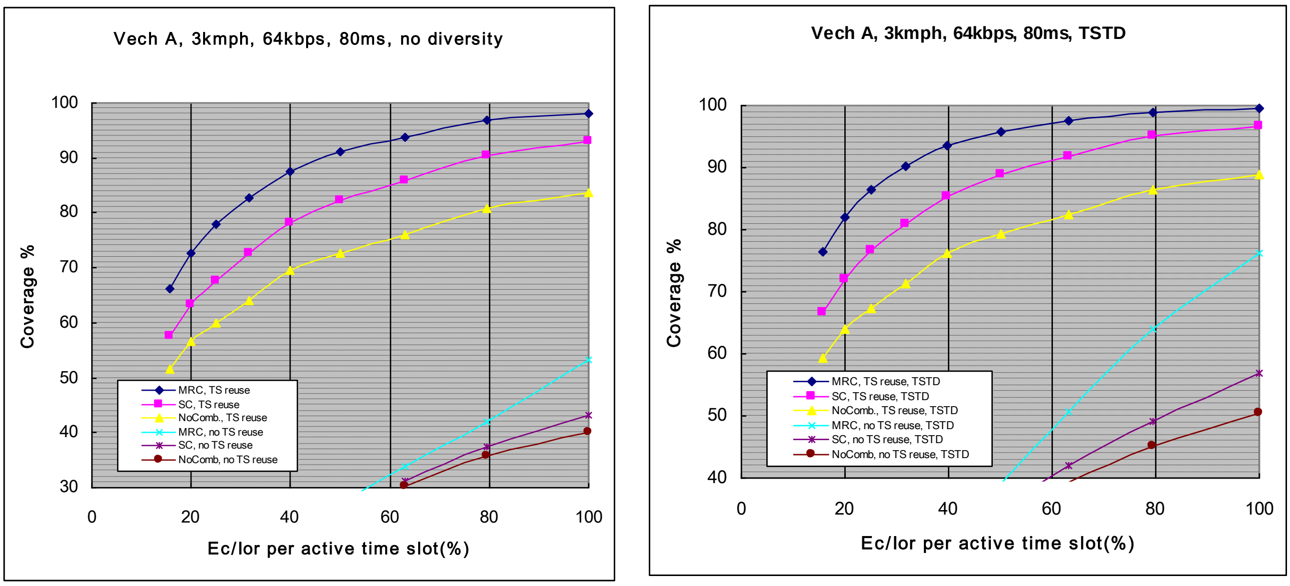

Figure 6.5.1.2.1 Coverage estimate for vehicle A 3km/h, 64kbps, 80ms TTI

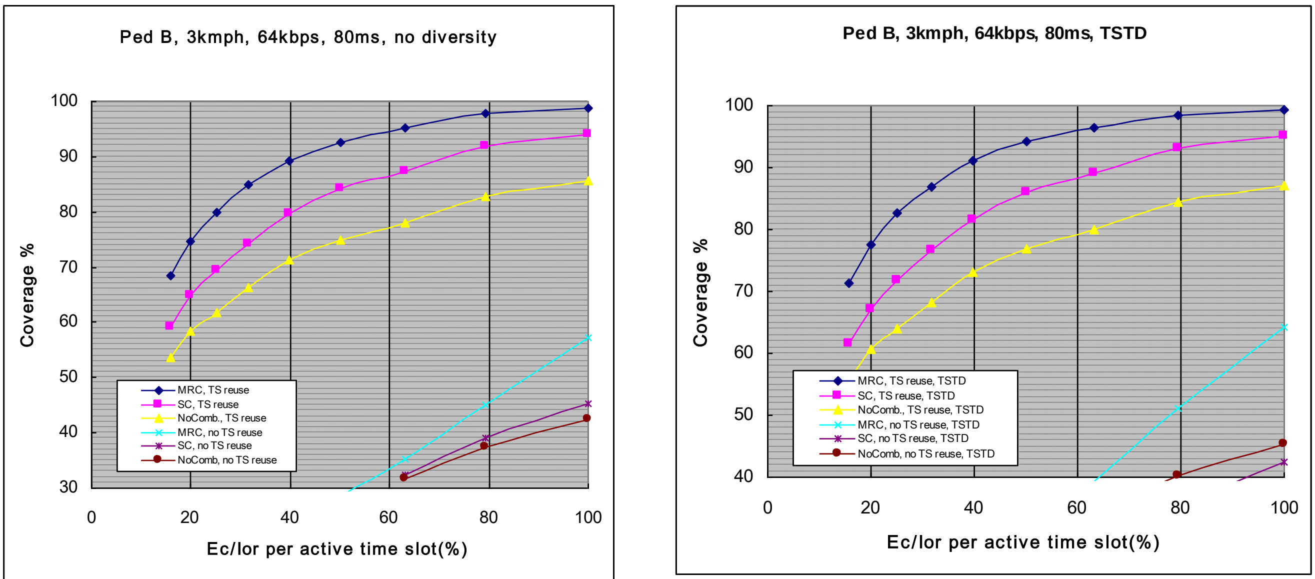

Figure 6.5.1.2.2 Coverage estimate for pedestrian B 3km/h, 64kbps, 80ms TTI

Annex A: Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
26/08/03	R1#33	R1-030675			Outline agreed	0.0.0.	0.0.1
11/09/03	R1#33	R1-030676 R1-030881 R1-030882 R1-030883 R1-030944			Inclusion of text proposals covering S-CCPCH power requirements using Release-5 physical layer functionality.	0.0.1	0.0.2
12/09/03	R1#33	R1-030950			Removal of revision marks	0.0.2	0.1.0
16/09/03	RP#21	RP-030535			Presented to RP #21 for information	0.1.0	1.0.0
08/10/03	R1#34	R1-031116 R1-031015			Inclusion of text proposals improving the presentation of results for FDD and update of results for FDD Ped-A 3 kmh.	1.0.0	1.1.0
24/11/03	R1#35	R1-031294			Inclusion of results for 3.84 Mcps TDD.	1.1.0	1.1.1
24/11/03	R1#35	R1-031357 R1-031371			Clarification of the applicability of some channel models and inclusion of text proposal on coverage aspects for FDD.	1.1.0	1.1.1
24/11/03	R1#35	Editor			Clean up of table & figure numbering & formatting.	1.1.0	1.1.1
03/12/03	R1#35	R1-031413			Approved with minor editorial corrections	1.1.1.	1.2.0
22/02/04	R1#36	R1-030234			Further Link Results for MBMS on S-CCPCH (3.84Mcps TDD)	1.2.0	1.2.1
22/02/04	R1#36	R1-030339			Coverage Results for MBMS with Macro Diversity (3.84Mcps TDD)	1.2.0	1.2.1
22/02/04	R1#36	R1-030334			Inclusion of a section on MBMS Selective Combining	1.2.0	1.2.1
05/03/04	R1#36	R1-040388			Approved as version 1.3.0	1.2.1	1.3.0
12/08/04	R1#36	R1-040342			Coverage results for MBMS (3.84 Mcps TDD)	1.3.0	1.3.1
12/08/04	R1#37	R1-040598			FDD results for 256 kbps S-CCPCH	1.3.0	1.3.1
20/08/04	R1#38	R1-040983			Approved as version 1.4.0	1.3.1	1.4.0
20/08/04	R1#38	R1-040828			Coverage Results for MBMS (1.28Mcps TDD)	1.4.0	1.4.1
02/09/05	R1#42	R1-050966			Approved pending changes in version 1.4.1 Addition of coverage results for soft combining (FDD)	1.4.1	1.5.0
21/09/05	RP#29	RP-050451			Submitted for approval at TSG RAN#29	1.5.0	2.0.0
26/09/05	RP#29				Approved as v6.0.0 to put under change control	2.0.0	6.0.0