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Introduction

TR 25.803 v1.0.0 is presented for information. The report captures S-CCPCH power requirements for MBMS service delivery.

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

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Technical Report

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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].

2 References

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

3 Definitions, symbols and abbreviations

Delete from the above heading those words which are not applicable.

Subclause numbering depends on applicability and should be renumbered accordingly.

3.1 Definitions

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

Definition format

***<defined term>**: <definition>.*

example: text used to clarify abstract rules by applying them literally.

3.2 Symbols

For the purposes of the present document, the following symbols apply:

Symbol format

<symbol> <Explanation>

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

Abbreviation format

<ACRONYM> <Explanation>

4 S-CCPCH performance for FDD

4.1 Simulation Assumptions

Table 1 presents parameters which are commonly used in the sub-sequent sections.

Table 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)
Transport Block Size	Varied according to information rate (16, 32, 64 or 128 kbps) and TTI value.
CRC	16 bits
TTI	20 ms, 40ms and 80ms
CPICH Ec/Ior	-10 dB
P-SCH Ec/Ior	-15 dB
S-SCH Ec/Ior	-15 dB
Tx Ec/Ior	Varied
OCNS	Used to sum total Tx Ec/Ior to 0 dB
Geometry (Iôr/Ioc)	-3 dB, -6dB
Channel estimation	Enabled
Power Control	Disabled
Channel	Case 1, 3 kmh (25.101) Case 2, 3kmh (25.101) Pedestrian A, 3 km/h (25.890-RAN4) Pedestrian B, 3 km/h (25.890-RAN4) Vehicular-A. 3 kmh (25.890-RAN4) Vehicular-A, 30 kmh (25.890-RAN4)

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 1-3 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

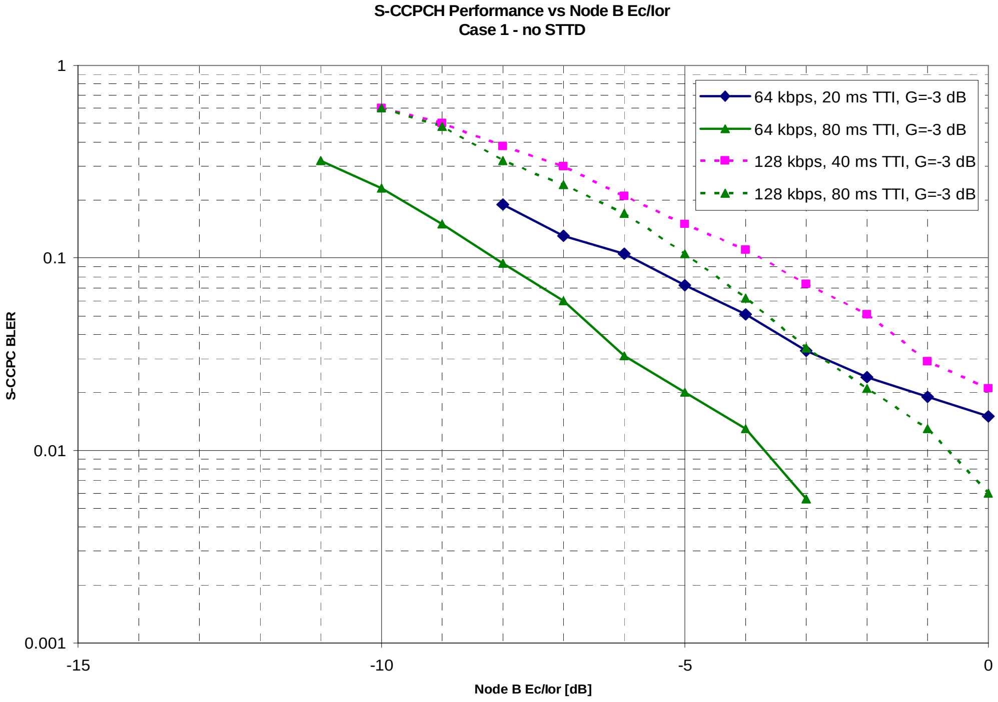


Figure 1: BLER vs. Tx Power - Case 1 (3 kmh)

4.2.1.2 Results for Case 2 – 3 kmh

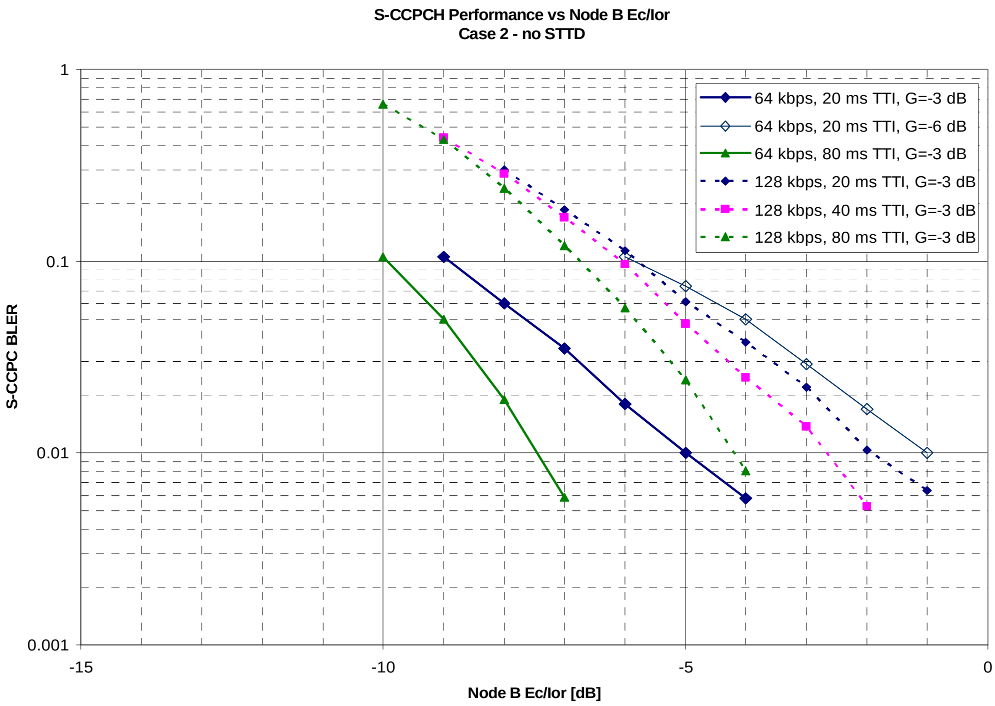


Figure 2: BLER vs. Tx Power - Case 2 (3 kmh)

4.2.1.3 Results for Vehicular – A (3 kmh)

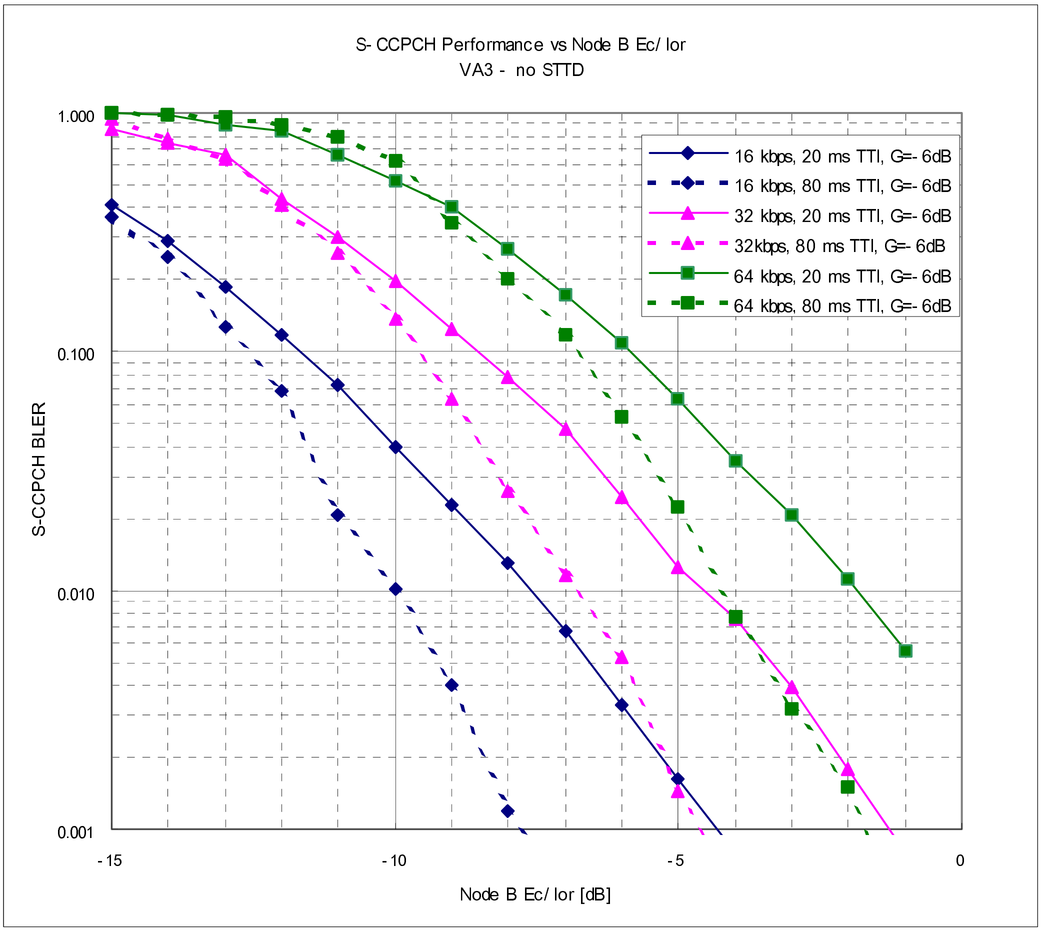


Figure 3: BLER vs. Tx Power – VA3

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 4-9 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

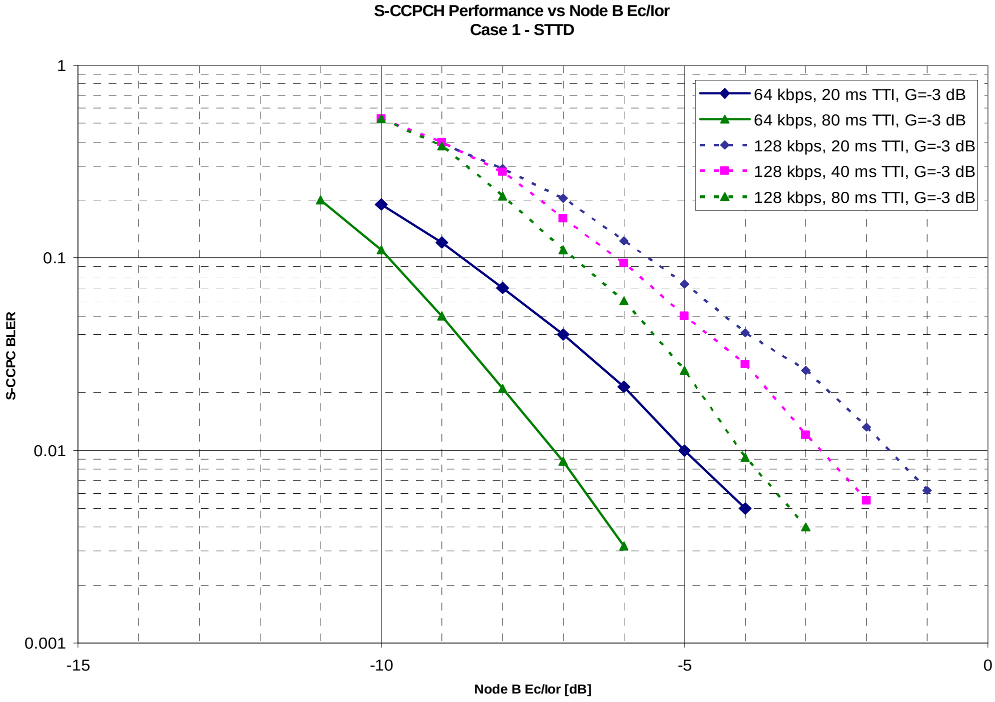
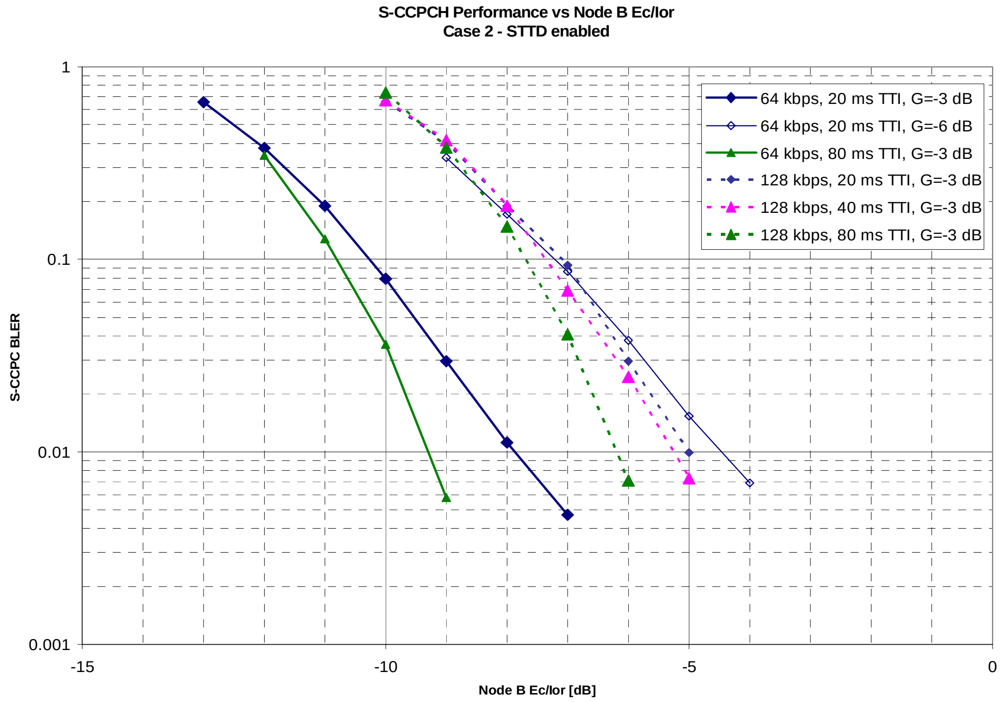


Figure 4: BLER vs. Tx Power – case 1

4.2.2.2 Results for Case 2 – 3



kmh

Figure 5: BLER vs. Tx Power – case 2

4.2.2.3 Results for Vehicular A (3 kmh)

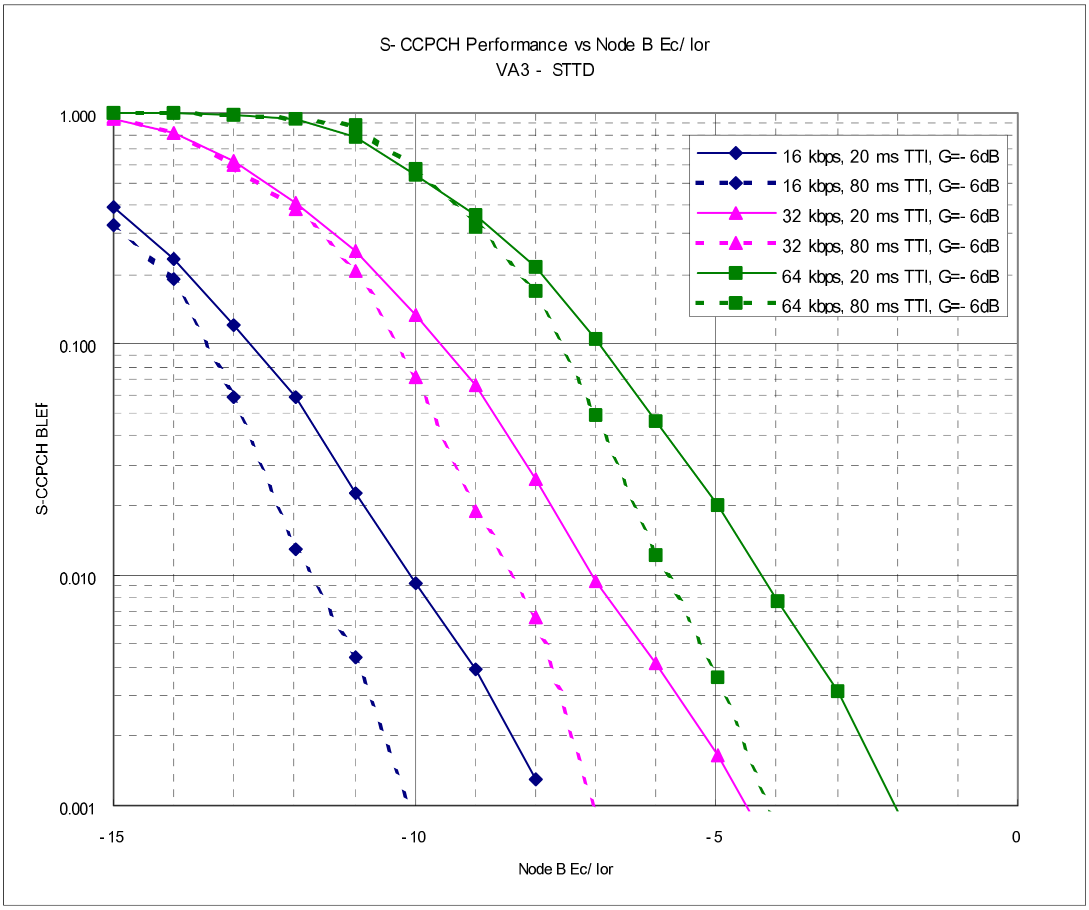


Figure 6: BLER vs. Tx Power – case 2

4.2.2.4 Results for Pedestrian A (3 kmh)

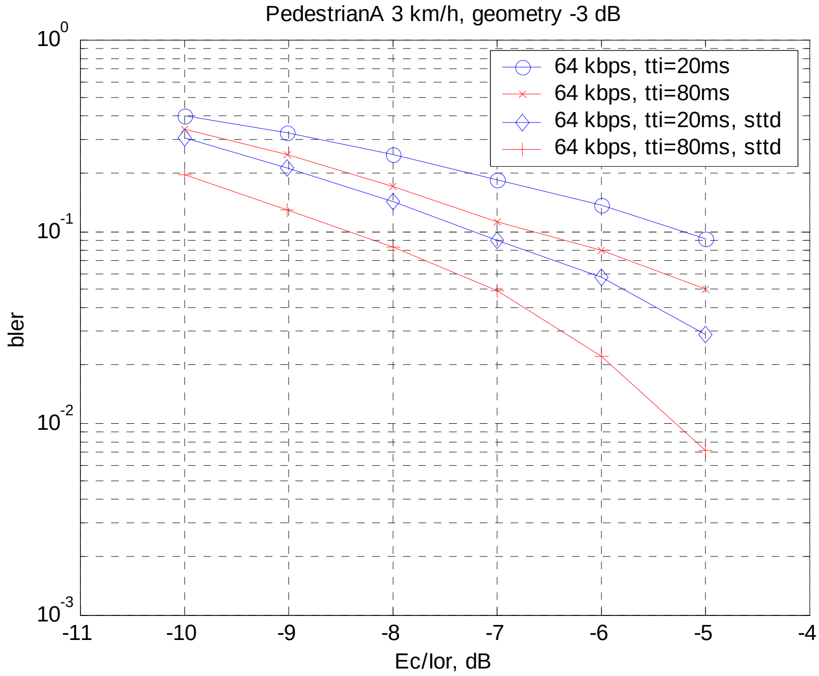


Figure 7: BLER vs. Tx Power – Pedestrian A (3kmh)

4.2.2.5 Results for Pedestrian B (3 kmh)

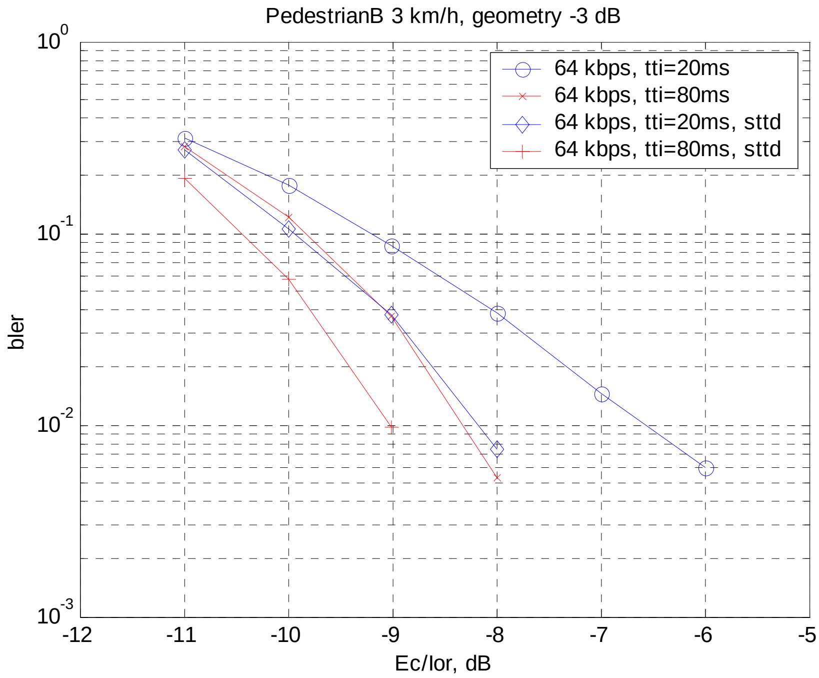


Figure 8: BLER vs. Tx Power – Pedestrian B (3 kmh)

4.2.2.6 Results for Vehicular - A (30 kmh)

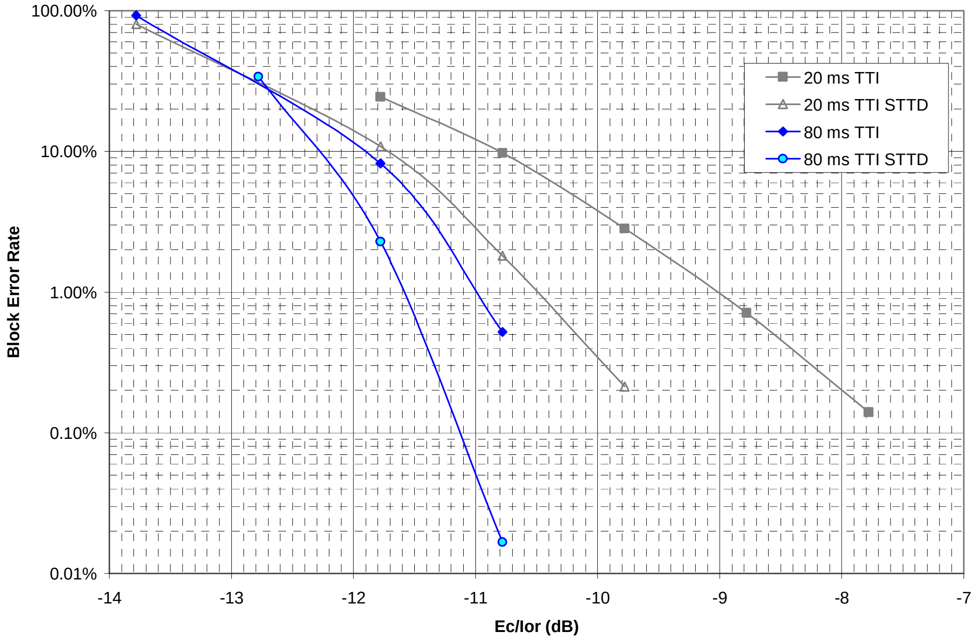


Figure 9: BLER vs. Tx Power – VA30

Figure 1 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 1.5dB and 0.5dB for the no STTD and STTD case respectively.

4.3 Performance using new functionality

4.4 Summary

This section provides a summary of the results for the 3 kmh channels which are the most demanding ones.

Tables 2-7 show the SCCPCH power requirement as fraction of the Node B power.

4.4.1 Results with Case 1 (3 kmh)

Table 2: Required Tx Ec/Ior for target BLER -- Case 1

Data Rate	TTI	Geometry	Ec/Ior for 1% BLER	
			No STTD	STTD
64 kbps	20 ms	-3 dB	> 0 dB	-5.0 dB
64 kbps	80 ms	-3 dB	-3.7 dB	-7.1 dB
128 kbps	20 ms	-3 dB	>0 dB	-1.6 dB
128 kbps	40 ms	-3 dB	>0 dB	-2.7 dB
128 kbps	80 ms	-3 dB	-0.6 dB	-4.0 dB

4.4.2 Results with Case 2 (3 kmh)

Table 3: Required Tx Ec/Ior for target BLER – Case 2

Data Rate	TTI	Geometry	Ec/Ior for 1% BLER	
			No STTD	STTD
64 kbps	20 ms	-3 dB	-5.0 dB	-7.9 dB
64 kbps	20 ms	- 6 dB	-1.0 dB	-4.5 dB
64 kbps	80 ms	-3 dB	-7.5 dB	-9.3 dB
128 kbps	20 ms	-3 dB	-2.0 dB	-5.0 dB
128 kbps	40 ms	-3 dB	-2.7 dB	-5.3 dB
128 kbps	80 ms	-3 dB	-4.2 dB	-6.2 dB

4.4.3 Results with Pedestrian-A (3 kmh)

Table 4: Required Tx Ec/Ior for target BLER – Pedestrian A

Data Rate	TTI	Geometry	Ec/Ior for 1% BLER	
			No STTD	STTD
64 kbps	20 ms	-3 dB	> -5.0 dB	> -5.0 dB
64 kbps	80 ms	-3 dB	> -5.0 dB	-5.3 dB

4.4.4 Results with Pedestrian-B (3 kmh)

Table 5: Required Tx Ec/Ior for target BLER -- Pedestrian B

Data Rate	TTI	Geometry	Ec/Ior for 1% BLER	
			No STTD	STTD
64 kbps	**20 ms**	**-3 dB**	-6.5 dB	-8.2 dB
64 kbps	**80 ms**	**-3 dB**	-8.3 dB	-9.0 dB

4.4.5 Results with Vehicular-A (3 kmh)

Table 6: Required Tx Ec/Ior for target BLER – VA3

Data Rate	TTI	Geometry	Ec/Ior for 1% BLER	
			No STTD	STTD
16 kbps	**20 ms**	**-6 dB**	-7.6 dB	-10.1 dB
16 kbps	**80 ms**	**-6 dB**	-10.0 dB	-11.8 dB
32 kbps	**20 ms**	**-6 dB**	-4.6 dB	-7.1 dB
32 kbps	**80 ms**	**-6 dB**	-6.8 dB	-8.4 dB
64 kbps	**20 ms**	**-6 dB**	-1.8 dB	-4.3 dB
64 kbps	**80 ms**	**-6 dB**	-4.2 dB	-5.8 dB

4.4.6 Results with Vehicular-A (30 kmh)

Table 7: Vehicular A results at 30 kmh

Data Rate	TTI	Geometry	Ec/Ior for 1% BLER	
			No STTD	STTD
64 kbps	20 ms	-3 dB	-9.0 dB	-10.5 dB
64 kbps	80 ms	- 3 dB	-11.0 dB	-11.6 dB

5 S-CCPCH performance for 3.84 Mcps TDD

5.1 Performance using Release-5 functionality

5.2 Performance using new functionality

5.3 Summary

6 S-CCPCH performance for 1.28 Mcps TDD

6.1 Simulation assumptions

Table 8 presents simulation assumptions that have been used in deriving the performance estimates described in this chapter.

Parameter	Assumption
Cellular layout	Hexagonal Grid
Re-use pattern	3
Propagation law	128.1-37.6log10(R)
Service, Bit rate	64, 32kbit/second, Data
FEC coding	Turbo
Transport Block Size	1280, 640; 16 bit CRC
TTI	20, 80 msec
Spreading Factor	16
MBMS timeslots per basestation	1
Ec/Ior in the MBMS timeslot	0dB
Slot Format	No TPC, TFCI, SS
Power Control	None

Channel Estimation	Enabled - Realistic
Receiver Detection	JD-MMSE
Multipath Channels	Multipath case 1 as defined in TS25.102
Carrier Frequency	2000 MHz
UE Speed	3km/h

Table 8 Simulation Parameters

The 3GPP case 1 channel model has been used in these link level simulations as it represents one of the more challenging propagation conditions in terms of achieving useful block error rates in a wide coverage area.

The simulations have been based upon each basestation allocating one timeslot for MBMS, in which full power is transmitted for the MBMS service. Therefore the basestation resource requirements are stated in terms of the fraction of bandwidth used for MBMS, rather than the fraction of basestation power as is the case for FDD.

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 10msec and 80msec)
- Transmit diversity
    - SCTD
    - 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

Figures 10 and 11 indicate the effect of increasing the TTI length from 20msec to 80msec for data rates of 32kbps and 64kbps.

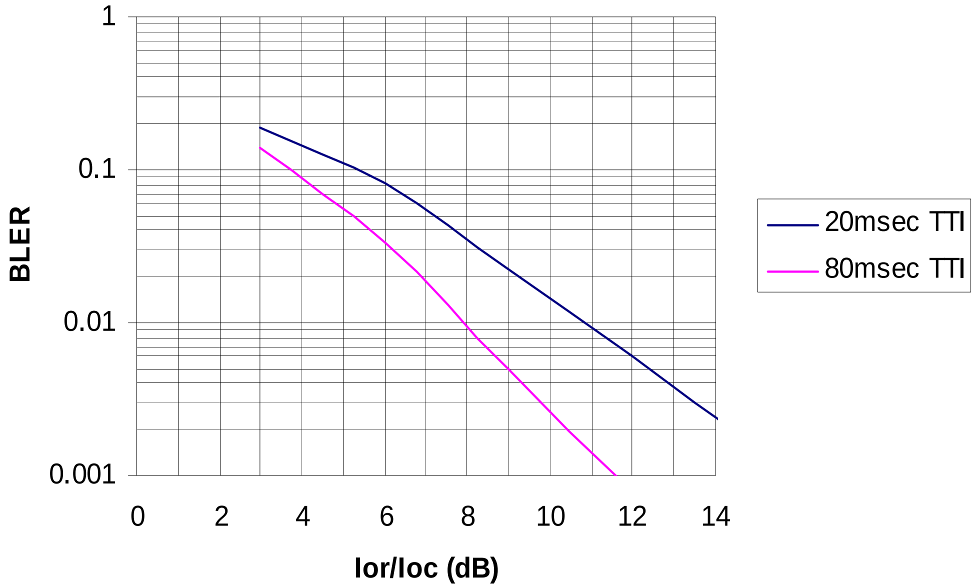


Figure 10: Performance improvement obtained by means of lengthening the TTI for MBMS 32kbps

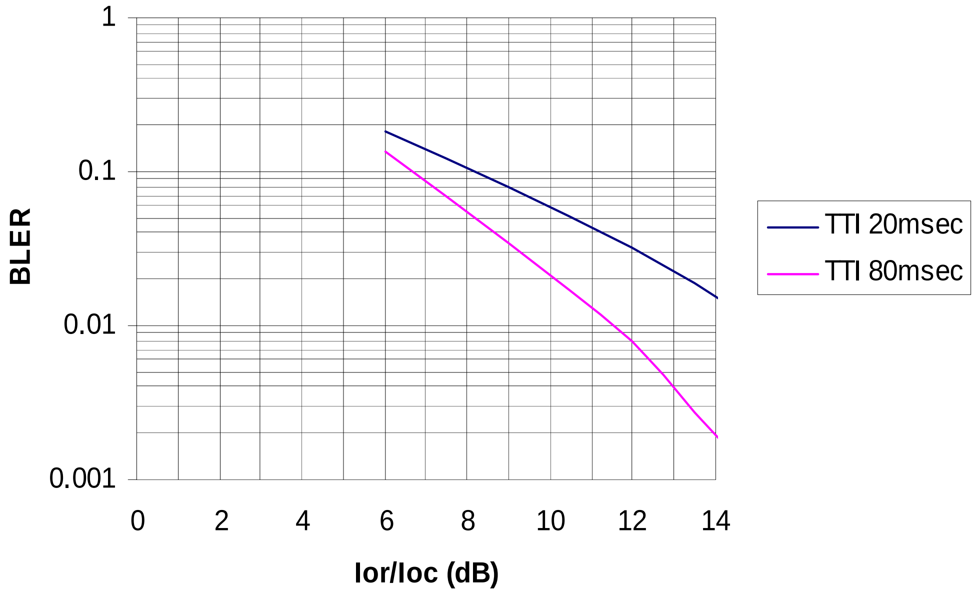


Figure 11 Performance improvement obtained by means of lengthening the TTI for MBMS 64kbps

The figures indicate a gain of around 3dB 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 12 to 15 indicate the effect of open loop transmit diversity on 32 and 64kbps MBMS services.

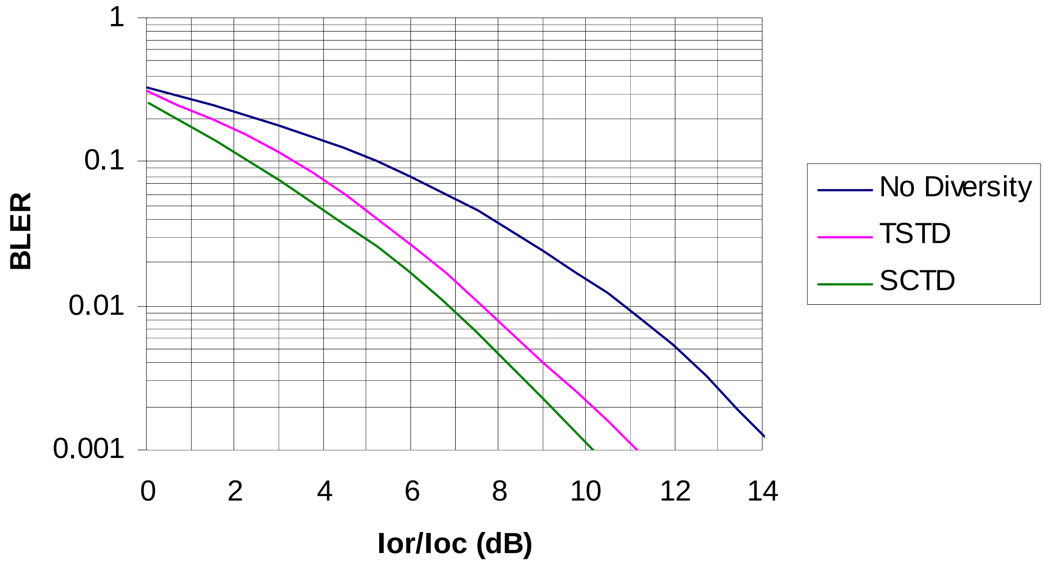


Figure 12 Open Loop Transmit Diversity performance for 32kbps MBMS service with TTI = 20 msec

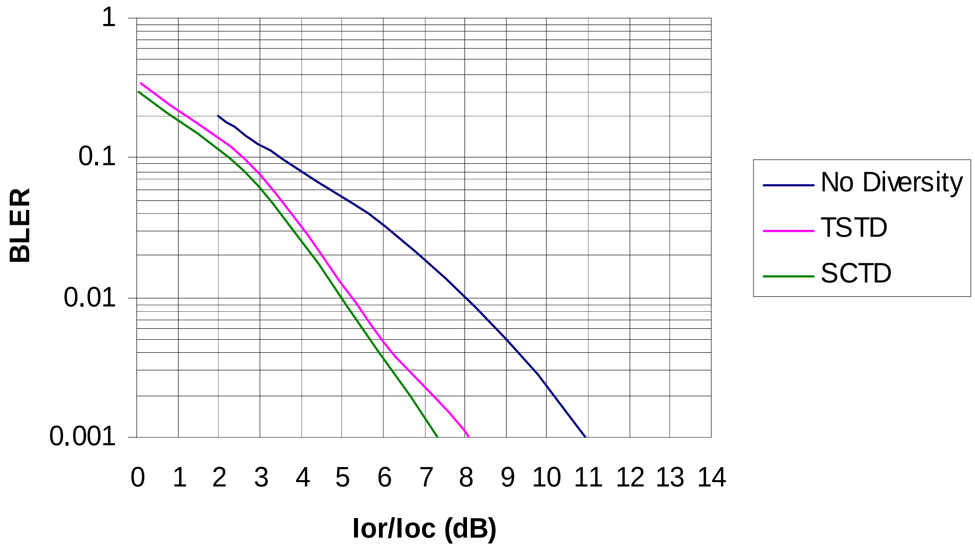


Figure 13 Open Loop Transmit Diversity performance for 32kbps MBMS service with TTI = 80msec

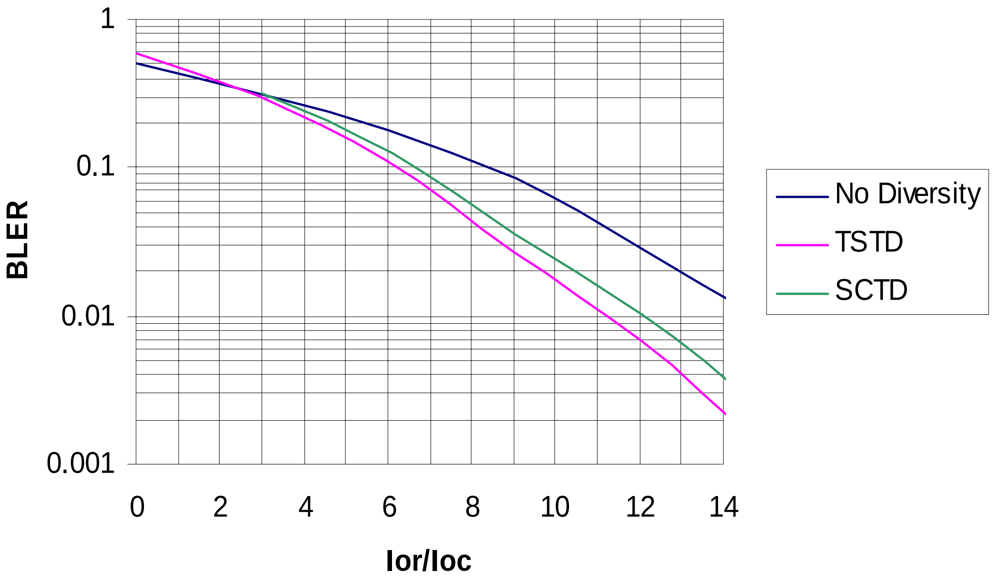


Figure 14 Open Loop Transmit Diversity performance for 64kbps MBMS service with TTI = 20msec

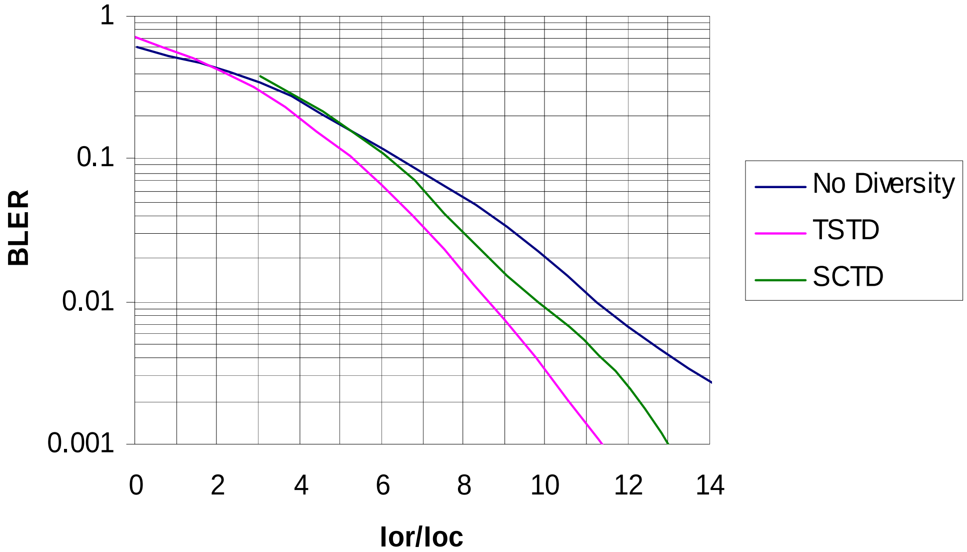


Figure 15 Open Loop Transmit Diversity performance for 64kbps MBMS service with TTI = 80msec

The figures indicate a gain of around 3dB, at BLER 1%, in addition to the gain that can be obtained by lengthening the TTI. At 32kbps, SCTD appears to be the better choice for transmit diversity, whilst at 64kbps, TSTD is marginally better. It should be noted that SCTD at 64kbps requires a higher degree of puncturing compared to TSTD due to the finite amount of available codes.

6.2.3 Coverage estimates for MBMS services using 1.28Mcps TDD

Estimates of average cell coverage have been obtained using a simple, interference limited system level model, based on the case 1 link level results. A 3 carrier deployment has been assumed, resulting in a total allocated bandwidth of 5MHz. Re-use patterns of 3, 4 and 7 relate to 14%, 20% and 33% respectively of this bandwidth when the MBMS service is transmitted using a dedicated timeslot in each cell.

	32kbps MBMS		**64kbps MBMS**	
	TTI 20msec	**TTI 80msec**	**TTI 20msec**	**TTI 80msec**
No Diversity	72%	83%	57%	71%
TSTD	84%	91%	71%	81%
SCTD	86%	95%	69%	76%

Table 9 Achievable cell coverage at 1% BLER for 64kbps and 32kbps MBMS services, when the re-use pattern is 3

	32kbps MBMS		**64kbps MBMS**	
	TTI 20msec	**TTI 80msec**	**TTI 20msec**	**TTI 80msec**
No Diversity	79%	87%	65%	77%
TSTD	88%	94%	78%	86%
SCTD	90%	97%	76%	81%

Table 10 Achievable cell coverage at 1% BLER for 64kbps and 32kbps MBMS services, when the re-use pattern is 4

	32kbps MBMS		**64kbps MBMS**	
	TTI 20msec	**TTI 80msec**	**TTI 20msec**	**TTI 80msec**
No Diversity	91%	95%	82%	90%
TSTD	96%	98%	90%	95%
SCTD	96%	99%	89%	93%

Table 11 Achievable cell coverage at 1% BLER for 64kbps and 32kbps MBMS services, when the re-use pattern is 7

6.3 Performance using new functionality

6.4 Summary

The following worst case performance bounds are drawn from the data:

- When Open Loop Transmit Diversity is not available or not employed, in excess of 33% of the 5MHz bandwidth (i.e. one carrier) is required for achieving 90% coverage for 64kbps. For 32kbps, 20-33% is required.

- When Open Loop Transmit Diversity is not available or not employed and around 20% of the bandwidth is used for MBMS, around 75% coverage can be achieved with 64kbps, or just under 90% for 32kbps.
- When SCTD is employed, 95% coverage can be achieved with 32kbps using 14% of the bandwidth
- When TSTD is employed, 95% coverage can be achieved with 64kbps using 33% of the bandwidth (i.e. one carrier)

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
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16/09/03	RP#21	RP-030535			Presented to RP #21 for information	0.1.0	1.0.0