



**D6-2.1b**

## **System Design Definition File**

**(For R1)**

**2<sup>nd</sup> version**

**Contractual Date of Delivery to the CEC:** none

**Actual Date of Delivery to the CEC:** 16/11/2004 (first version: 30/06/2004)

**Author(s):** Catherine Dargeou (ASP)

**Participant(s):** see table [Document Authors](#)

**Workpackage:** WP06

**Est. person months:** 4 p.m

**Security:** Pub.

**Nature:** R

**Version:** 3.3

**Total number of pages:** 57

### **Abstract:**

The D06-2-1b document describes the test bed as foreseen within MAESTRO release 1 scope. It aims at highlighting all of the SDMB functions supported in release 1 and at proposing a validation strategy composed of two test beds, namely laboratory test bed and field test bed. Finally the document provides an inventory list which identifies all required equipment for the test bed. Even though it was not agreed to be a deliverable document, it will still be delivered to serve as a reference to all specification and design documents describing each component of the test bed (delivered within the scope of Work Package 6 or 7).

**Keyword list:** MAESTRO test bed R1 design

## EXECUTIVE SUMMARY

This document contains D06-2-1b.ASP.MAESTRO.v2.0 of the IST Integrated Project MAESTRO – Mobile Applications & sErVICES based on Satellite and Terrestrial inteRwOrking (IST Integrated Project n° 507023).

MAESTRO project aims at studying technical implementations of innovative mobile satellite systems concepts targeting close integration & interworking with 3G and Beyond 3G mobile terrestrial networks.

MAESTRO aims at specifying & validating the most critical services, features, and functions of satellite system architectures, achieving the highest possible degree of integration with terrestrial infrastructures. It aims not only at assessing the satellite systems' technical and economical feasibility, but also at highlighting their competitive assets on the way they complement terrestrial solutions.

This is the second document of task 2 in Work Package 6 – “Architecture”. The WP 6 aims at:

- Identifying the technical requirements of the SDMB system.
- Defining the SDMB system architecture that inter-works with the 3GPP architecture and meets all system requirements.
- Defining the functions and interfaces of all SDMB sub-systems namely User Equipment (UE), Intermediate Module Repeater (IMR), space segment, Hub and services centre.
- Estimating the manufacturing and installation costs associated to the intermediate repeater.
- Estimating the development cost of the Hub.
- Analysing the impacts of SDMB system on the 3G mobile network.

The D06-2-1b.ASP.MAESTRO document describes the test bed as foreseen within MAESTRO release 1 scope. It aims at highlighting all of the SDMB functions supported in release 1 and at proposing a validation strategy composed of two test beds, namely laboratory test bed and field test bed. Finally the document provides an inventory list which identifies all required equipment for the test bed. Even though it was not agreed to be a deliverable document, it will still be delivered to serve as a reference to all specification and design documents describing each component of the test bed (delivered within the scope of Work Package 6 or 7).

The task is lead by Alcatel Space and is supported actively by all MAESTRO partners.

## COPYRIGHT

© Copyright 2004 The MAESTRO Consortium

consisting of :

- Alcatel Space (ASP), France
- Motorola Toulouse SAS (MSPS), France
- LogicaCMG UK Limited (LOGICACMG), United Kingdom
- Agilent Technologies Belgium SA (AGILENT), Belgium
- Ascom Systec AG (ASC), Swiss
- University College London (UCL), United Kingdom
- Alma Mater Studiorum University Of Bologna (UOB), Italy
- The University of Surrey (UNIS), United Kingdom
- Fraunhofer Gesellschaft e.V. (FHG/IIS), Germany
- Udcast (UDCAST), France
- Space Hellas SA (SPH), Greece
- Ercom Engineering Reseaux Communications (ERCOM), France
- AWE Communications GMBH (AWE), Germany
- GFI Consulting (GFIC), France
- SES Astra (SES), Luxembourg
- British Telecommunications PLC (BT), United Kingdom
- E-TF1 (E-TF1), France
- Bouygues Telecom (BYTL), France
- Alcatel CIT (A-CIT), France
- Alcatel SEL AG (ASEL), Germany

This document may not be copied, reproduced, or modified in whole or in part for any purpose without written permission from the MAESTRO Consortium. In addition to such written permission to copy, reproduce, or modify this document in whole or part, an acknowledgement of the authors of the document and all applicable portions of the copyright notice must be clearly referenced.

All rights reserved.

This document may change without notice.

**DOCUMENT HISTORY**

<b>Vers.</b>	<b>Issue Date</b>	<b>Content and changes</b>
2.0	15 May 2004	Initial Draft
2.1	7 June 2004	Draft: Include Agilent contribution Include ERCOM contribution Add Motorola comments Add appendix related to the RAB settings.
2.2	24 June 2004	Change Police size to 10 Update the definition list Add more details with respect to trial scenarios Correct some typos
3.0	30 June 2004	Release the document
3.1	10 November 2004	Various updates
3.2	16 November 2004	Various updates
3.3	16 November 2004	Final version for delivery

## DOCUMENT AUTHORS

This document has been generated from contributions coming from most of the MAESTRO partners. The contributors are the following:

<b>Partners company</b>	<b>Contributors</b>
Alcatel Space	<ul style="list-style-type: none"><li>• Catherine Dargeou</li></ul>
ERCOM	<ul style="list-style-type: none"><li>• Daniel Braun</li></ul>
Agilent	<ul style="list-style-type: none"><li>• Thierry Dubois</li></ul>

## DOCUMENT APPROVERS

This document has been verified and approved by the following partners:

<b>Partners company</b>	<b>Approvers</b>
Alcatel Space	<ul style="list-style-type: none"><li>• Christophe Selier</li></ul>
Alcatel Space	<ul style="list-style-type: none"><li>• Nicolas Chuberre</li></ul>

## TABLE OF CONTENTS

<b>1</b>	<b>INTRODUCTION .....</b>	<b>10</b>
1.1	BACKGROUND .....	10
1.2	FIELDS OF APPLICATION.....	10
1.3	DOCUMENT STRUCTURE .....	10
1.4	DOCUMENT STATUS.....	10
<b>2</b>	<b>DOCUMENTARY REFERENCE SYSTEM .....</b>	<b>11</b>
2.1	APPLICABLE DOCUMENTS.....	11
2.2	APPLICABLE NORMS AND STANDARDS.....	11
2.3	REFERENCE DOCUMENTS .....	11
2.4	DOCUMENTS TREE.....	12
<b>3</b>	<b>TERMS, DEFINITIONS, ABBREVIATED TERMS AND SYMBOLS.....</b>	<b>13</b>
3.1	TERMINOLOGY AND DEFINITIONS .....	13
3.2	ABBREVIATIONS .....	13
<b>4</b>	<b>GENERAL PRESENTATION .....</b>	<b>17</b>
<b>5</b>	<b>FUNCTIONAL ARCHITECTURE.....</b>	<b>18</b>
5.1	RADIO INTERFACE .....	18
5.1.1	<i>Logical channels</i> .....	18
5.1.2	<i>Transport channels</i> .....	18
5.1.3	<i>Physical channels</i> .....	19
5.2	ACCESS LAYER FUNCTION.....	19
5.2.1	<i>MAC definition</i> .....	20
5.2.2	<i>RLC definition</i> .....	20
5.2.3	<i>RRC definition</i> .....	20
5.3	PHYSICAL LAYER FUNCTION .....	20
5.3.1	<i>SDMB frame format</i> .....	20
5.3.2	<i>SDMB physical layer features</i> .....	22
<b>6</b>	<b>ORGANIC (OR LOGICAL) ARCHITECTURE .....</b>	<b>24</b>
6.1	LABORATORY TEST BED .....	24
6.1.1	<i>Laboratory test bed principle</i> .....	24
6.1.2	<i>Laboratory test bed configurations</i> .....	25
6.1.2.1	Inter-operability test bed .....	25
6.1.2.2	Radio link test bed.....	25
6.1.2.3	IMR evaluation.....	25
6.1.2.4	Propagation test bed .....	26
6.1.3	<i>Laboratory test bed organs and interfaces</i> .....	26
6.1.4	<i>Description of the organs and the logical interfaces</i> .....	27
6.1.4.1	Content provider.....	27
6.1.4.2	Hub.....	27
6.1.4.2.1	Node B.....	27
6.1.4.2.2	RNC .....	28
6.1.4.2.3	RNC – Node B interface .....	29
6.1.4.3	Propagation channel emulator.....	29
6.1.4.4	Terrestrial repeater .....	30
6.1.4.5	Terminal.....	31
6.1.4.6	S-DMB signal source and fading generator .....	31
6.1.4.7	Central controller .....	32
6.1.4.8	Monitoring tools .....	33

6.1.4.9	SIMSTAR output interface .....	34
6.1.4.10	SIMSTAR input interface .....	34
6.1.5	<i>Gain level study for the lab test bed</i> .....	34
6.1.6	<i>Lab test bed scenarios</i> .....	35
6.1.6.1	Inter-operability scenarios.....	35
6.1.6.1.1	FACH initialisation .....	35
6.1.6.1.2	Cell selection and camping .....	35
6.1.6.1.3	IMSI Attach .....	35
6.1.6.1.4	RRC connection establishment.....	35
6.1.6.1.5	Data Transfer.....	35
6.1.6.1.6	System Information change .....	35
6.1.6.2	Transmission scenarios objectives .....	35
6.1.6.2.1	End to end reception performances .....	35
6.1.6.2.2	Rake study.....	37
6.1.6.2.3	SDMB waveform characterisation.....	38
6.2	FIELD TEST BED.....	39
6.2.1	<i>Overview</i> .....	39
6.2.2	<i>Description of the organs and the logical interfaces</i> .....	40
6.2.2.1	Content provider .....	40
6.2.2.2	Hub .....	40
6.2.2.3	Satellite emulator.....	41
6.2.2.4	Terrestrial repeater .....	41
6.2.2.5	Terminal.....	41
6.2.2.6	Drive test tool.....	41
6.2.2.7	Central controller .....	41
6.2.2.8	Hub – UE interface .....	41
6.2.2.9	Hub – IMR interface.....	41
6.2.2.10	IMR – UE interface .....	42
6.2.3	<i>Field test bed installation</i> .....	42
6.2.3.1	Constraints .....	42
6.2.3.2	Link budget.....	43
6.2.4	<i>Field test bed scenarios</i> .....	44
<b>7</b>	<b>INVENTORY</b> .....	<b>46</b>
7.1	LAB TEST BED .....	46
7.2	FIELD TEST BED.....	49
<b>8</b>	<b>RAB SETTINGS</b> .....	<b>52</b>
8.1	PRE-PDP PARAMETERS .....	53
8.1.1	<i>RRC connection Setup</i> .....	53
8.1.2	<i>RRC security mode command</i> .....	53
8.1.3	<i>NAS attach procedure</i> .....	53
8.1.4	<i>NAS authentication procedure</i> .....	53
8.1.5	<i>Identity request</i> .....	53
8.2	NAS PDP PARAMETERS.....	54
8.3	AS PDP PARAMETERS .....	54
8.3.1	<i>RRC Radio Bearer setup</i> .....	54
8.3.2	<i>PDCP info</i> .....	55
8.3.3	<i>RLC info</i> .....	56
8.3.4	<i>RB mapping info</i> .....	56
8.4	MAC MULTIPLEXING .....	56
8.5	SYSTEM INFORMATION ADDITION .....	56

## LIST OF TABLES

Table 1 – Application document table .....	11
Table 2 – Applicable norms.....	11
Table 3 – Reference documents table .....	12
Table 4 – Laboratory test bed organs and interfaces summary.....	27
Table 5 – Field test bed organ and interfaces summary.....	40
Table 6 – Budget link for the field test bed.....	44
Table 7: Lab test bed inventory.....	48
Table 8: Test bed inventory for field trials .....	51

## LIST OF FIGURES

Figure 1 – Documentation tree.....	12
Figure 2 – SDMB system architecture .....	17
Figure 3 – Release 1 test bed functional architecture.....	18
Figure 4 – Release 1 MAESTRO channels correspondence.....	19
Figure 5 – Access scheme .....	20
Figure 6 - SDMB radio frame and slot structure.....	21
Figure 7 - SDMB channel timing structure .....	22
Figure 8 – SDMB channel coding, multiplexing and mapping .....	23
Figure 9 – Principle of the laboratory test bed .....	24
Figure 10 – Inter-operability test bed .....	25
Figure 11 - Radio link test bed .....	25
Figure 12 – IMR evaluation platform .....	26
Figure 13 – Propagation test bed.....	26
Figure 14 – RNC – Node B interface .....	29
Figure 15 – SIMSTAR-1/MS block diagram .....	30
Figure 16 - SIMSTAR-1/MS functional architecture.....	30
Figure 17 : step 1 - Capturing S-DMB signal on file.....	31
Figure 18 step 2 – Streaming, fading and up-conversion .....	32
Figure 19 – Lab test bed control.....	33
Figure 20 – Up-converter architecture .....	34
Figure 21 – Down converter architecture .....	34
Figure 22 – Gain level study of the lab test bed.....	35
Figure 23 – Field test bed.....	40



Figure 24: Configuration of the field trial site..... 43

Figure 25 – Lab test bed platform ..... 46

Figure 26 – Field test bed platform ..... 49

# 1 INTRODUCTION

## 1.1 Background

Task 2 of the Work Package 6 deals with the SDMB system architecture. The outcome of the task is composed of two documents, namely D06-2-1a.ASP.MAESTRO – “System Design Definition” and D06-2-1b.ASP.MAESTRO – “MAESTRO release 1 test bed design document”.

The D06-2-1a.ASP.MAESTRO document describes the commercial SDMB system in terms of functional, logical and physical architectures. It identifies all sub-systems and interfaces and ensures top-level cohesion between all of them.

The D06-2-1b.ASP.MAESTRO document describes the test bed as foreseen within MAESTRO release 1 scope. It answers the deliverable D6-1.1 – SDMB Technical Requirements for release 1. It highlights all of the SDMB functions to be tested in release 1 and proposes a validation strategy composed of two test beds, namely laboratory test bed and field test bed. Finally the document provides an inventory list which identifies all required equipment for the test beds.

Even though it was not agreed to be a deliverable document, it will still be delivered to serve as a reference to all specification and design documents describing each component of the test bed (delivered within the scope of WP 6 and 7).

## 1.2 Fields of application

This document is meant to be used by the teams in charge of specifying, designing, developing, integrating verifying and validating the release 1 MAESTRO test bed.

## 1.3 Document structure

The document is composed of the following sections:

- General presentation. This section describes the concept of the SDMB system.
- Functional architecture. This section aims at identifying which functions of the commercial SDMB system will be supported and tested within the release 1 scope.
- Organic architecture. This section introduces both the laboratory and the field test beds; it provides a high-level description of each organ and interface of the test beds and identifies specific scenarios to be tested in release 1.
- Inventory. This section lists all components required for the implementation of each test bed and identifies who is responsible to supply the equipment.

## 1.4 Document status

Released

## 2 DOCUMENTARY REFERENCE SYSTEM

### 2.1 Applicable documents

#	Reference	Title
[AD1]	MAESTRO Annex 1	Description of Work
[AD2]	D6-1.1.ASP.MAESTRO.V3.1	SDMB system technical requirements
[AD3]	TN6-1-04.ASP.MAESTRO. V2.4	MAESTRO Release 1 Test Bed specification
[AD4]	D6-2.1a.ASP.MAESTRO	SDMB system design document (Release 1)

**Table 1 – Application document table**

### 2.2 Applicable norms and standards

#	Reference	Title
[AN1]	TS 25.101	UE Radio Transmission and Reception (FDD)
[AN2]	TS 25.133	Requirements for Support of Radio Resource Management (FDD)
[AN3]	TS 25.201	Physical Layer – General description
[AN4]	TS 25.211	Physical Channels and mapping of transport channels (FDD)
[AN5]	TS 25.212	Multiplexing and Channel Coding (FDD)
[AN6]	TS 25.213	Spreading and Modulation (FDD)
[AN7]	TS 25.214	Physical Layer Procedures (FDD)
[AN8]	TS 25.301	Radio Interface Protocol Architecture
[AN9]	TS 25.302	Services Provided by the Physical Layer
[AN10]	TS 25.306	UE Radio Access Capabilities

**Table 2 – Applicable norms**

### 2.3 Reference documents

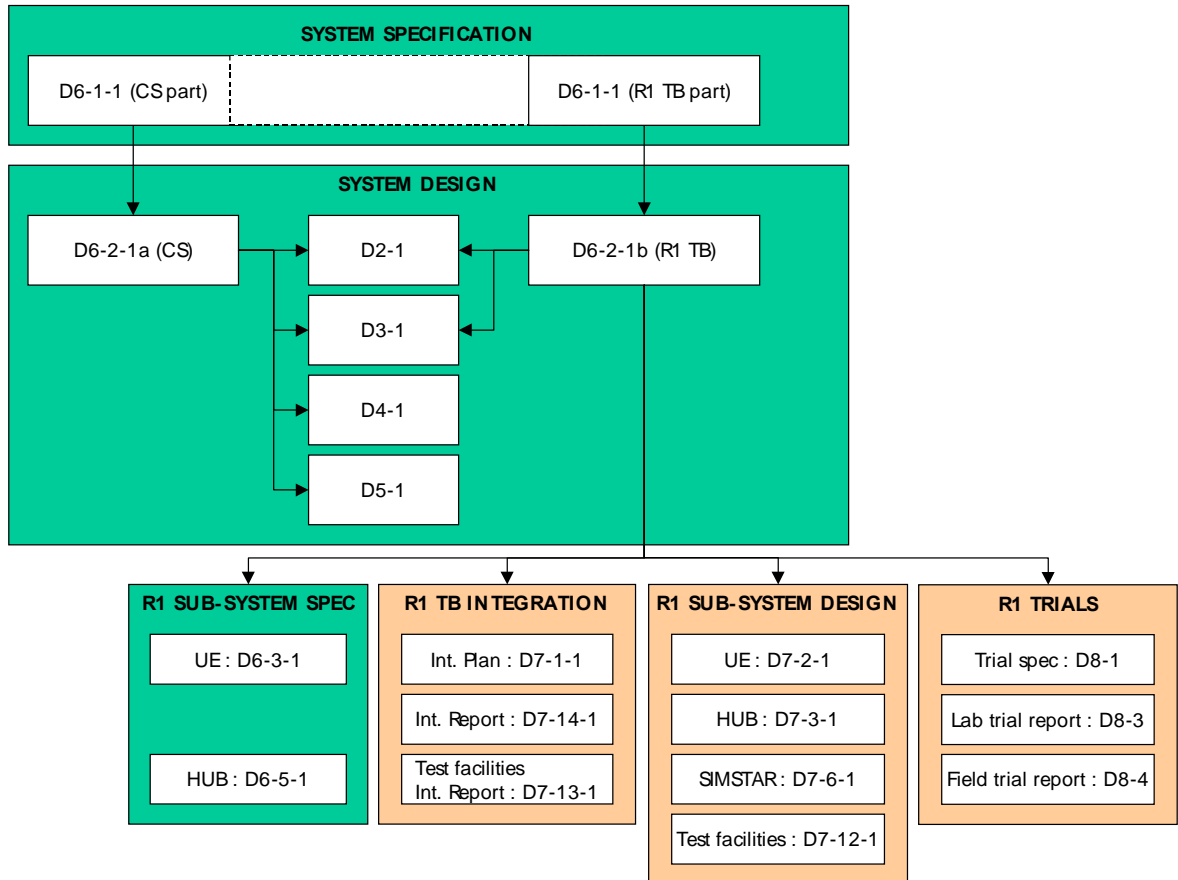
#	Reference	Title
[RD1]	D2-1.1_ASP_MAESTRO_V0_1	SDMB Physical Layer Specifications (Release 1)
[RD2]	D3-1.1_UNIS_MAESTRO_V2.3	SDMB Access Layer Definition (Release 1)
[RD3]	D6-3.1_MSPS_MAESTRO	UE SDMB specification document (Release 1)
[RD4]	D6_5_1_ERCOM_MAESTRO	SDMB HUB specification document (Release 1)
[RD5]	D7-1.1_MSPS_MAESTRO	Release 1 test bed integration plan
[RD6]	D7-2.1_MSPS_MAESTRO	UE high level design document (Release 1)
[RD7]	D7_3_1_ERCOM_MAESTRO	Hub design document (Release 1)
[RD8]	D7-6.1_ASC_MAESTRO	Propagation channel emulator design document
[RD9]	D7-12.1_AGILENT_MAESTRO	Test facilities specifications and design document
[RD10]	D7-13.1_AGILENT_MAESTRO	Release 1 test facilities integration report

[RD11]	D7-14.1_MSPS_MAESTRO	Release 1 test bed integration report
[RD12]	D8-1_SPH_MAESTRO	Trials specifications for Release 1
[RD13]	MoDiS deliverable 11	MoDiS Trial results and evaluation report

**Table 3 – Reference documents table**

**2.4 Documents tree**

The diagram below intends to describe how the R1 test bed design document relates with the other deliverable documents in the work packages 6 and 7.



**Figure 1 – Documentation tree**

It is interesting to note that the neither the IMR specification nor the IMR design documents are shown in the documentation tree. This is because the IMR deliverables describe the IMR in the scope of the commercial SDMB system but not the one used in the test bed. All information related to the repeater used in the test bed will be contained in this document.

### 3 TERMS, DEFINITIONS, ABBREVIATED TERMS AND SYMBOLS

#### 3.1 Terminology and definitions

Version 1.4

BM-SC	Means the BM-SC as defined for MBMS and including specific SDMB features
Cell	Means the Terrestrial mobile network cell
Content	File or data stream transmitted by the SDMB system and possibly (for the Download service) completed by terrestrial retransmissions
Download delivery method	A delivery method that delivers some multimedia content with loose time constraints. The service is best map on 3GPP defined background traffic class capability.
End User	The End user owns the terminal, subscribes to the MNO & Mobile Portal services
Groupcast service	A service offered to end-user allowing to send in a cost efficient way the same content to a group of users. This may include streaming or download.
SDMB service	A push service that delivers a set of Multimedia content to several recipients. The service includes information, which allows the user equipment to process the content according to the end-user's rights and terminal capabilities. The access to the service may be restricted to a certain group of users which may have to pay a fee.
Relevant content	A multimedia content which is expected to interest the end user with respect to its user preference profile.
Service area	Refers to the area where the SDMB services are available. Basically it is defined taking into account a set of satellite spots providing the European coverage.
Spot area	Corresponds to the areas covered by a satellite spot beam. There is not necessarily a service continuity between two spot areas. We assume that the same data is datacast in a spot area and it differs from the data datacast in other spot areas.
Streaming delivery method	A delivery method that delivers some multimedia content with real time constraints. It may refers to TV or radio type of services. Such service is manually activated by the end-user. Content are played as soon as received by the end-user terminal. The service is best map on 3GPP defined streaming traffic class capability.
Terrestrial mobile network	The terrestrial mobile network(s) on which the SDMB system relies.
UE	The UMTS/GSM User equipment modified to include SDMB features.
User preference profile	The description of the SDMB-content related user preferences (preferred user services) in the UE.
User service	A consistent set of contents, distributed using a given delivery method.

#### 3.2 Abbreviations

Version	1.4	DSP	Digital Signal Processing
2G	Second Generation (Mobile communication system)	DVB	Digital Video Broadcasting
3G	Third Generation (Mobile communication system)	DVB-S	DVB Satellite
3GPP	3rd Generation Partnership Project	EC	European Commission
A-CIT	Alcatel CIT, France (MAESTRO Partner)	EIRP	Equivalent Isotropically Radiated Power
AAC+	Improved Advanced Audio Coding	ERCOM	Ercom Engineering Reseaux Communications, France (MAESTRO Partner)
ABFN	Analogue Beam Forming Network	ESA	European Space Agency
ACI	Adjacent Channel Interference	E-TF1	E-TFI, France (MAESTRO Partner)
ACIR	Adjacent Channel Interference Ratio	ETSI	European Telecommunications Standard Institute
ACLR	Adjacent Channel Leakage Ratio	EVM	Error Vector Magnitude
ACS	Adjacent Channel Selectivity	FDD	Frequency Division Duplex
ADC	Analogue to Digital Conversion	FDM	Frequency Division Multiplex
AGC	Automatic Gain Control	FDMA	Frequency Division Multiple Access
AGILENT	Agilent Technologies Belgium SA, Belgium (MAESTRO Partner)	FEC	Forward Error Correction
AM/AM	Amplitude – Amplitude transfer function	FHG/IIS	Fraunhofer Gesellschaft e.V., Germany (MAESTRO Partner)
AM/PM	Amplitude – Phase transfer function	FP5	5th Research Framework Program of the European Commission
ASC	Ascom Systec AG, Swiss (MAESTRO Partner)	FP6	6th Research Framework Program of the European Commission
ASEL	Alcatel SEL AG, Germany (MAESTRO Partner)	FSS	Fixed Satellite Services
ASP	Alcatel Space, France	G/T	Figure of merit
AWE	AWE Communications GMBH, Germany (MAESTRO Partner)	GD	Group Delay
AWGN	Additive White Gaussian Noise	GEO	Geostationary Earth Orbit
BCF	Base Common Functions	GF	Gain Flatness
BCH	Broadcast Channel	GFI	GFI Consulting, France (MAESTRO Partner)
BER	Bit Error Rate	GNSS	Global Navigation Satellite System
BLER	Block Error Rate	GPRS	General Packet Radio Service
BM-SC	Broadcast Multicast Service Center	GSM	Global System for Mobile Communications
BT	British Telecommunications PLC, United Kingdom (MAESTRO Partner)	GUI	Graphic User Interface
BYTL	Bouygues Telecom, France (MAESTRO Partner)	GW	Gateway
CBS	Cell Broadcast Service	HDFSS	High Density FSS
CCI	Co-Channel Interference	HLR	Home Location Register
CCN	Contract Change Notice	HPA	High Power Amplifier
CDD	Content Delivery Descriptor	HTML	Hyper Text Markup Language
CDMA	Code Division Multiple Access	HW	Hardware
CDN	Content Delivery Network	I/O	Input / Output
CNP	Combined Network Planning	IBO	Input Back-Off
COTS	Commercial Off The Shelf	IMR	Intermediate Module Repeater
CPICH	Common Pilot Channel	IMT-2000	International Mobile Telecommunications 2000
CTCH	Common Traffic Control Channel	IP	Internet Protocol
DL	DownLink	IRT	Intelligent Ray Tracing
DMB	Digital Multimedia Broadcasting	IST	Information Society & Technology
DRM	Digital Rights Management	ITU	International Telecommunication Union

KO	Kick-Off	PTP	See p-t-pt
LBS	Location Based Services	p-t-p	Point to Point
LDR	Large Deployable Reflector	PVR	Personal Video Recorder
LMS	Land Mobile Satellite	QoS	Quality of Service
LNA	Low Noise Amplifier	R1	MAETRO Test Bed Release 1
LNB	Low Noise Block	R2	MAETRO Test Bed Release 2
LOGICACMG	LogicaCMG UK Limited, United Kingdom (MAESTRO Partner)	RAN	Radio Access Network
LOS	Line Of Sight	RLC	Radio Link Control
LTWTA	Linearised Travelling Wave Tube Amplifier	RNC	Radio Network Controller
MAC	Medium Access Control	RNPT	Radio Network Planning Tool
MAESTRO	Mobile Applications & sErVICES based on Satel- lite and Terrestrial inteRwOrking	RNS	Radio Network Subsystem
MBMS	Multimedia Broadcast/Multicast Service	S-CCPCH	Secondary Common Control Physical Channel
MM	MultiMedia	SDMB	Satellite Digital Multimedia Broadcasting
MMI	Man Machine Interface	S-DMB	See SDMB
MMS	Multimedia Messaging Service	SES	SES Astra, Luxembourg (MAESTRO Partner)
MNO	Mobile Network Operator	SF	Spreading Factor
MoDis	IST FP5 Mobile Distribution project - MOBILE Digital broadcast Satellite	SFN	Single Frequency Network
MP3	Moving Picture Experts Group Layer-3 Audio (audio file format/extension)	SGSN	Serving GPRS Support Node
MPA	Multi-Port Amplifier	SIM	Subscriber Identity Module
MPC	Multi-Port Combiner	SMS	Short Message Service
MPD	Multi-Port Divider	SPH	Space Hellas SA, Greece (MAESTRO Partner)
MPEG4	Motion Picture Experts Group 4 (Standard - Compressed Video at 64 Kbps)	S-SCH	Secondary Synchronisation Channel
MSC	Mobile Switching Centre	SSPA	Solid State Power Amplifier
MSPS	Motorola Toulouse SAS, France (MAESTRO Partner)	S-UMTS	Satellite UMTS
MSS	Mobile Satellite Services	SW	Software
NLOS	Non Line Of Sight	TBC	To Be Confirmed
Node B	UMTS Base Station	TBD	To Be Defined
O&M	Operation and Maintenance	TDD	Time Division Duplex
OBO	Output Back-Off	T-UMTS	Terrestrial UMTS
OMC	Operation and Maintenance Center	TV	Television
OMUX	Output Multiplexer	TWTA	Travelling Wave Tube Amplifier
PA	Power Amplifier	UCL	University College London, United Kingdom (MAESTRO Partner)
P-CCPCH	Primary Common Control Physical Channel	UDCAST	Udcast, France (MAESTRO Partner)
PCDE	Peak Code Domain Error	UE	User Equipment
PER	Packet Error Rate	UMTS	Universal Mobile Telecommunications System
PFD	Power Flux Density	UNIS	The University of Surrey, United Kingdom (MAESTRO Partner)
PICH	Paging Indicator Channel	UoB	Alma Mater Studiorum Universita Di Bologna, Italy (MAESTRO Partner)
PIM	Protocol Interface Module	URAN	UMTS Radio Access Network
P-SCH	Primary Synchronisation Channel	USB	Universal Serial Bus
PSSP	Public Security Service Provider	UT	User Terminal
		UTRA	UMTS Terrestrial Radio Access
		UTRAN	UMTS Terrestrial Radio Access Network

Uu	UMTS air interface
W-CDMA	Wideband Code Division Multiple Access
WH	Walsh – Hadamard
WP	Work Package
WRC	World Radio Conference
XHTML	Extensible Hypertext Markup Language
XML	eXtensible Markup Language



## 4 GENERAL PRESENTATION

The Satellite Digital Multimedia Broadcasting (SDMB) system intends to implement a multicast layer over unicast terrestrial 3G UMTS mobile networks. As shown on Figure 2, the system concept is based on a combined satellite and terrestrial repeaters architecture for delivery of interactive broadcasting/multicasting digital multimedia services to mobile end-users. The system will aim to permit indoor penetration by means of dedicated large power GEO satellites providing several beams over Europe.

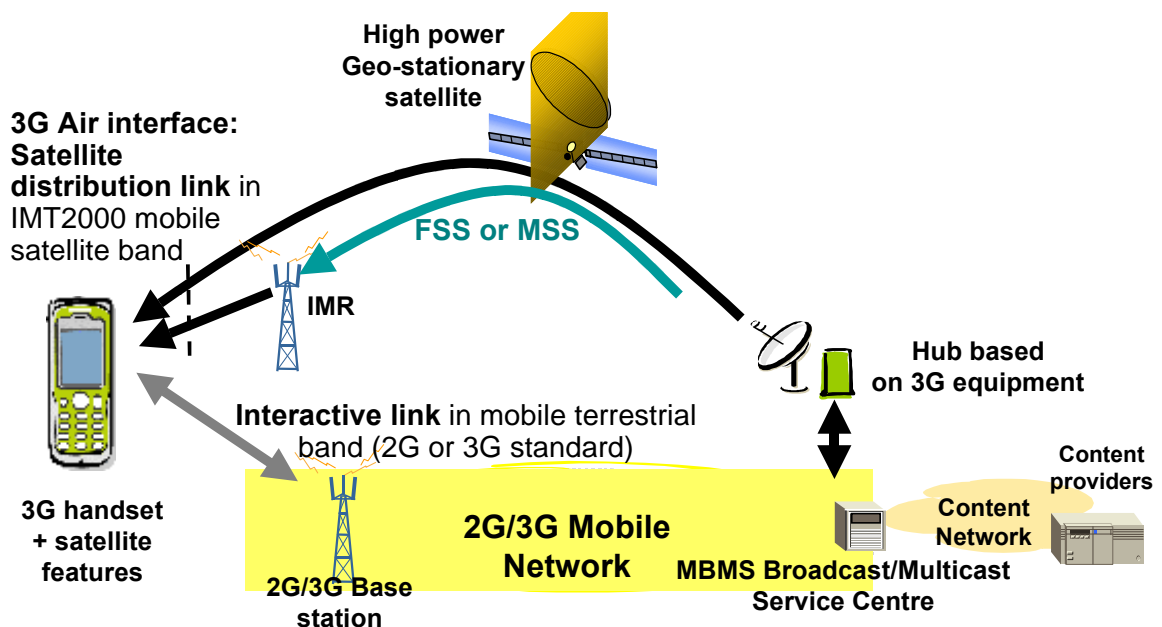


Figure 2 – SDMB system architecture

MAESTRO aims at specifying and validating the most critical services, features, and functions of satellite system architecture, achieving the highest possible degree of integration with terrestrial infrastructures. It aims not only at assessing the satellite systems' technical and economical feasibility, but also at highlighting their competitive assets on the way they complement terrestrial solutions.

In the scope of release 1, the MAESTRO study includes setting up two platforms representative of an SDMB system from the broadcast mission point of view (no terrestrial network). One of these platforms will be dedicated to laboratory trials while the other one will be used for field trials.

The goal of the laboratory test bed is to provide a platform to consolidate simulation results. Therefore, one of the key features of that platform is to allow reproducibility.

As in MoDiS, the goal of the field test bed is to demonstrate the feasibility of the SDMB system but using a terminal built on a commercial UE which features a higher integration level and a complete UMTS/GPRS protocol stack.

## 5 FUNCTIONAL ARCHITECTURE

The following figure presents the basic functional architecture of a SDMB system and highlights the functions that will be tested within the scope of MAESTRO release 1.

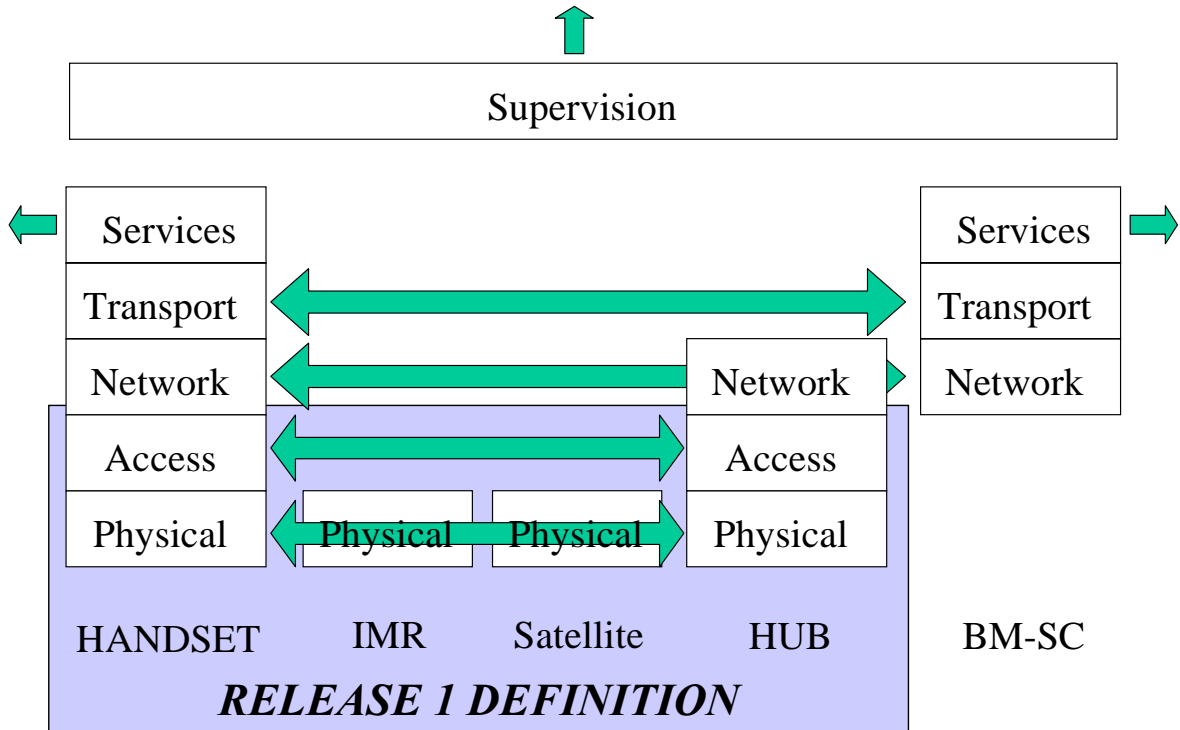


Figure 3 – Release 1 test bed functional architecture

### 5.1 Radio interface

The radio interface is organised into channels, each one grouping a specific set of functions at the data and/or control planes. The set of channels used in release 1 is slightly different from the one used in SDMB due to the fact that we are using a UMTS terminal without MBMS features.

#### 5.1.1 Logical channels

Logical channels relevant to release 1 MAESTRO test bed are:

- BCCH : Broadcast Common Control Channel
- DTCH : Dedicated Traffic CHannel

The BCCH is a point-to-multi-point down-link channel used to broadcast system control information required for any terminal to join the network. The DTCH is a point-to-multi-point down-link channel used to transfer information to all or a group of specified end-users connected to the network.

#### 5.1.2 Transport channels

Transport channels relevant to release 1 MAESTRO test bed are:

- FACH : Forward Access Channel
- PCH : Paging Channel
- BCH : Broadcast Channel

The BCH is used to broadcast system information specific to the UTRAN. A UE cannot register to the UTRAN without decoding the BCH. The FACH is used for data transmission. To each transport channel, there is an associated transport format. A transport format is defined as a combination of encoding, interleaving, bit rate and mapping onto physical channel.

### 5.1.3 Physical channels

Physical channels relevant to release 1 MAESTRO test bed are:

- CPICH : Common Pilot CHannel
- SCH : Synchronisation CHannel
- P-CCPCH : Primary Common Control Physical Channel
- S-CCPCH : Secondary Common Control Physical Channel

The CPICH carries a pre-defined sequence of symbol, which serves as phase reference for SCH, P-CCPCH and S-CCPCH. The SCH consists of two sub-channels, the primary and the secondary SCH. They are both used for cell search. The P-CCPCH carries the BCH and the S-CCPCH carries the FACH.

Figure below shows the mapping between the different channels. As Oppose to what is shown in [RD2] : “SDMB Access Layer Definition”, logical channels MTCH and MCCH are not relevant to release 1, only DTCH will be used thus easing the implementation of the access layer.

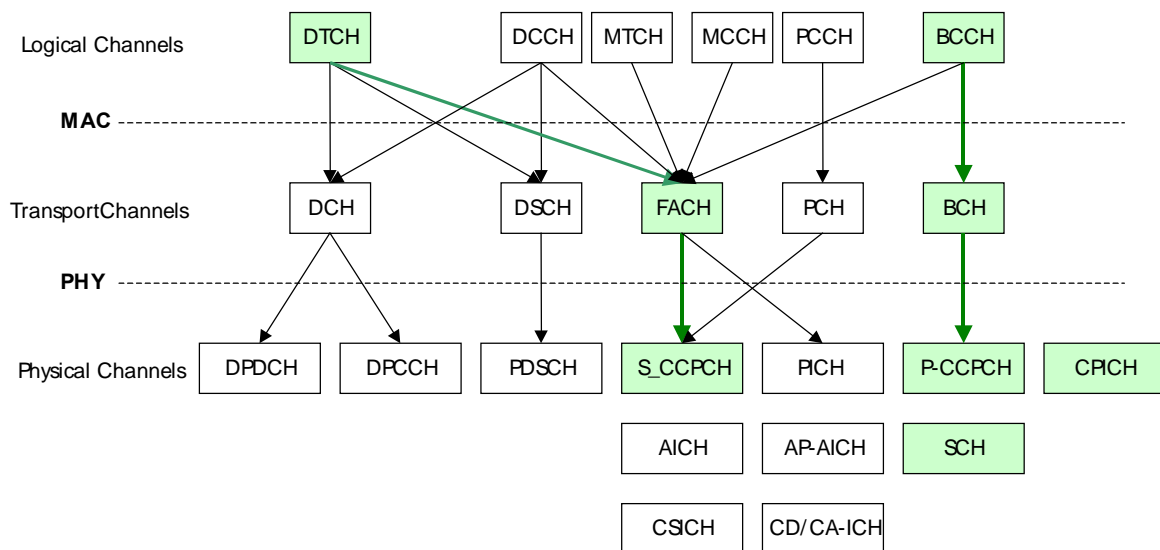


Figure 4 – Release 1 MAESTRO channels correspondence

## 5.2 Access layer function

The access layer includes 2 layers, namely the data link layer or layer 2 and part of the network layer or layer 3.

The layer 2 consists of three sub-layers, the Medium Access Control (MAC), the Radio Link Control (RLC) and the Packet Data Convergence Protocol (PDCP). The first two exists in both the user-plane and the control-plane, whereas the PDCP is only relevant to the user-plane.

The network layer is part of the control-plane; it is also organised in sub-layers, however the only one applicable to the SDMB is the Radio Resource Control (RRC).

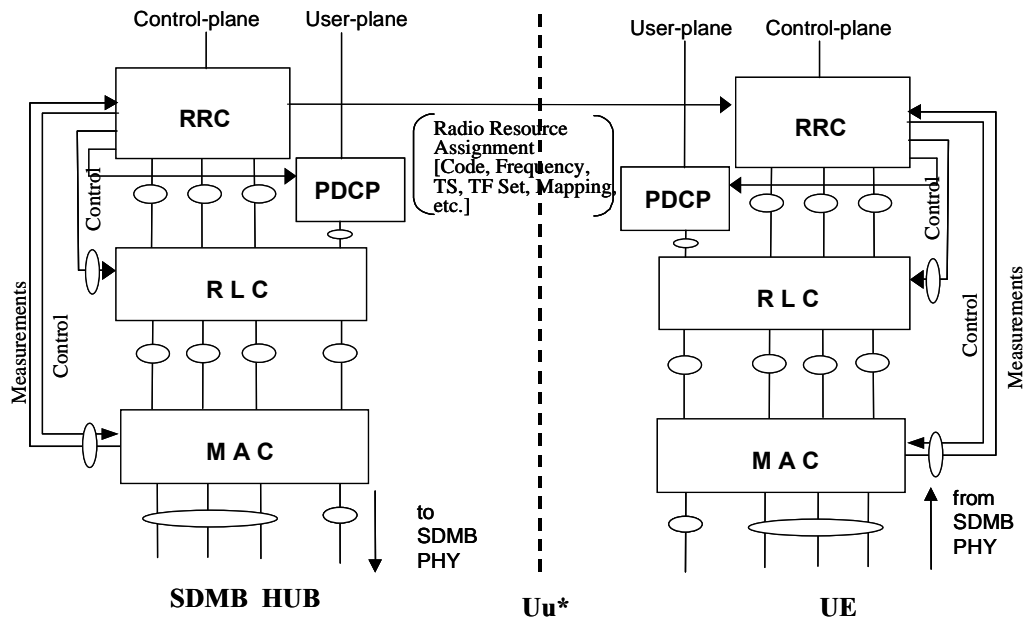


Figure 5 – Access scheme

This view of the access layer is similar to the one described in the commercial SDBM system.

### 5.2.1 MAC definition

See [RD2]: SDMB Access Layer Definition

### 5.2.2 RLC definition

See [RD2]: SDMB Access Layer Definition

### 5.2.3 RRC definition

See [RD2]: SDMB Access Layer Definition

## 5.3 Physical layer function

This section provides a brief reminder of what the SDMB frame structure is and lists the features fulfilled by the physical layer.

### 5.3.1 SDMB frame format

The SDMB frame/slot structure and physical timing structured is similar to the one defined in the 3GPP standard.

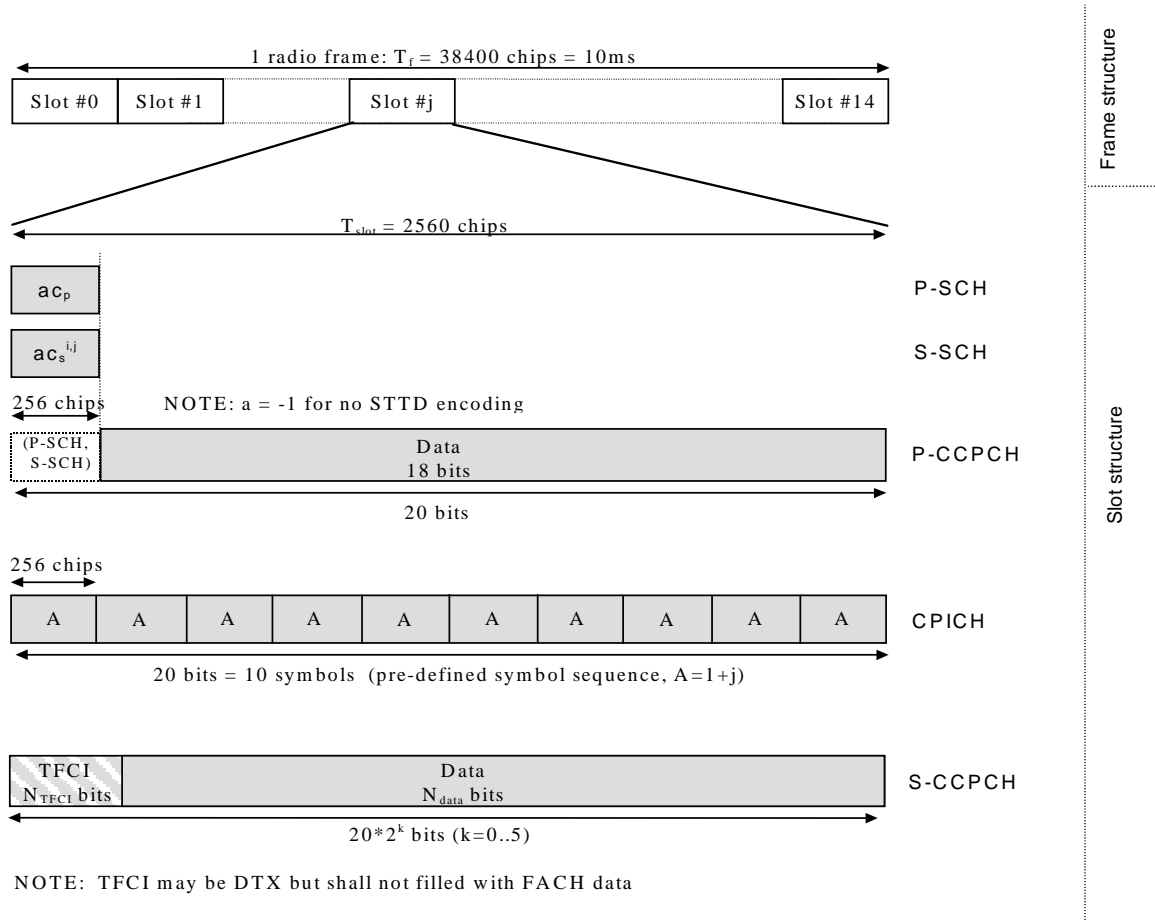
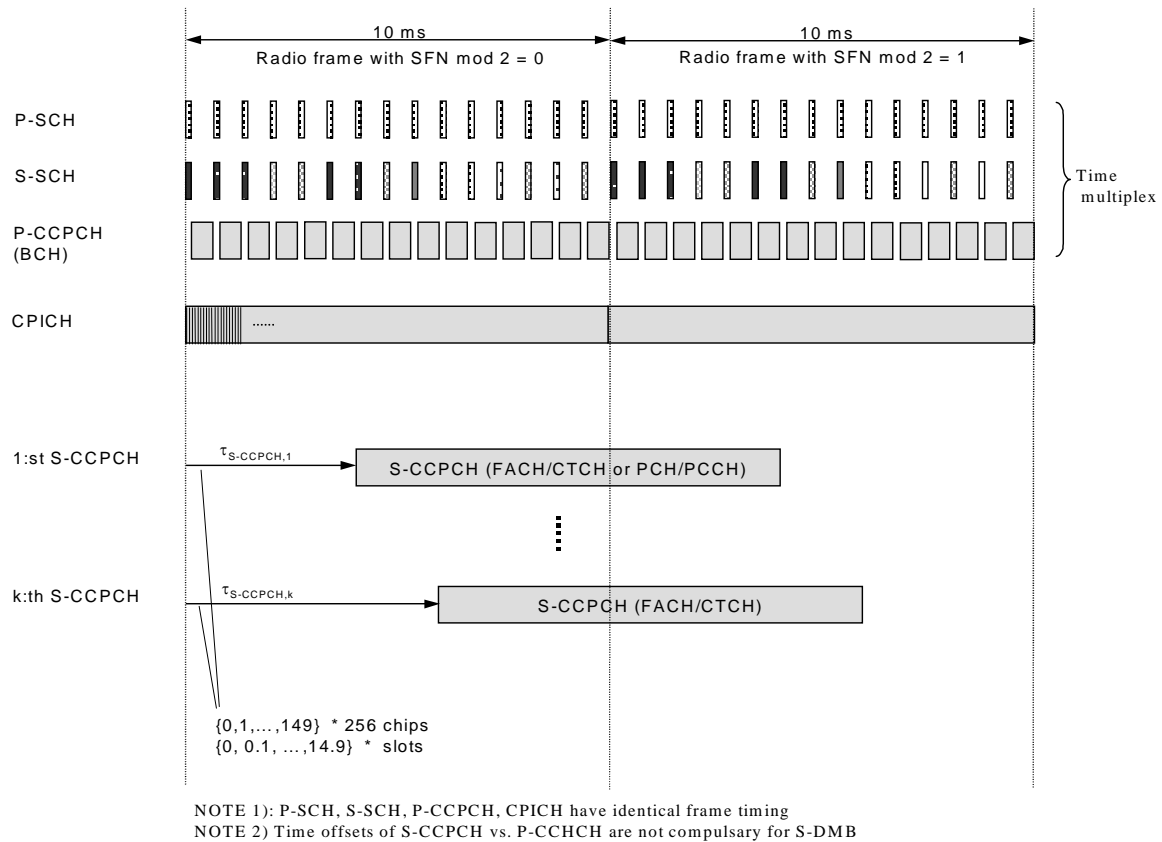


Figure 6 - SDMB radio frame and slot structure



**Figure 7 - SDMB channel timing structure**

For more details, refer to [RD1] – SDMB physical layer specifications.

### 5.3.2 SDMB physical layer features

The physical layer processing includes the following steps:

- CRC attachment.  
Each block received from the MAC sub-layer is appended with CRC bits. The number of inserted bits is configurable: 0, 8, 12, 16 or 24.
  - Concatenation.  
After CRC insertion, all blocks received within the same TTI are concatenated together. The TTI length is configurable: 10ms, 20ms, 40ms or 80ms.
  - Channel coding.  
In order to improve the quality of the transmission, each “concatenated” block is coded using a 1/3-rate turbo code.
  - Tail attachment
  - Rate matching
- A rate matching function is used to ensure that the bit rate in the transport channel fits the bit rate of the physical channel.
- First interleaving
  - Second interleaving
  - Physical channel mapping and multiplexing
  - Spreading

- Scrambling
- Modulation

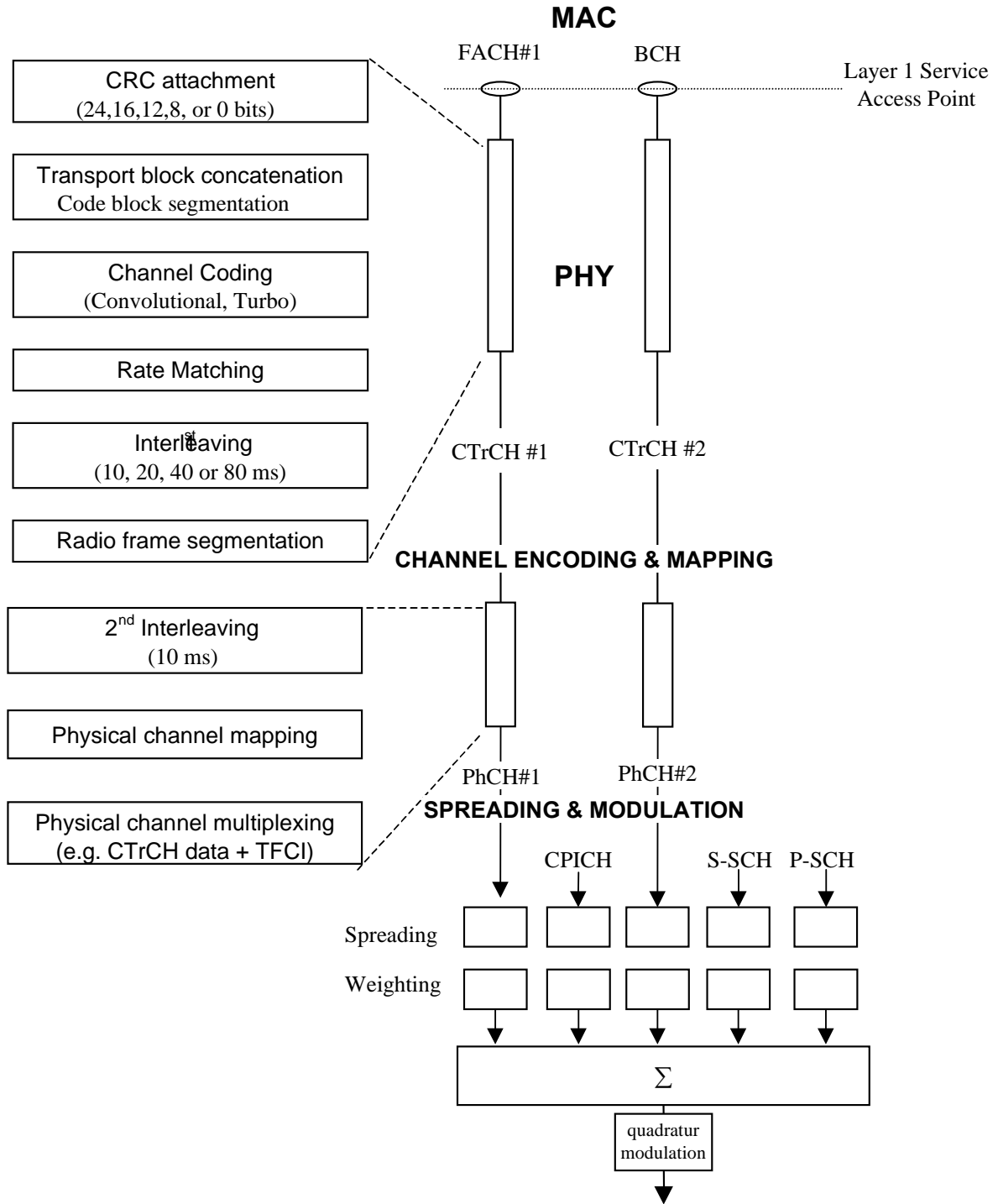


Figure 8 – SDMB channel coding, multiplexing and mapping

The above diagram has been derived from information contained in [RD1] – SDMB physical layer specifications where you can find further details. As opposed to what is described in that document, release 1 will only support one S-CCPCH and one FACH. That's why we refer on the above figure to CTrCH (Coded Transport CHannel) as opposed to CCTrCH (Coded Composite Transport CHannel).

## 6 ORGANIC (OR LOGICAL) ARCHITECTURE

In the scope of release 1, MAESTRO study includes setting up two platforms representative of a SDMB system from the broadcast mission point of view (no terrestrial network). One of these platforms will be dedicated to laboratory trials while the other one will be used for field trials.

### 6.1 Laboratory test bed

The goal of the laboratory test bed is to provide a platform to consolidate simulation results. Therefore, one of the key features of the platform is to allow reproducibility.

#### 6.1.1 Laboratory test bed principle

The laboratory platform differs from the real SDMB system described on Figure 2 in the following:

- The satellite is replaced by the SIMSTAR emulator, which features satellite and terrestrial multi-path channels. Each channel can emulate up to 6 uncorrelated multi-path. The SIMSTAR emulator operating in the IF domain, frequency conversion modules are required at each end of the emulator.
- The Hub functions are fulfilled by a Node B and a RNC simulator featuring broadcast support and adapted to the MAESTRO application.
- The MAESTRO terminal is based out of a 3GPP compliant integrated handset which has been modified so as to be able to receive SDMB data. The terminal can be connected to a laptop for further analysis of the data. The laptop also hosts the UE video client.
- The content provider is replaced by a simple data generator, which may at first be integrated in the RNC simulator.
- The MAESTRO platform does not feature any interactive link in a sense that it does not interact with either a 3G or a 2G network.

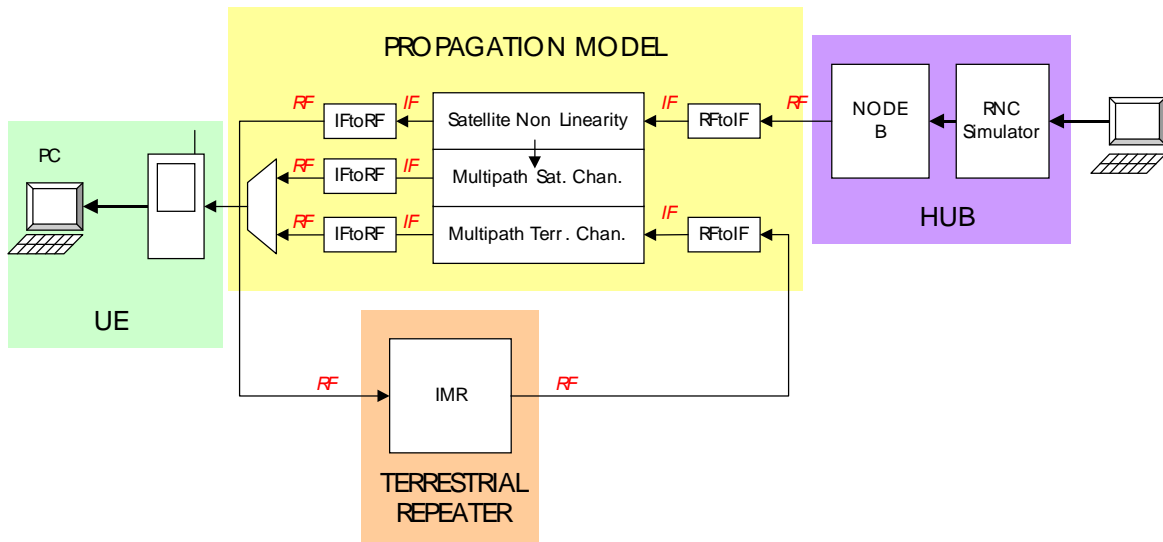


Figure 9 – Principle of the laboratory test bed

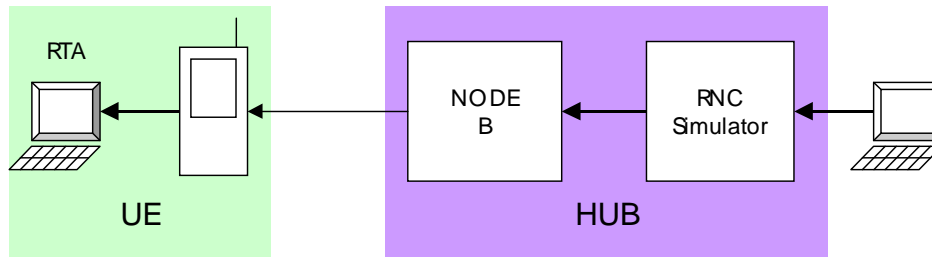
Now, it has been chosen not to integrate the test bed as represented in the above figure but to split it in four sub-test beds in order to de-risk the integration process and to decrease the number of frequency conversion cards required thus reducing the overall cost of the test bed.



## 6.1.2 Laboratory test bed configurations

### 6.1.2.1 Inter-operability test bed

The first step consists in testing the inter-operability functions of the system such as terminal initialisation, FACH configuration or PC data post-processing. As shown on the figure below, this reduced test bed connects directly the HUB to the terminal; it will be later on referred to as inter-operability test bed.



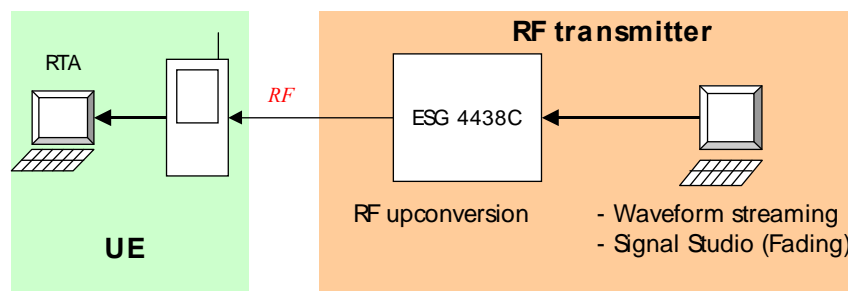
**Figure 10 – Inter-operability test bed**

### 6.1.2.2 Radio link test bed

The second step of the integration consists in measuring the terminal performances with respect to radio transmission. In this configuration, the terminal interfaces directly with a test equipment able to deliver a signal representative of what would be received from the satellite. This set-up is composed of the following parts:

- signal generation: waveform streaming from hard disk
- signal fading : introducing different faded multi-paths
- RF up-conversion: the ESG E4438C signal generator is used as up-converter from base band to RF.

This test bed will be later on referred to as radio-link test bed.



**Figure 11 - Radio link test bed**

### 6.1.2.3 IMR evaluation

The third step of the integration consists in measuring performances at the output of the IMR thus taking into account non-linearity insertion, propagation effect and IMR degradations. Performances to be measured are:

- Measurement of pilot power
- Synchronisation power
- EC/Io

- EVM and PCDE
- Spurious level

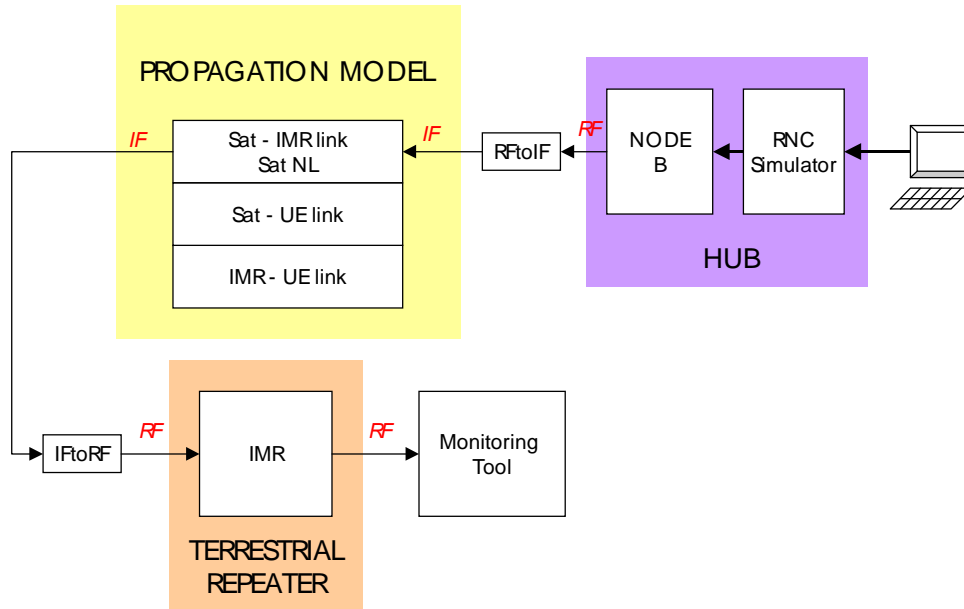


Figure 12 – IMR evaluation platform

6.1.2.4 Propagation test bed

The fourth and last step of the integration phase essentially aims to fulfil the same goal as the one described on Figure 9. The idea is to directly feedback the “satellite to IMR” path to the “IMR to UE” path (without going through the IMR) and to pass as parameters the IMR performances to the SIMSTAR equipment.

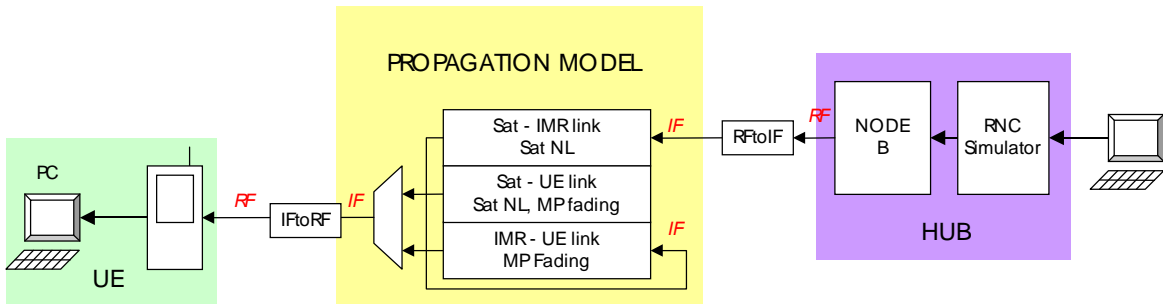


Figure 13 – Propagation test bed

6.1.3 Laboratory test bed organs and interfaces

The following table lists the organs and logical interfaces at sub-system level and identifies where it is specified.

Characteristics of the organ or the logical I/F				Complementary information	
Id	Type	Ref	Title of the document		
UE	Organ	D6-3	UE SDMB specification	Included in this document	
		D7-2	UE high level design document		
SIMSTAR	Organ	D7-6	Propagation channel emulator design document		
Hub	Organ	D6-4	SDMB Hub Specification		
		D7-3	SDMB Hub design document		
IMR	Organ	D6-2-1b	MAESTRO release 1 test bed design document		
Content Provider	Organ	D6-2-1b	MAESTRO release 1 test bed design document		
RF transmitter	Organ	D7-12	Test facilities specifications and design document		
Monitoring tools	Organ	N/A			On-shelf equipment. Documentation available on the net
SIMSTAR output interface	Logical interface	D6-2-1b	MAESTRO release 1 test bed design document		
		D7-6	Propagation channel emulator specification		
SIMSTAR input interface	Logical interface	D6-2-1b	MAESTRO release 1 test bed design document		
		D7-6	Propagation channel emulator design document		

**Table 4 – Laboratory test bed organs and interfaces summary**

#### 6.1.4 Description of the organs and the logical interfaces

##### 6.1.4.1 Content provider

An internal file will be used as data generator. It will be truncated in packets to be sent on the FACH. As up today, packets sent are raw packets in a sense that they are sent directly over RLC-UM without any PDCP processing. However, modification have been implemented in the RNC to support IP packets.

It will be possible to use FP level data sent every tick to generate additional S-CCPCH, thus resulting in interference degradations. Those additional S-CCPCH are not intended to be decoded by the UE.

##### 6.1.4.2 Hub

The Hub emulator is physically composed of two entities, namely the RNC simulator and the Node B.

##### 6.1.4.2.1 Node B

An off-the-shelf Alcatel Node B component is used.

#### 6.1.4.2.1.1 Node B HW configuration

- One Carrier/three sectors with 30W Power Amplifier,
- Indoor cabinet with DC power,
- Local Maintenance Tool,
- STM1 interface.

#### 6.1.4.2.1.2 Node B Feature list

The Node B is only responsible of the physical layer of the UTRAN interface except for the management of the BCCH where it acts also as an RRC entity.

- UTRA-FDD up-link [1920-1980] (unused), down-link [2110, 2170],
- No transmit diversity,
- Support of the following common down-link physical channels: one primary SCH, one secondary SCH, one primary CPICH, one PICH, one P-CCPCH and three S-CCPCH up to 384 kbps with or without use of TFCI ,
- Synchronisation to an external clock reference extracted from the lub interface transmission link clock or to a GPS clock,
- lub layer 3 = FP and NBAP,
- lub layer 2 = ATM AAL2/AAL5,
- Periodic broadcast of BCCH System Information Blocks,
- Inclusion of the System Frame Number (SFN) in the BCH,
- LMT features: all the O&M is performed via the LMT (Configuration/Transmit power tuning/Node B set-up/ supervision).

#### 6.1.4.2.2 RNC

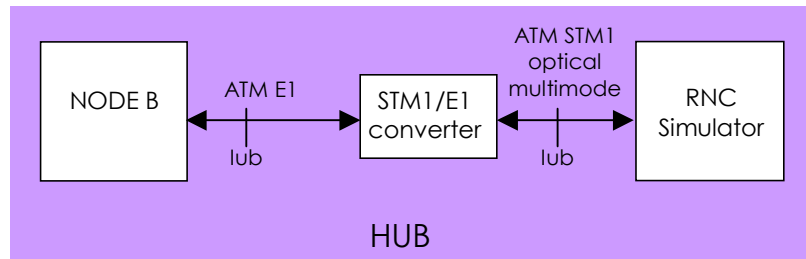
The RNC main function is to receive SDMB Data from the data generator and to forward them to the Node B. The RNC is implemented by ERCOM and includes a set of UMTS protocol layers (see 5.2). Refer to WP3 D3-1 Access Layer Definition

To serve the purpose of the MAESTRO test bed, the following functions must be implemented in the RNC simulator:

- UDP encoding-decoding
- UDP checksum
- SIB menus integration
- SIB values adjustment
- MAC logical channels
- Multiple S-CCPCH generation
- PDCP header compression
- Data file handling improvement
- SIB update without a reset

#### 6.1.4.2.3 RNC – Node B interface

The RNC – Node B interface is a 3GPP-compliant Iub interface, with an STM1/E1 device converting the optical STM1 of the RNC Simulator to/from the electrical E1 of the Node B.



**Figure 14 – RNC – Node B interface**

#### 6.1.4.3 Propagation channel emulator

The propagation channel emulator SIMSTAR-1/MS is developed by ASCOM. It models mobile satellite channel with its characteristic effects and impairments due to transmission and propagation conditions such as path delay, Doppler, multi-path fading, shadowing and receiver internal and external thermal noise in a realistic manner.

All functions involved in the generation of the impairment previously mentioned are fully implemented in the digital domain, thus guaranteeing high accuracy and reproducibility.

Due to schedule issues, the SIMSTAR may not be able to support both non-linearity and multi-path fading features in the scope of the release 1. It has been decided that multi-path fading will be developed first in order to guarantee evaluation of the rake performances in all relevant propagation conditions. Realistic satellite mobility will be implemented in release 1; on the other end, realistic terrestrial mobility implementation may be considered as an option. Indeed, its development is highly dependent on AWE co-operation to provide stored channel files with a channel delay profile (including rough Rice factor) of about every 5 m on a trajectory through a city and with the required post processing to reduce the number of paths to match SIMSTAR capability. SIMSTAR would then use these external files to produce the slow and very slow fading on each paths while the fast fading is generated internally with a power according to the mean power and Rice factor given in these files.

The SIMSTAR-1/MS is based on a modular concept. Basic modules are:

- Channel modules,
- DSP board and,
- Host PC.

The channel cards can emulate either forward link (FL) or return link (RL). In its full extension, the SIMSTAR-1/MS includes a total of six channel cards thus allowing emulating a maximum of three bi-directional satellite channels (Three FL channels and three RL channels). In the scope of MAESTRO, only the three FL cards will be used to respectively emulate satellite to UE, satellite to IMR and IMR to UE interfaces.

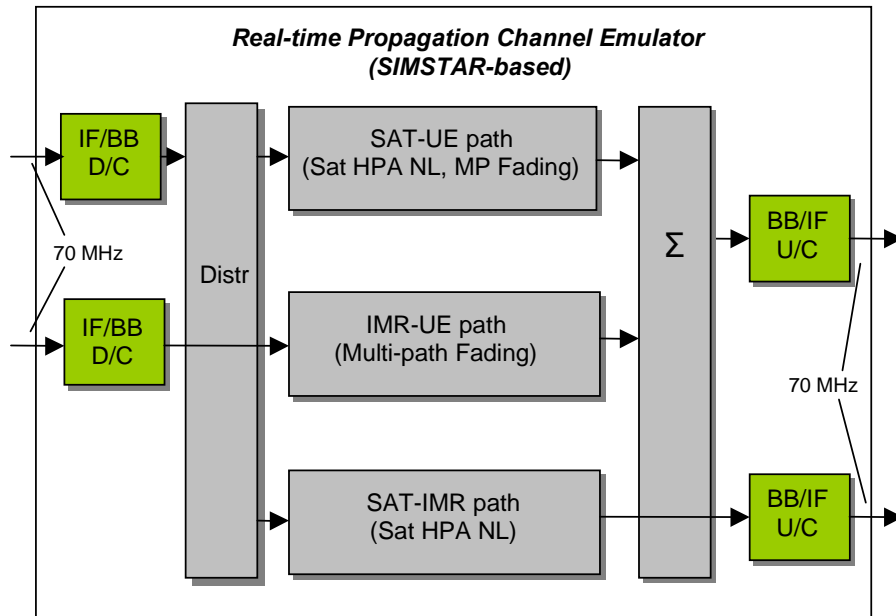


Figure 15 – SIMSTAR-1/MS block diagram

The channel modules perform all high speed digital processing required for functions directly involved in the signal path. They also perform analogue to digital and digital to analogue conversion. Parameters process generation (e.g. parameter interpolation, fading, shadowing) is performed by on the DSP board, which provides sufficient real time computing to supply parameters for up to 6 channel modules. The control interface is implemented on a standard host PC.

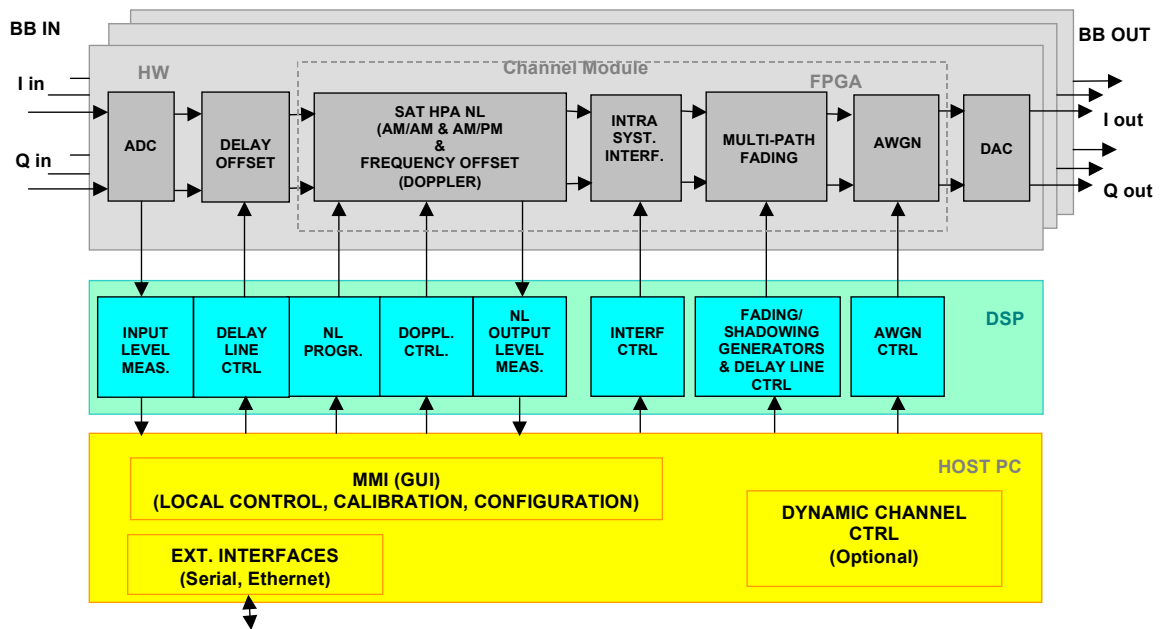


Figure 16 - SIMSTAR-1/MS functional architecture

For more details, refer to document [RD8]: “Propagation Channel Emulator Design Document”.

6.1.4.4 Terrestrial repeater

In the course of the MAESTRO project, several IMR implementations are to be studied. However the MAESTRO test bed will only consider a transparent on-channel repeater.

An off-the-shelf Andrew Node M product will be used. Its characteristics are:

- Downlink frequency : 2110- 2170 MHz
- Maximum downlink output power : 43 dBm at 1 carrier / 38 dBm at 3 carriers
- Minimum downlink input power at full output power : -60 dBm per 1 carrier / -65 dBm per 3 carriers
- Maximum input power without damage : +10 dBm
- Minimum antenna isolation for maximum gain : 83 dB
- Delays : < 8  $\mu$ s
- Gain adjustment range : 53 to 103 dB. The Node M can be configured to operate either at fixed output power or at fixed gain.
- Return loss : 15 dB typical
- Adjacent channel leakage : -45 dBc (first adjacent channel), -50 dBc (second adjacent channel)
- Out of band rejection : -70 dB in 200 kHz

#### 6.1.4.5 Terminal

The terminal is a modified UMTS integrated handset manufactured by MSPS. It can be connected to a PC for data post-processing. The PC hosts multiple applications that will be used at different stages of the test bed integration and validation:

- The real time analyser (RTA) software. It is a proprietary SW procured by MSPS. It will be used to debug the test bed during the first step of the integration. Thus, this SW will only be available in the scope of WP7 activities.
- A debug display. This tool is used to display real time protocol information on the UE screen.
- A UE protocol log reader. This tool allows to log and save the followings parameters: BLER, PER, RRC state, SYS infos messages.

The terminal shall be able to decode multiple FACH over a single S-CCPCH.

Refer to [RD3] : “ UE S-DMB specification document” for further details.

#### 6.1.4.6 S-DMB signal source and fading generator

This set-up will be used as RF transmitter in the radio link test bed.

In a first step the signal coming from the Node B is captured on file. At that time the inter-operability tests have been completed successfully which ensure that the captured signal is suited for terminal initialisation and FACH configuration. The recorded signal is stored on hard disk and can be up to several Gigabytes in length (only limited by disk size).

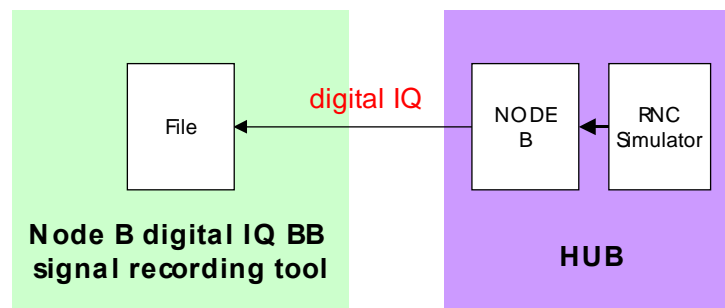
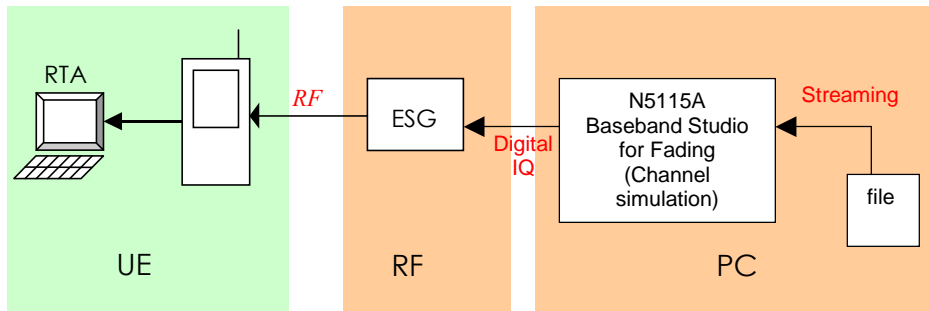


Figure 17 : step 1 - Capturing S-DMB signal on file

In a next step this recorded file will be streamed from hard disk into Baseband Studio for Fading's PCI card that is located on the same PC. The intensive computational fading is performed in real-time according to the parameters that were set in the controlling GUI. The N5115A product will be adapted so that S-DMB specific test cases can be selected, similar to the 3GPP standard cases for T-UMTS macro-diversity testing. Input for this update will come from WP2 and the IST SATIN project.

Finally the faded signal is fed digitally into the ESG4438C (Agilent signal generator) where it is upconverted from Baseband to RF. The resulting signal will then be used to challenge the device under test.



**Figure 18 step 2 – Streaming, fading and up-conversion**

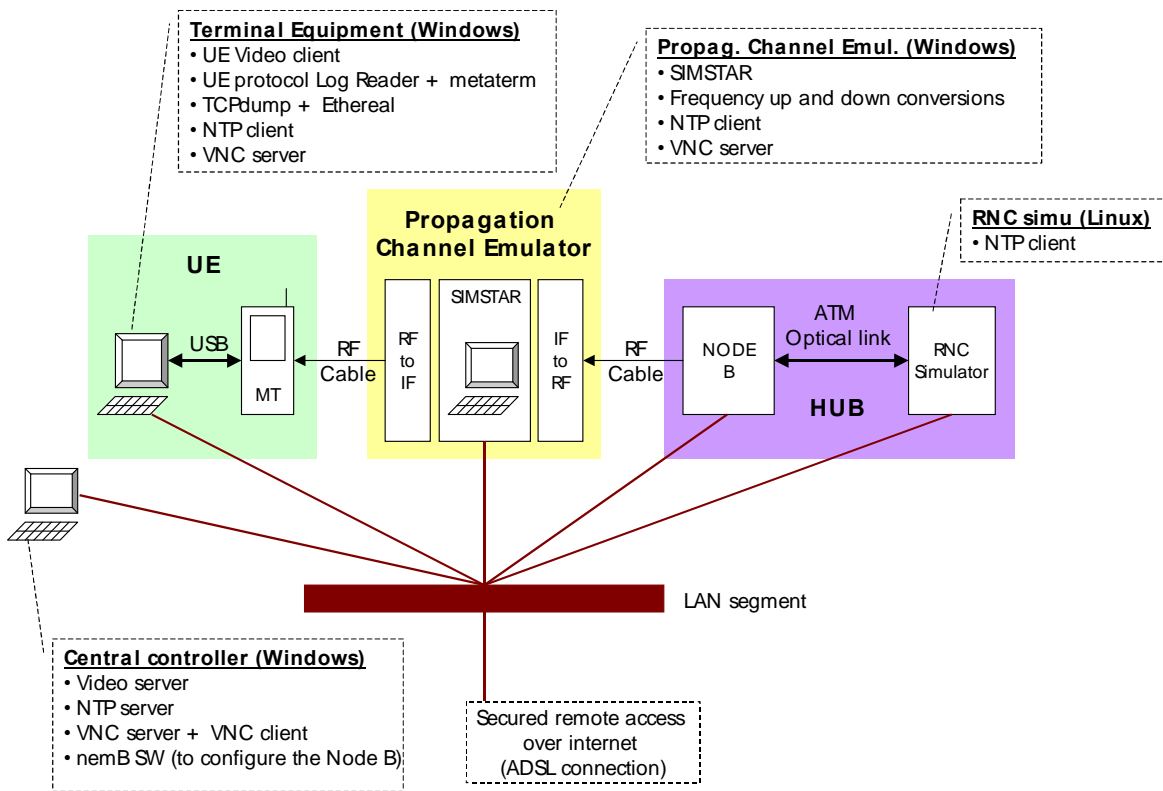
#### 6.1.4.7 Central controller

All test bed equipment will be connected to a central controller PC through a LAN segment. That PC will also be connected to the internet via an ADSL connection so that any MAESTRO partner can either check or set the configuration of any given equipment. A security protocol still remains to be defined in order to ensure that only one MAESTRO partner can launch a test at a time while multiple MAESTRO partners could access the test bed to provide debug support.

The RNC will be remotely controlled by the central PC via ssh with a command line interface.

Both the TE and the SIMSTAR will be remotely controlled by the central PC via VNC. VNC is a free software, thus it does not require any licenses to run. A VNC server is required to be installed on every PC whose screen we want to view remotely with a VNC client. As a result, a VNC server shall be installed on both the TE and the SIMSTAR while a VNC client shall be installed on the central PC. Given that we want to be able to access the central controller PC from the internet, a VNC server shall also be installed on the central controller PC.





**Figure 19 – Lab test bed control**

The central controller PC will host the following applications:

- VNC client
- VNC server
- Video server
- NTP server
- NemB SW (to configure the Node B)<sup>1</sup>

#### 6.1.4.8 Monitoring tools

The Agilent spectrum analyser E4440A could be used to evaluate the performances of the IMR. This analyser can be used to measure the following:

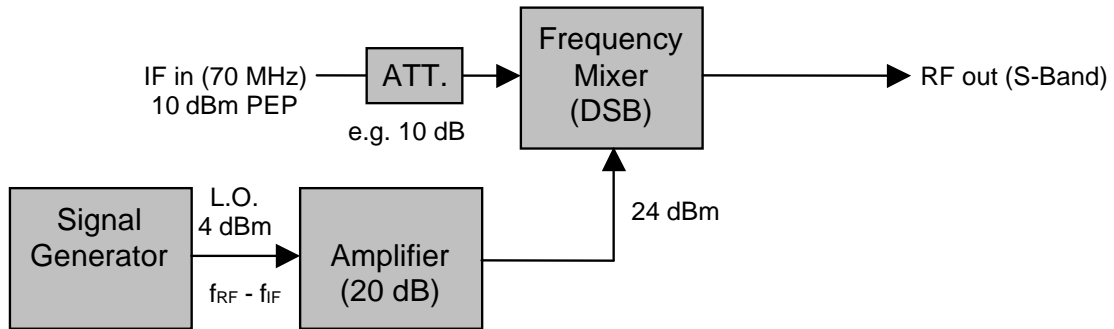
- Channel power
- CPICH power accuracy
- Occupied bandwidth
- Inter-modulation
- Error Vector Magnitude (composite EVM) and the Peak Code Domain Error (PCDE)
- Adjacent channel leakage power ratio

<sup>1</sup> As up today, it is still unclear whether the nemB SW will run on a dedicated PC or whether it will run on the central controller PC. If there is a dedicated nemB PC, that latter must be equipped with VNC server and NTP client.

- Spurious emissions

#### 6.1.4.9 SIMSTAR output interface

The SIMSTAR to UE interface requires the implementation of an up-conversion from 70MHz to S band. This up conversion can be achieved by putting together on-shelf components. A high-level block diagram of the converter is given hereafter.

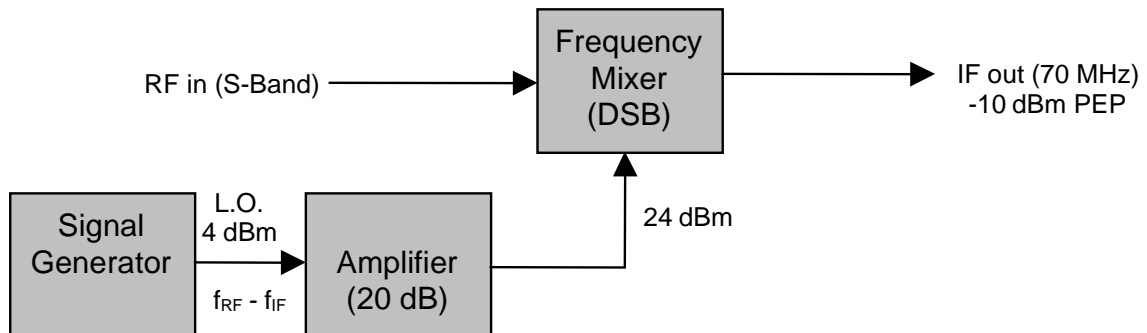


Signal levels indicative (example)

**Figure 20 – Up-converter architecture**

#### 6.1.4.10 SIMSTAR input interface

The Node B to SIMSTAR conversion requires a down frequency conversion from S-band to 70MHz. A high-level block diagram of the down converter is given hereafter. In order to reduce the cost of the test bed, the same local oscillator can be used for both the up and down conversions.

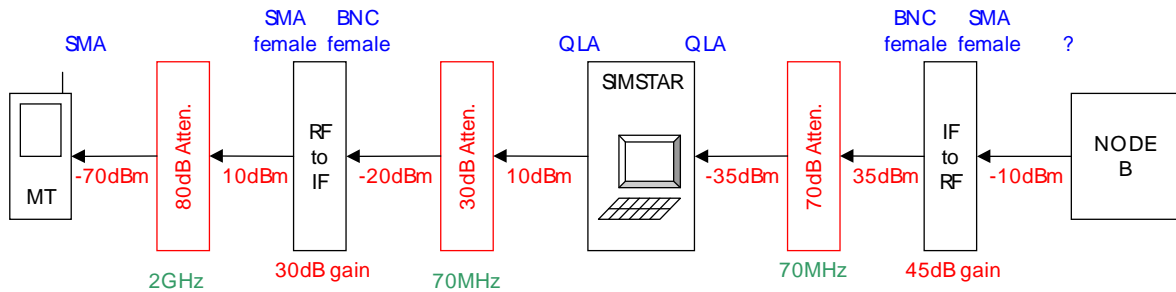


Signal levels indicative (example)

**Figure 21 – Down converter architecture**

### 6.1.5 Gain level study for the lab test bed

The figure below show how all the test bed equipment will be connected together.



**Figure 22 – Gain level study of the lab test bed**

## 6.1.6 Lab test bed scenarios

### 6.1.6.1 Inter-operability scenarios

#### 6.1.6.1.1 FACH initialisation

See [RD1]: SDMB Access Layer Definition

Only one useful S-CCPCH and one FACH will be supported in release 1.

#### 6.1.6.1.2 Cell selection and camping

See [RD1]: SDMB Access Layer Definition

#### 6.1.6.1.3 IMSI Attach

See [RD1]: SDMB Access Layer Definition

#### 6.1.6.1.4 RRC connection establishment

See [RD1]: SDMB Access Layer Definition

#### 6.1.6.1.5 Data Transfer

See [RD1]: SDMB Access Layer Definition

#### 6.1.6.1.6 System Information change

See [RD1]: SDMB Access Layer Definition

### 6.1.6.2 Transmission scenarios objectives

The goal of the laboratory test bed is to confirm the trades-off deduced from the simulation results. The test bed will therefore be used to evaluate the impact of various parameters on the transmission performances. Performances will be estimated at the terminal by measuring the Block Error Rate (BLER) and the Packet Error Rate (PER). The Bit Error Rate (BER) will be overlooked as there is no way to get accurate information on the BER using the MSPS terminal.

#### 6.1.6.2.1 End to end reception performances

One of the main goals of Release 1 is to evaluate the end-to-end reception performances under different operational environments and parameters settings. Evaluation will be performed by con-

ducting measurements of the BLER and PER on the receiver's side. In order to maintain a relatively small amount of trials, some parameters may be put aside in favour of some others if they turn out to have a negligible impact on performance. If all the subsequent trials cannot be run, the selection of trials to be run will be made depending on simulations' output from WP2. A list of parameters that are considered for the lab trials are listed below.

Parameters to be evaluated with both BLER and PER are the following:

- User environment (e.g. indoor/outdoor)
- Area (e.g. urban/suburban/rural)
- UE mobility
- Number of transmitting sources
  - No satellite channel emulator. This test corresponds to the IOT tests where the output of the Node B is directly connected to the UE.
  - No IMR i.e. satellite only configuration
  - Various number of IMR inside or outside the rake windows
- Satellite position (i.e. elevation angle)
- Information bit rate
- TTI<sup>2</sup>
- Slot format (and hence spreading factor)
- CRC size
- Number of blocks per TTI
- Carrier capacity.

<sup>2</sup> Below are two tables summarising the configurations supported by both the UE and the Node B in terms of throughput.

Configurations supported by the NodeB							Configurations supported by the UE						
TTI (ms)		Rate (kbps)					TTI (ms)		Rate (kbps)				
		12	64	128	256	384			12	64	128	256	384
10	V	V	V	S	V		10	S	S	S	S	V	
20	S	V	V	NS	NS		20	S	S	S	S	V	
40	S	V	NS	NS	NS		40	S	S	S	S	V	
80	S	NS	NS	NS	NS		80	S	S	S	S	S	

V : Configuration validated in the field (not necessarily with an Alcatel Node B / Motorola UE)

S : Configuration supported by the equipment but not validated in the field

NS : Configuration not supported by the equipment due to HW/SW limitations

The Node B will be configured to generate multiple S-CCPCH on the same carrier but a single S-CCPCH will be decoded by the UE.

- Co-channel Interference level

The channel propagation emulator will be used to generate external system interference (produced in another satellite or other terrestrial systems)

- The interference scenario defines a signal-to-interference ratio (C/I) for the satellite direct service link and for the IMR links depending on the position of the user within the spot beam coverage areas in the fictitious SDMB system.

Parameters to be evaluated with PER only

- PDCP header compression
- IP packet size

Trials scenarios will be described in details in document D8.1.1 – Trials specifications for release 1. The whole set of trials will be run on the laboratory test bed while a subset should be identified to be run on the field test bed. The trials scenarios should be somehow simulated in the different work packages (WP2 and WP3 for release 1) in order to be able to correlate both trials and simulations results.

#### 6.1.6.2.2 Rake study

Another main goal of the MAESTRO project is to prove that the UE can recombine signals issued on the direct path (satellite emulator) with signals issued on the terrestrial path (on-channel repeaters).

The recombination process involves a rake receiver which can be characterised by the following parameters:

- Algorithms used to do the channel acquisition and the tracking
- Size of the window
- Number of fingers

It is not expected for the SDMB system to require different channel acquisition and tracking mechanisms than the ones used for the T-UMTS system.

The nominal span of the rake window of a 3G handset 20 $\mu$ s. Given the feedback from both the MoDiS experiment (refer to **[RD13]**) and simulation results, it is not sufficient to ensure reliable recombination of the signals. As a result, it has been decided to extend the rake window of the MSPS terminal<sup>3</sup>.

Finally, simulations have shown that the optimal number of fingers for an SDMB receiver would be 12 (recombination fingers). Even though, the MAESTRO terminal does not feature such a high number of recombining fingers, there will not be any modification in the number of fingers implemented in the scope of the MAESTRO project due to budget, timing and hardware restrictions.

Since the MSPS UE is based on commercial equipment, it will not be possible to actually visualise signals at the output of the rake receiver. Therefore the trials intend to validate the recombination from a qualitative point of view rather than from a quantitative one. The idea is to configure the SIMSTAR so as to vary the number of contributions falling in the rake window. Assuming an appropriate configuration, BLER performances measured on the receiver's side shall increase with the number of contributions.

---

<sup>3</sup> The size of the extended rake window will be kept confidential within the MAESTRO consortium.

#### 6.1.6.2.3 SDMB waveform characterisation

In order to better understand the performances measured at the UE, it has been decided to measure the following performances at the output of the IMR:

- Power measurements
  - Total output power
  - Pilot Power
  - Synchronisation power
  - EC/Io
- Unwanted emission
  - Out of band emission
  - Spurious emission
- Modulation accuracy
  - EVM
  - Peak code domain error

Performances like frequency stability, out of band gain, input inter-modulation and output inter-modulation will not be measured because they depend only on the repeater's characteristics which have been proven 3GPP compliant.

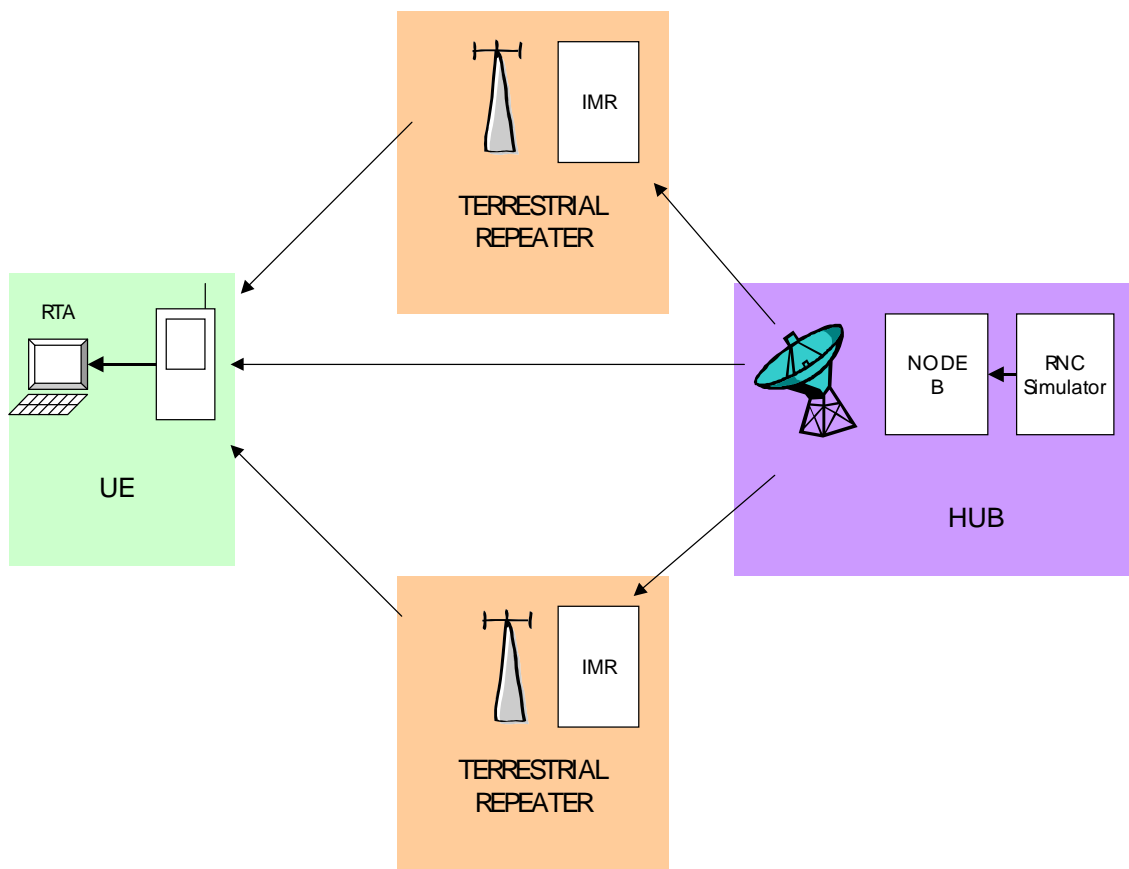
## 6.2 Field test bed

As in MoDiS, the goal of the field test bed is to demonstrate the feasibility of the SDMB system but using a terminal built on a commercial UE which features a higher integration level and a complete UMTS/GPRS protocol stack.

### 6.2.1 Overview

The field platform differs from the real SDMB system described on Figure 2 in the following:

- The satellite and the transmission part of the Hub have been replaced by an equivalent transmitter located on a high altitude place, set in such a way that the received radio level at the terminal is about equivalent to what would be received from a satellite. For the trial, transmission will be performed in the terrestrial IMT2000 frequency band. Compared to the laboratory test bed, the propagation channel emulator has been completely removed from the picture, thus constituting the main difference between the two platforms.
- The Hub is composed of a Node B and a RNC simulator featuring broadcast support and adapted to the MAESTRO application.
- The Hub feeds the terrestrial repeaters directly. A maximum of 2 on-channel repeaters will be used in the MAESTRO field test bed.
- The MAESTRO release 1 terminal is based out of a 3GPP compliant integrated handset which has been modified so as to be able to receive SDMB data. It can be connected to a laptop for further data processing. The laptop will also hosts the UE video client.
- The content provider is replaced by a simple data generator, which will at first be integrated in the RNC simulator.
- The MAESTRO platform does not feature any interactive link in a sense that it does not interact with either a 3G or a 2G network.



### Figure 23 – Field test bed

The Node B feeds an helix antenna which broadcasts the Node B output towards both the UE and the IMR. The IMR is essentially an amplifier. It is connected to a directional antenna oriented towards the UE. The link between the antenna and the UE is called the direct path while the link between the IMR and the UE is called the terrestrial path. The platform will be used to check recombination of signals issued on both direct and terrestrial paths at the UE.

The field test bed integration will be divided into three incremental steps:

- Satellite only configuration
- Satellite + one on-channel repeater
- Satellite + two on-channel repeaters

Those steps will be further described in D7.1.1- “Test bed integration document”.

The following table lists the organs and logical interfaces at sub-system level and identifies where it is specified.

Characteristics of the organ or the logical I/F				Complementary information
Id	Type	Reference	Title of the document	
UE	Organ	D6-3	SDMB UE specification	Included in this document
		D7-2	UE high level design document	
Hub	Organ	D6-5	SDMB Hub specification	
		D7-3	Hub design document	
IMR	Organ	D6-2-1b	MAESTRO release 1 test bed design document	
Drive Test Tool	Organ	D7-12	Test facilities specification and design document	
Hub-UE interface	Logical interface	D6-2-1b	MAESTRO release 1 test bed design document	
Hub-IMR interface	Logical interface	D6-2-1b	MAESTRO release 1 test bed design document	
IMR-UE interface	Logical interface	D6-2-1b	MAESTRO release 1 test bed design document	

**Table 5 – Field test bed organ and interfaces summary**

## 6.2.2 Description of the organs and the logical interfaces

### 6.2.2.1 Content provider

Refer to 6.1.4.1.

### 6.2.2.2 Hub

Refer to 6.1.4.2.



### 6.2.2.3 Satellite emulator

The satellite emulator consists of an antenna directly connected to the Node B. A helix antenna will be used to achieve circular polarisation.

The characteristics of the helix antenna are:

- Size : 15cm (high) x 30cm (long)
- Weight : **[TBD]**
- Horizontal beamwidth : ~100°
- Gain : 5dBi

### 6.2.2.4 Terrestrial repeater

Refer to 6.1.4.4.

### 6.2.2.5 Terminal

Refer to 6.1.4.5.

### 6.2.2.6 Drive test tool

The test bed integration will be eased due to the fact that we plan on using a drive test tool developed by Agilent.

There are three types of measurements that can be performed with the drive test tool:

- RF coverage: RF power estimation is based on AGC measurement.
- Inner-modem BER: BER is a measure of data integrity, expressed as the ratio of received bits that are in error, relative to the amount of bits received. It is often expressed as a negative power of ten. The inner-modem BER measurement is based on pilot data bits demodulated in the chip rate processing part (=inner-modem) of the data path. Offline recalculation is needed to translate between pilot data BER and user data BER at different data rates.
- RAKE internal status: For the 8 RAKE fingers, the following information will be measured and logged: finger position (taps), finger energy (dB) and finger status (searching, recombining, refining or idle).

### 6.2.2.7 Central controller

As for the lab test bed, a central PC will be used to control the test bed. Details on how the central PC will operate will be provided in a WP7 technical note.

### 6.2.2.8 Hub – UE interface

The UE interfaces with the Hub using a 3GPP standardised UTRA FDD W-CDMA carrier.

### 6.2.2.9 Hub – IMR interface

The Hub – IMR interface uses a 3GPP standardised UTRA FDD W-CDMA carrier.

The on-channel repeater is actually connected to an antenna which is directly fed by the Hub emulator.

Initially this receiver antenna were foreseen to be a parabolic antenna. However, the minimum size of a parabolic antenna is about 4 times the wavelength, i.e. 60 cm at 2GHz. Now, BYTL, didn't agree to place such big antenna on any of their site. Alternative solutions are still being investigated:

- Horn antenna:
  - Dimensions (HxWxD) : 25x35x25 cm
  - Gain: about 12 to 13 dB in S-band
  - Linear polarisation (thus a 3dB loss must be considered when doing the link budget because the satellite emulator will operate with circular polarisation).
  
- Patch antenna:
  - Dimensions (HxWxD): 25x25x10 cm
  - Gain: 14dB
  - Beamwidth: 40°
  - Circular polarisation
  
- Panel antenna based on a commercial equipment
  - To be further studied

#### 6.2.2.10 IMR – UE interface

The IMR – UE interface uses a 3GPP standardised UTRA FDD W-CDMA carrier.

The output of the on-channel repeater is broadcast over the air interface using panel antennas. ASP will only provide one panel antenna per repeater. However, we could connect two other antennas to the repeater, thus increasing the area covered by the field test bed. We expect those additional antennas to be provided by BYTL. We could eventually share the same antennas as the ones already deployed by BYTL to support the UMTS network.

The panel antennas provided by ASP are Andrew products, namely DB950F65T2ZE-B products.

Their characteristics are:

- Vertical polarisation
- Antenna inputs: 7-16 DIN
- Dimensions (LxWxD): 1524x152x102 mm
- Beamwidth degree: 65°
- Gain: 18 dBi
- Front to back ratio : >40dB
- VSWR max : <1.4

### 6.2.3 Field test bed installation

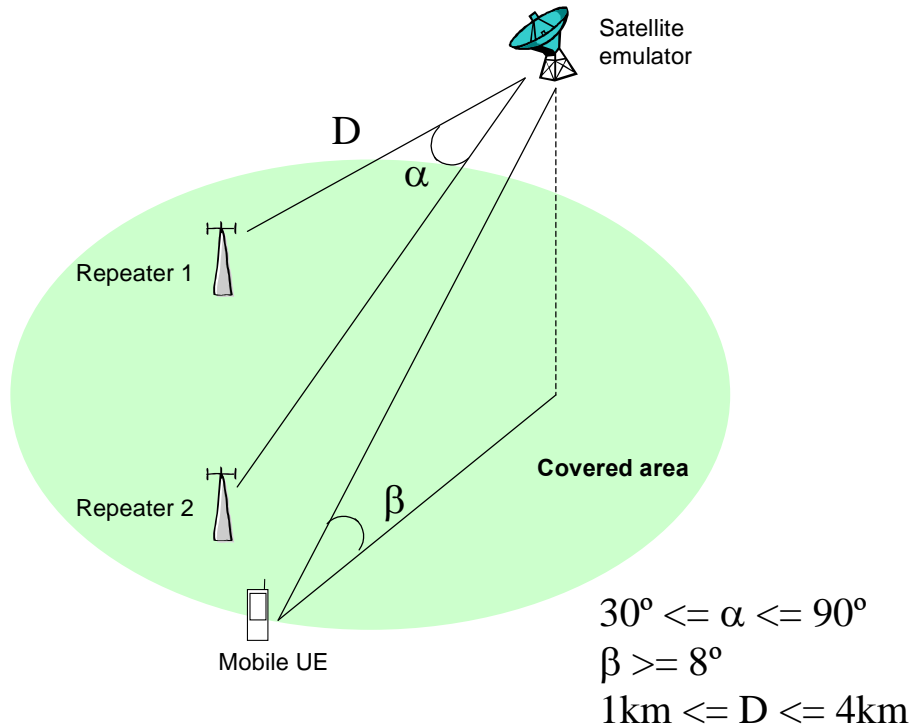
#### 6.2.3.1 Constraints

The field test bed will be located in the south-west of Paris, France. The field trials will be conducted in close co-operation with Bouygues Telecom, who will also provide the necessary temporary UMTS frequency.

The test bed requires the use of three sites, one for the satellite emulator and two for the on-channel repeaters. The sites must be chosen to comply with the following requirements:

- The satellite emulator must be placed high enough to ensure an elevation angle of at least 8° everywhere in the coverage area of the test bed. The elevation angle is referred to as  $\beta$  in Figure 24.

- The repeaters must be between 1 and 4 km away from the satellite emulator.
- The angle between the repeaters and the satellite emulator (referred to as  $\alpha$  in Figure 24) shall be in the range of  $30^\circ$  to  $90^\circ$ . This is because the helix antenna used to model the satellite emulator has a horizontal beamwidth of about  $100^\circ$ .



**Figure 24: Configuration of the field trial site**

#### 6.2.3.2 Link budget

The table below aims at providing indications as per how the link budget will be computed for the field test bed.

		Unit	Description
Hub	Node B output power	dBm	The output power of the Node B is set by the test bed user.  Its level will be defined in accordance with BYTL so as to insure good SDMB performances without perturbing any 2G and/or 3G networks.  It is believed that the power at the output of the Node B shall not exceed 30 dBm
	Cable loss	dB	Lc
	Helix antenna gain	dB	5
IMR1	Distance between the satellite emulator and the IMR1	km	D
	Receiver antenna gain	dB	G <sub>A</sub>

	Repeater gain	dB	G  As for the level at the output of the Node B, the repeater gain will be set in accordance with BYTL so as to insure good SDMB performances without perturbing any terrestrial networks.
	Propagation losses	dB	$LOSS=100+20\log(D)$
	Expected Rx power level	dBm	$P_{RX}=P_{NODE\ B} - Lc + 5 - LOSS + G_A$
	Expected TX power level	dBm	$P_{TX}=P_{RX} + G$  It is believed that the power at the output of the repeater shall not exceed 30 dBm
	Measured Rx power level	dBm	The measured RX power level shall be comparable to the expected level.
	Measured TX power level	dBm	The measured TX power level shall be comparable to the expected level.
IMR2	Distance between the satellite emulator and the IMR2	km	D
	Receiver antenna gain	dB	$G_A$
	Repeater gain	dB	G.  As for the level at the output of the Node B, the repeater gain will be set in accordance with BYTL so as to insure good SDMB performances without perturbing any terrestrial networks.
	Propagation losses	dB	$LOSS=100+20\log(D)$
	Expected Rx power level	dBm	$P_{RX}=P_{NODE\ B} - Lc + 5 - LOSS + G_A$
	Expected TX power level	dBm	$P_{TX}=P_{RX} + G$  It is believed that the power at the output of the repeater shall not exceed 30 dBm.
	Measured Rx power level	dBm	The measured RX power level shall be comparable to the expected level.
	Measured TX power level	dBm	The measured TX power level shall be comparable to the expected level.

**Table 6 – Budget link for the field test bed**

#### 6.2.4 Field test bed scenarios

The field test bed aims at providing a platform to demonstrate the feasibility of the SDMB system.

The trials objectives are to assess the overall quality of the SDMB reception on the handset terminal and the drive test tool for both indoor and outdoor environments.

The reception quality on the handset terminal shall be defined as the ratio of the number of well received packets over the number of transmitted packets. The reception quality on the drive test tool on the other hand shall be defined as the ratio of the number of well received bits on the pilot channel over the number of transmitted bits at chip rate level (inner modem BER). The macro-

diversity situation (RAKE status) and overall RF coverage of the area under investigation will be used as complementary measurements to draw firm conclusions on the reception quality.

The measurements on the handset terminal and the drive test tool will be synchronised with GPS timestamps so that they can be correlated with each other in the post-processing phase.

The outdoor measurements will be done on an itinerary defined so as to ensure reception of data from :

- Satellite only,
- Satellite plus repeater 1,
- Satellite plus repeater 2,
- Satellite plus repeaters 1 and 2,
- Repeater 1 only,
- Repeater 2 only on different parts of the itinerary.

BYTL has been requested to provide the project with indoor access to a building in order to perform indoor measurements.

## 7 INVENTORY

A list of all equipment, software/applications and tools that are required for the proper execution of the lab and field trials are provided hereafter.

### 7.1 Lab Test bed

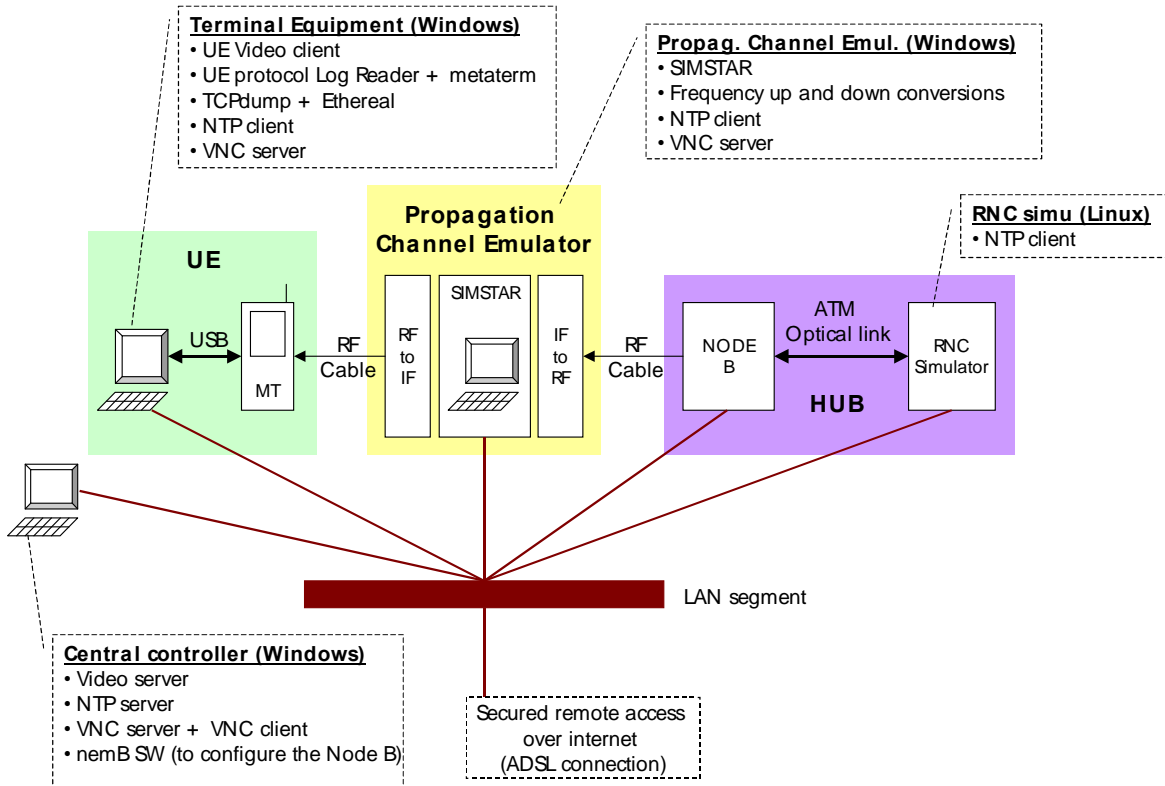


Figure 25 – Lab test bed platform

See section 6.1.4.7 for comments of the figure.

Lab test bed			
Component	Quantity	Provided by	Description
<b>Lab UE equipment</b>			
Modified User Equipment (handset terminal)	1	MSPS	3GPP compliant terminal modified to serve the purpose of MAESTRO release 1 test bed
TE laptop	1	MSPS	Laptop is Windows 2000 based with Ethernet connection and hard disk capacity of at least ??? GB
UE Protocol Log Reader (SW)	1	MSPS	This tool allows to log and save the following parameters : BLER, RRC state, Sysinfos msgs.
Phone debug display (UE application)	1	MSPS	This tool is used to display in real time on the UE screen some protocol infor-

<b>Lab test bed</b>			
<b>Component</b>	<b>Quantity</b>	<b>Provided by</b>	<b>Description</b>
			mation.
UE internal interface	1	MSPS	USB cable to connect the laptop to the terminal
UE external interface	1	MSPS	SMA connector on the UE side N male connector on the Node B side Connector type on the SIMSTAR? Cables? Attenuators?
<b>Hub equipment</b>			
RNC simulator	1	ERCOM	RNC simulator (based on a Linux PC with Ethernet connection) with release 1 software version
RNC config tool RNC config file RNC test script	1	ERCOM	User interface enabling to modify and to store RNC configuration parameters in the RNC configuration file and in the RNC test script  The file stored and read by the RNC configuration tool  The script used to launch and to stop the RNC simulator
Node B digital IQ base-band signal recording tool	1	ASP	This equipment will only be used in the scope of WP7 activities
Node B	1	ASP	Commercial Alcatel Node B
NemB SW	1	ASP	Alcatel SW used to configure and check the status of the Node B.  The NemB SW will most probably be run on the control center PC.
Attenuator	1	ASP	For the IOT, a 100dB attenuator must be placed in between the Node B output and the UE.  <b>For the propagation test bed, what level is expected by the SIMSTAR?</b>
Hub internal interfaces	1	ASP	STM-1/E-1 converter to connect the RNC simulator to the Node B.
Hub external interfaces	1	ERCOM	Ethernet connection towards the central controller which hosts the video server.
<b>Propagation equipment</b>			
Propagation Channel Emulator (BB part)	1	ASCOM	Real-time channel emulator with analogue input & output (SIMSTAR) - 19" industrial rack PC-based housing several FPGA/DSP ISA/PCI-bus boards and signal combining/splitting boards  + MAESTRO SDMB SW and FW

<b>Lab test bed</b>			
<b>Component</b>	<b>Quantity</b>	<b>Provided by</b>	<b>Description</b>
BB/IF conversion unit	1	ASCOM	19" industrial rack PC-based housing several up/down converters (ISA-bus)
19" rack for Propagation channel emulator	1	ASP	Rack used to host the SIMSTAR equipment coming along with the various frequency converters.
IF/RF up-converter	1	ASP	This converter is used to connect the SIMSTAR to the UE
RF/IF down-converter	1	ASP	This converter is used to connect the SIMSTAR to the Node B.
<b><i>Control center</i></b>			
Desktop/laptop PC with Ethernet interface	1	ASP	A Windows 2000 PC for centralised administration of the test bed
NTP server	1	SPH	Windows-based Network-Time Protocol server for time synchronising the UE, propagation channel emulator and RNC simulator via Ethernet
<b><i>Test equipments</i></b>			
RTA	1	MSPS	This equipment will only be used in the scope of WP7 activities
Spectrum analyser E4440A	1	AGILENT	High performance spectrum analyser with integrated 3G module  This equipment will only be used in the scope of WP7 activities
S-DMB signal source and fading generator (ESG4438C and N5115A)	1	AGILENT	Waveform streaming signal generator + real-time channel emulator
Oscilloscope	1	ASCOM	Digital storage oscilloscope (Sampling rate tbd)

**Table 7: Lab test bed inventory**



7.2 Field test bed

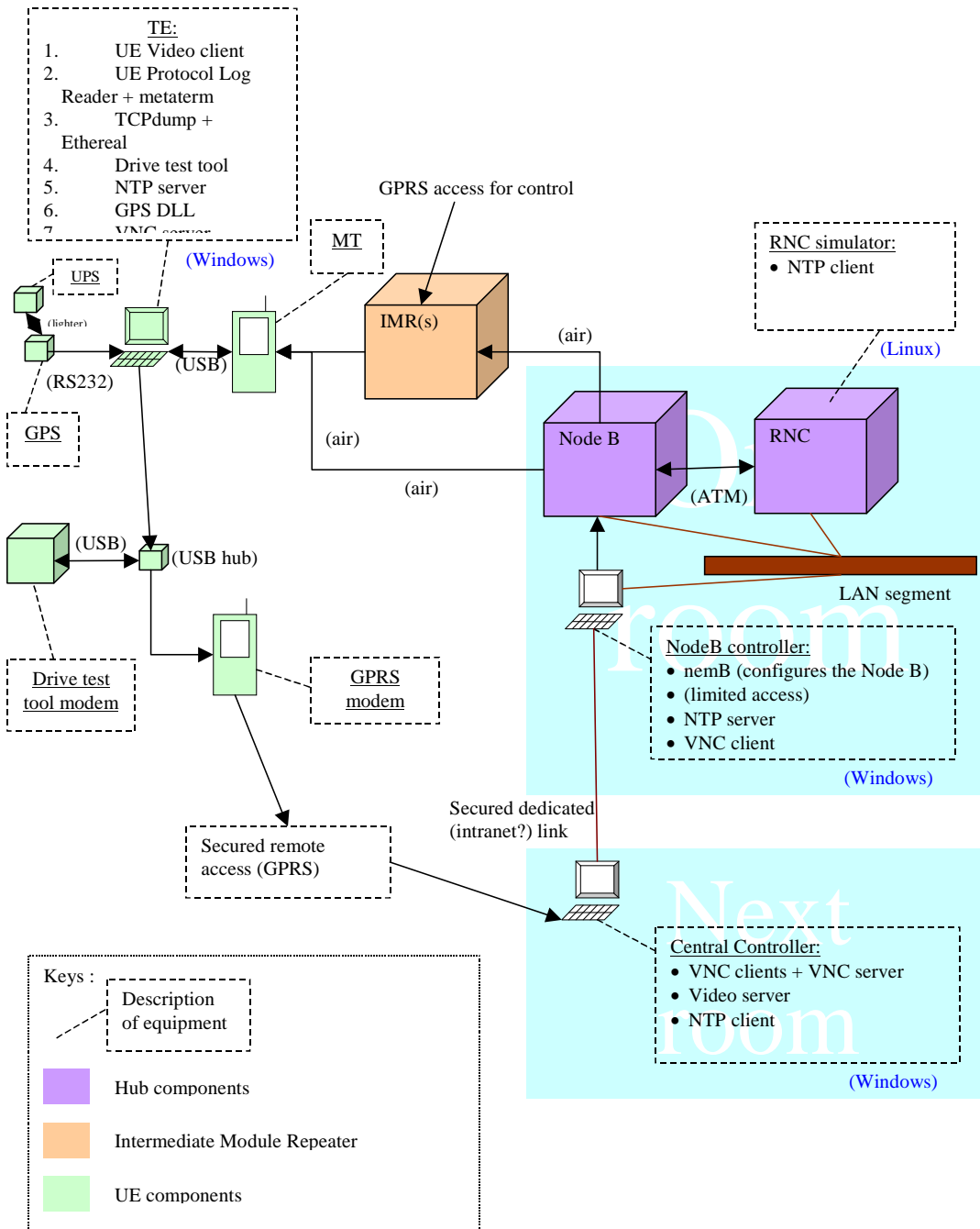


Figure 26 – Field test bed platform

Field test bed

Component	Quantity	Provided by	Description
<b>Field UE equipment<sup>4</sup></b>			
Modified User Equipment (handset terminal)	1	MSPS	3GPP compliant terminal modified to serve the purpose of MAESTRO release 1 test bed
TE laptop	1	MSPS	Laptop is Windows 2000 based with Ethernet connection and hard disk capacity of at least ??? GB
UE Protocol Log Reader (SW)	1	MSPS	This tool allows to log and save the following parameters : BLER, RRC state, Sysinfos msgs.
Phone debug display (UE application)	1	MSPS	This tool is used to display in real time on the UE screen some protocol information.
UE internal interface	1	MSPS	USB cable to connect the laptop to the terminal
<b>Hub equipment</b>			
RNC simulator	1	ERCOM	RNC simulator (based on a Linux PC with Ethernet connection) with release 1 software version
RNC config tool RNC config file RNC test script	1	ERCOM	User interface enabling to modify and to store RNC configuration parameters in the RNC configuration file and in the RNC test script  The file stored and read by the RNC configuration tool  The script used to launch and to stop the RNC simulator
RNC rack	1	ERCOM	A rack is needed for the RNC and the STM-1/E-1 converter.
Node B	1	ASP	Commercial Alcatel Node B
Hub internal interface	1	ASP	STM-1/E-1 converter to connect the RNC simulator to the Node B.
Hub external interfaces	1	ERCOM	Ethernet connection towards the central controller which hosts the video server.
<b>IMR equipment</b>			
Node-M repeater	2	ASP	Transparent on-channel repeater
Reception antennas	2	ASP	There must be one antenna per repeater to collect the signal coming from the Node B.
Emission antennas	2 or 4	ASP, BYTL	Panel antennas are used to transmit the output of the Node-M. ASP will pro-

<sup>4</sup> Since R1 field trials, R1 lab trials and R2 UE development may be concurrent activities, a total of 3 UE should be provided to the MAESTRO consortium. That includes 3 modified 3GPP handset terminals, 3 laptops and all the necessary connectics.

<b>Field test bed</b>			
<b>Component</b>	<b>Quantity</b>	<b>Provided by</b>	<b>Description</b>
			vide 2 panel antennas whose reference are UMW065172D (Andrew product) It is not excluded that BYTL provides two other antennas to increase the area covered by the field test bed.
<b>Control equipment</b>			
GIS application for visualising measurement results	1	SPH	A Windows-based GIS application that will display the logged measurements on a map of the field area
GPS receiver and antenna	1	SPH	For acquiring GPS-based time and positioning data Powered by car lighter socket or standard 220V/12V transformer
NTP server	1	SPH	Windows-based Network-Time Protocol server for time synchronising the UE and RNC simulator via Ethernet
<b>Test equipments</b>			
RTA	1	MSPS	This equipment will only be used in the scope of WP7 activities
Spectrum analyser E4440A	1	AGILENT	High performance spectrum analyser with integrated 3G module This equipment will only be used in the scope of WP7 activities
<b>Miscellaneous</b>			
Drive Test Tool and laptop	1	AGILENT	S-DMB reference receiver without data demodulating capabilities, measures CPICH BER, RF power and RAKE channel profile  Laptop is Windows 2000 based with Ethernet connection
Car	1	ASP	Rental car for the outdoor measurement campaign. From MSPS point of view, there is no need to use an antenna car kit.
Trolley	1	ASP	Trolley for the indoor measurement campaign. (with power generator???)
UPS	1	AGILENT	For the car

Table 8: Test bed inventory for field trials

## 8 RAB SETTINGS

We assume that (at least for R1) the UE will handle Maestro broadcasted data using, more or less, a statically created PDP context.

This document lists the parameters normally available for normal PDP contexts, and how they can be set in Maestro.

As a summary, the parameters that are missing:

- channels mapping on FACH
- PDCP configuration (header compression)

The points that are to be studied:

- whether PDCP header compression is applicable to UDP in Motorola UE
- how MAC multiplexing is to be configured (related to channel mapping)

Finally this document shows how system information blocks could be used to send Maestro parameters to the UE.

The normal flow when activating a PDP context is:

RRC connection setup

GMM attach

optional identity procedure

optional authentication procedure

(now the mobile is attached)

(optionally, RRC release)

(if released, RRC cnx setup +CM service request)

PDP context activation

RRC RB establishment

(now the mobile has a PDP context)

Only parameters sent by RNC or Core Network to the UE are concerned, assuming UE parameters that are to be known by RNC+CN will be configurable in the Hub.

The following sections provide a list of parameters required for the well functioning of the test bed. Values chosen for those parameters will be described in document D7.1.1 "Test bed integration plan".

## 8.1 Pre-PDP parameters

These parameters are normally exchanged during RRC connection, attach procedure, etc..

### 8.1.1 RRC connection Setup

Name	3GPP ref	Possible use for maestro	UE possible action to determine parameter
U-RNTI, C-RNTI	25.331, §10.2.40	Not used ?	A fixed value may be required for UE to camp on cell
RRC state indicator	25.331, §10.2.40	Not used ?	A fixed value may be required for UE to camp on cell
DRX cycle length	25.331, §10.2.40	If paging required, paging will be sent on each possible slot in drx cycle	A fixed value can be used

### 8.1.2 RRC security mode command

Name	3GPP ref	Possible use for maestro	UE possible action to determine parameter
All ciphering and integrity parameters	25.331, §10.2.43	Not used	Integrity and ciphering are deactivated

### 8.1.3 NAS attach procedure

Name	3GPP ref	Possible use for maestro	UE possible action to determine parameter
(P-)TMSI, PTMSI signature	24.008, §9.2.15 (CS) and 9.4.2 (PS)	Not used	A fixed value may be required for UE to camp on cell
CTS permission (CS)	24.008, §9.2.15	Not used	Not permitted
RAI	24.008, §9.4.2	Not used	A fixed value may be required for UE to camp on cell
READY timer	24.008, §9.4.2	Not used	Fixed value, implementation dependent
T3302 value	24.008, §9.4.2	Not used	Fixed value, implementation dependent
Cell Notification	24.008, §9.4.2	Not used	Fixed value, implementation dependent

### 8.1.4 NAS authentication procedure

Name	3GPP ref	Possible use for maestro	UE possible action to determine parameter
RAND, AUTN	24.008, §9.2.2	Not used	Not used for integrity and ciphering are deactivated

### 8.1.5 Identity request

no parameters

## 8.2 NAS PDP parameters

Parameters sent by UE: these are parameters that are never sent in Maestro, and typically easily set in UE.

Name	3GPP ref	Possible use for maestro	UE possible action to determine parameter
Requested NSAPI	24.008 §9.5.1	Not used	Any value
Requested LLC SAPI	24.008 §9.5.1	Not used	Any value
Requested QoS	24.008 §9.5.1	Not used	Any value
Requested PDP address	24.008 §9.5.1	The local IP demanded address, if not dynamically assigned	Fixed value, must be configured in hub
Access point name	24.008 §9.5.1	Not used	Any fixed value
Protocol configuration	24.008 §9.5.1	Not used	Any fixed value

Name	3GPP ref	Possible use for maestro	UE possible action to determine parameter
Negotiated LLC SAPI	24.008 §9.5.2	Not used in G3	
Negotiated QoS	24.008 §9.5.2	Not used	Fixed value
Radio priority	24.008 §9.5.2	Not used	Fixed value
PDP address	24.008 §9.5.2	The local IP address, if dynamically assigned	Fixed value, must be configured in hub
Protocol configuration options	24.008 §9.5.2,10.5.6.3	Optional in g3, not used (concern only PPP PDP contexts)	none
Packet flow id	24.008 §9.5.2,10.5.6.11	Optional in g3, not used	None, or value 0=best effort

These parameters are typically exchanged through SM PDP context activation

## 8.3 AS PDP parameters

### 8.3.1 RRC Radio Bearer setup

Name	3GPP ref	Possible use for maestro	UE possible action to determine parameter
Integrity protection mode info	25.331, §10.2.33	Not used, ciphering and integrity not activated	N/A
Ciphering mode info	25.331, §10.2.33	Not used, ciphering and integrity not activated	N/A
Activation time	25.331, §10.2.33	Not used	N/A
New C-/U-RNTI	25.331, §10.2.33	Not used ?	A fixed value may be required for UE to camp on cell
New DSCH-RNTI	25.331, §10.2.33	Not used ?	A fixed value may be required for UE to camp on cell
RRC state indicator	25.331, §10.2.33	Not used ?	A fixed value may be required for UE to camp on cell
UTRAN DRX cycle	25.331, §10.2.33	Not used ?	A fixed value may be

Name	3GPP ref	Possible use for maestro	UE possible action to determine parameter
length			required for UE to camp on cell
URA identity	25.331, §10.2.33	Not used ?	A fixed value may be required for UE to camp on cell
RB information elements	25.331, §10.2.33 10.3.4.17,10.3.4.22	RAB to be set, and their parameters. See below	
TrCH Information Elements	25.331, §10.2.33	The transport channel information	No new transport channel added.  Shall use SIBx FACH configuration.

From RB information elements:

- RAB information for setup,

for each RAB (currently, we assume one): RAB information for setup 10.3.4.10, 10.3.4.20

Name	3GPP ref	Possible use for maestro	UE possible action to determine parameter
RB identity	25.331, §10.3.4.20	none	Fixed value
PDCP info	25.331, §10.3.4.20, 10.3.42	PDCP configuration: see below	Currently no other way to get the information. see below
>RLC info	25.331, §10.3.4.20, 10.3.4.23	See below	
RB mapping info	5.331, §10.3.4.20, 10.3.4.21	See below	Set that RAB is mapped on FACH

### 8.3.2 PDCP info

25.331, §10.3.4.2

Name	3GPP ref	Possible use for maestro	UE possible action to determine parameter
Support for loss less SRNS relocation	25.331, §10.3.4.2	None	False
PDCP PDU header	25.331, §10.3.4.2	PDCP header required for IP header compression	No header, see below
Header compression information	25.331, §10.3.4.2	IP header compression algorithm and parameters	TBD

There are 2 possible PDCP configuration that could be used in Maestro:

- no header, PDCP does nothing
- IP header compression, in which case a PDCP header is to be used.

In R99 only RFC2507 IP header compression is used.

- Since most RFC2507 implementation focuses on TCP, it has to be checked in UE if RFC2507 compression is available for UDP.

- It is currently not available in RNC simulator, but could be added.

**There is currently no way to communicate PDCP mode from the hub to the UE.**

PDCP transparent mode (no header) can be selected for R1.

### 8.3.3 RLC info

Name	3GPP ref	Possible use for maestro	UE possible action to determine parameter
Uplink RLC mode	25.331, §10.3.4.23	Not applicable	Probably fixed to UM to be coherent with DL
downlink RLC mode	25.331, §10.3.4.23, 10.3.4.25	RLC-UM mode only is foreseen	Fixed to UM.

### 8.3.4 RB mapping info

#### 25.331 §10.3.4.21

This information element defines one or several mappings for the radio bearer being set. On typical PDP contexts, it defines its mapping on:

- DCH transport channel, which is not relevant for Maestro
- common transport channel, normally used when being in CELL-FACH

In case of common transport mapping, it defines:

- a transport channel type, typ. FACH for DL
- a transport channel id (identifies the FACH channel, identity is given to UE in SIB4, Secondary CCPCH system information element)
- a logical channel identity, used to identify the RAB on the common channel

**There is currently no way to give this mapping information to the UE**

## 8.4 MAC multiplexing

D3.1 suggests to use optional TFCT field, and MBMS-id field (equivalent to C/T field) with new values defined.

However, for R1, it may be simpler in the UE to use TFCT='11'b (DCCH or DTCH over FACH), + predefined UE-id + C/T field identifying logical channel.

This way, UE would act as if a PDP context was established, and being in cell\_fach mode.

This option has to be studied by Motorola.

## 8.5 System information addition

#### 10.2.48.8

Three possibilities can be foreseen to add custom SIB for Maestro usage, if needed:

- There exist (both in R99 and R5, I have not checked R6) 2 reserved values in SIB type. This could be used in test bed if needed, and possibly in commercial versions.
- Some existing fields may be unused and could be used for Maestro. For instance, cell-id or URA-id could be used to select a Maestro profile in UE. This mechanism would not be ac-



ceptable for commercial release but could be usable for test bed, with probably low impact on UE.

- Most RRC PDU, including system information block, includes an “*non critical message extension*” targeted for message extensions. This is probably the best mechanism for commercial release (assuming extension is defined by 3GPP/ETSI), and possibly usable in test bed (impact on UE ?)

For instance:

```

SysInfoType3 ::=                               SEQUENCE {
  sib4indicator                                BOOLEAN,
  -- UTRAN mobility IEs
  cellIdentity                                CellIdentity,
  cellSelectReselectInfo                      CellSelectReselectInfoSIB-3-4,
  cellAccessRestriction                      CellAccessRestriction,
  -- Extension mechanism for non- release99 information
  nonCriticalExtensions                      SEQUENCE {} OPTIONAL
}

```