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### *ACE-VCE Database of UWB/WB Radiators: Applications, Requirements, Standards, Existing Concepts*

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#### Abstract

The present document describes the WideBand Element DataBase. The purpose is to provide a tool for sharing and organizing on one hand WB/MB applications, standards and requirements, and on the other hand antenna technology and development. The present document constitutes the shell to the database, describing it on high level, and points to files on the VCE containing the individual information.

#### Keyword List:

Wideband antenna, multiband antenna, radiating element, antenna specification, database

## **Table of contents**

<b>1 INTRODUCTION.....</b>	<b>3</b>
1.1 BACKGROUND.....	3
1.2 SCOPE.....	3
1.3 DATABASE DEVELOPMENT.....	3
1.4 ORGANISATION OF THE DOCUMENT.....	3
<b>2 REFERENCES AND ABBREVIATIONS.....</b>	<b>4</b>
2.1 REFERENCE DOCUMENTS.....	4
2.2 ABBREVIATIONS.....	4
<b>3 DATABASE DESCRIPTION.....</b>	<b>7</b>
3.1 DATABASE ORGANISATION.....	7
3.2 APPLICATIONS.....	7
3.2.1 <i>Application Description</i> .....	7
3.2.2 <i>Navigation</i> .....	7
3.2.3 <i>Mobile Communication</i> .....	8
3.2.4 <i>Satellite Communication</i> .....	8
3.2.5 <i>EMC and Test</i> .....	8
3.2.6 <i>Sensing (Remote and Near Field)</i> .....	8
3.3 ANTENNA TYPES.....	9
3.3.1 <i>Antenna Type Description</i> .....	9
3.3.2 <i>Planar Antennas</i> .....	9
3.3.3 <i>Waveguide and Horn Antennas</i> .....	10
3.3.4 <i>Wire Antennas</i> .....	10
3.3.5 <i>Travelling Wave Antennas</i> .....	10
3.3.6 <i>Fractal Antennas</i> .....	10
3.3.7 <i>Related Antenna Technologies</i> .....	10
<b>4 CROSS REFERENCES.....</b>	<b>11</b>

# 1 INTRODUCTION

## 1.1 Background

There is a strong interest for wideband, WB, ultra wideband, UWB and multiband, MB, antennas today. This is driven by applications with the need for wide or multiple frequency bands. Examples of multiband applications are; multi-purpose and multiband mobile base station and hand-held terminals, satellite navigation terminals, satellite communication. Examples of true wideband applications are; ground penetrating radar, GPR, medical imaging systems, UWB communication with WLAN, DVB and Bluetooth. One sector of wideband applications is the explosive development in the consumer market for wireless short-range, high data-rate communications links.

## 1.2 Scope

The present document describes the WideBand Element DataBase, WBEDB, in the [ACEDOW] defined as deliverable A2.3.D1 "ACE-VCE database of UWB/WB radiators". The purpose of the WBEDB is to provide a tool for sharing and organising on one hand WB/MB applications, standards and requirements, and on the other hand antenna technology and development. For this purpose a database has been developed, that on one side describes radiating antenna elements and on the other side describes wide-band applications with characteristic antenna requirements.

The present document constitutes the shell to the database, describing it on high level, and points to files on the VCE containing the individual information for the different applications and the antenna types. This format has been found to be the most efficient from a generation and maintenance point of view.

## 1.3 Database Development

The UWB/WB Antenna Database is a living document. The database will be updated as required within the frame of ACE-2. The framework for the maintenance of the database after ACE will have to be decided.

A potential development is to integrate it with other databases within the VCE, possibly requiring an adapted format.

## 1.4 Organisation of the Document

Section 1: Introduction

Section 2: References and abbreviations

Section 3: Description of the Database content

Section 4: Cross reference table showing relations between Wideband Antenna Types and Applications

## 2 REFERENCES AND ABBREVIATIONS

### 2.1 Reference Documents

[ACEDOW] Sixth Framework Programme, Priority 2, Information Society Technologies IST,  
ACE Network of Excellence, Proposal no.: 508009 Annex 1

### 2.2 Abbreviations

Acronym	Meaning
ACE	Antenna Centre of Excellence
AR	Axial Ratio
BPSK	Binary Phase Shift Keying
BSS	Broadcast Satellite Services (or Base Station System)
CAT	Computerized Axial Tomography (or Cosmic Anisotropy Telescope)
CP	Circular Polarisation
CPW	CoPlanar Waveguide
CSMA/CA	Carrier Sense Multiple Access / Carrier Avoidance
DAB	Digital Audio Broadcasting
DB	DataBase
dB	Decibel
dBi	dB above isotropic level
dBm	dB above 1 mW
DBS	Direct Broadcast Satellite (or Services)
dBW	dB above 1 W
DC	Direct Current
DCS	Digital Communications System (or Digital Cellular System)
DECT	Digital European Cordless Telecommunications
DSSS	Direct Sequence Spread Spectrum
DVB	Digital Video Broadcasting
DVB-H	Digital Video Broadcast - Handheld
DVB-RCS	Digital Video Broadcast – Return Channel via Satellite
DVB-T	Digital Video Broadcast - Terrestrial
EBG	Electromagnetic Band Gap (structures)
EFIE	Electric Field Integral Equation
EOC	Edge Of Coverage
EIRP	Effective Isotropic Radiated Power
EMC	ElectroMagnetic Compatibility
ESA	European Space Agency
ETSI	European Telecommunications Standard Institute
FCC	Federal Communications Commission
FDTD	Finite-Difference Time-Domain
FEC	Forward Error Correction
FEM	Finite Element Method
FM-CW	Frequency Modulated Continuous Wave

FOV	Field Of View
FSS	Fixed Satellite Services (or Frequency Selective Surface)
GEO	Geostationary or Geosynchronous Earth Orbit
GFSK	Gaussian Frequency Shift Keying
GLONASS	GLOBAL Navigation Satellite System, operated by the Russian Federation Ministry of Defence
GMTI	Ground Moving Target Indication
GNSS	Global Navigation Satellite System (e.g. GPS, Galileo)
GPR	Ground Penetrating (or Probing) Radar
GPS	Global Positioning System
GSM	Global System for Mobile communication
GSO	Geostationary Satellite Orbit
HPA	High-Power Amplifier
HPBW	Half-Power BeamWidth
IEEE	Institute of Electrical and Electronics Engineers
IFA	Inverted F Antenna
IFS	Iterative Function System
IR	InfraRed
ISM	Industrial, Scientific and Medical, unlicensed radio bands
LAN	Local Area Network
LEO	Low Earth Orbit
LHCP	Left-Hand Circular Polarisation
LNA	Low Noise Amplifier
LOS	Line Of Sight
LTI	Linear Time Invariant
MAC	Media Access Control
MB	Multiband
MBOA	Multiband OFDM Alliance
MC-CDMA	Multi-Carrier Code Division Multiple Access
MEMS	Micro-Electro-Mechanical Systems
MEO	Medium Earth Orbit
MIMO	Multi Input / Multiple Output
MMIC	Monolithic Microwave Integrated Circuit
MPE-FEC	Multi-Protocol Encapsulation - Forward Error Correction
MRI	Magnetic Resonance Imaging
MTI	Moving Target Indication
MZ	Mach Zehnder
NASA	National Aeronautics and Space Administration
NF	Near Field
NLOS	Non Line Of Sight
OFDM	Orthogonal Frequency Division Multiplexing
OMJ	Ortho-Mode Junction
PCB	Printed Circuit Board (or PolyChlorinated Biphenyl)
PCMCIA	Personal Computer Memory Card International Association
PCS	Personal Communications Services
PDA	Personal Digital Assistant
PEC	Patch Excited Cup (or Perfect Electric Conductor)

PIFA	Planar Inverted F Antenna
PIM	Passive InterModulation
PPM	Pulse Position Modulation
RET	Remote Electrical Tilt
RF	Radio Frequency
RFC	Radio Frequency Compatibility
RFID	Radio Frequency IDentification
RHCP	Right-Hand Circular Polarisation
RX	Receive
S/W	Software
SAP	Short Annular Patch
SAR	Synthetic Aperture Radar (or Specific Absorption Ratio)
SCD(A)	Semi Circular Disc (Antenna)
SCPC	Single Carrier Per Channel
SFN	Single Frequency Networks
SHF	Super High Frequency (3 – 30 GHz)
SIG	Special Interest Group
SKA	Square Kilometre Array ( <a href="http://www.skatelescope.org">www.skatelescope.org</a> )
SMA	SubMiniature version A (connector operating from DC to 18 GHz)
TBD	To Be Defined
TDMA	Time Division Multiple Access
TEM	Transverse ElectroMagnetic
TSA	Tapered Slot Antenna (Vivaldi antennas)
TT&C	Telemetry, Tracking & Control
TX	Transmit
UHF	Ultra High Frequency (300 - 3000 MHz)
UMTS	Universal Mobile Telecommunication System
USAT	Ultra Small Aperture Terminal
UV	UltraViolet
UWB	Ultra WideBand
VCE	Virtual Centre of Excellence ( <a href="http://www.antennasvce.org">www.antennasvce.org</a> )
VHF	Very High Frequency (30 – 300 MHz)
VLA	Very Large Array
VLBA	Very Long Baseline Array
VLBI	Very Long Baseline Interferometer
VSWR	Voltage Standing Wave Ratio
WB	WideBand
WBEDB	WideBand Element DataBase
WCA	Wide Coverage Antenna
WG	WaveGuide
Wi-Fi	Wireless Fidelity (commercial name for IEEE 802.11x)
WiMAX	Worldwide Interoperability for Microwave Access (based on IEEE 802.16)
WLAN	Wireless LAN
WPAN	Wireless Personal Area Network
WPR	Wall Penetrating (or Probing) Radar
XP(D)	CrossPolarisation (Discrimination)

### 3 DATABASE DESCRIPTION

#### 3.1 Database Organisation

The WBEDB consists of two parts, described in the following sections, the first one containing Applications and a second containing Antenna Types. Each Application or Antenna Type is provided as separate documents, referred to by links in the database content sections in the following.

The database information is contained in separate documents uploaded to the VCE. Organisation and references to the individual documents are given in the following sections.

The location of the database files is on the ACE VCE under *FILE SHARING*. The Antenna Type part in the directory:

`\A2.3 Wideband And Multiband Antennas\WP2.3-1 Wideband and multiband radiators\Antenna_Types\`

and the Application part in the directory:

`\A2.3 Wideband And Multiband Antennas\WP2.3-1 Wideband and multiband radiators\Antenna_Applications\`

#### 3.2 Applications

##### 3.2.1 Application Description

The Application part of the database is derived from system requirements and standards for wideband systems. To a large extent, companies active in these fields have been engaged to produce the antenna requirements. The content of the descriptions is as follows:

1. Header including Name, Responsible Revision
2. Background and Definitions
3. Specification
4. Sources of Information
5. Antenna Types

The Applications are organized in the following groups:

1. Navigation
2. Mobile Communication
3. Satellite Communication
4. EMC and Test
5. Sensing, Remote and Near Field

##### 3.2.2 Navigation

APPLICATION	File name
1 GNSS terminal	<a href="#">Application_Navigation_GNSS_SAABERICSSON_20051117.pdf</a>

### 3.2.3 Mobile Communication

APPLICATION	File name
1 Ultra WB communication	<a href="#">Application_MobComm_UWB_UNICAL_20051212.pdf</a>
	<a href="#">Application_MobComm_UWB_UKARL_20051122.pdf</a>
	<a href="#">Application_MobComm_UWBSlides_UKARL_20051122.pdf</a>
2 Multiband/UWB commun.	<a href="#">Application_MobComm_MultibandUWB_UKARL_20051115.pdf</a>
2 Mobile Satellite terminal	<a href="#">Application_MobComm_SatTerm_UNICAL_20051212.pdf</a>
3 Handheld terminal	<a href="#">Application_MobComm_HandheldTerminal_LIVU_20051122.pdf</a>
4 Portable satellite terminal	<a href="#">Application_MobComm_PortSatTerm_SAABERICSSON_20051228.pdf</a>
5 Base station antennas	<a href="#">Application_MobComm_BaseStation_SAABERICSSON_20051228.pdf</a>
6 Indoor comm	<a href="#">Application_MobComm_Indoor_SAABERICSSON_20051228.pdf</a>
7 WLAN	<a href="#">Application_MobComm_WLAN_ICCS_20051205.pdf</a>
8 Bluetooth	<a href="#">Application_MobComm_Bluetooth_UMLV_20040519.pdf</a>
9 DVB-H	<a href="#">Application_MobComm_DVB-H_UMLV_20041221.pdf</a>

### 3.2.4 Satellite Communication

APPLICATION	File name
1 TT&C Satellite ant.	<a href="#">Application_SatComm_WCA_SAABERICSSON_20051228.pdf</a>
2 Satellite communication	<a href="#">Application_SatComm_Comm_SAABERICSSON_20051117.pdf</a>
3 Multibeam Satellite comm.	<a href="#">Application_SatComm_Multibeam_SAABERICSSON_20051117.pdf</a>

### 3.2.5 EMC and Test

APPLICATION	File name
1 EMC/RFC field sensors	<a href="#">Application_EMC&amp;Test_FieldSensor_TNO_20040510.pdf</a>
2 Test range probe	<a href="#">Application_EMC&amp;Test_TestRangeProbes_SATIMO_20051125.pdf</a>

### 3.2.6 Sensing (Remote and Near Field)

APPLICATION	File name
1 GPR	<a href="#">Application_Sensing_GPR_UNIVBRIS_20040604.pdf</a>
2 Medical Imaging Applications	<a href="#">Application_Sensing_Medical_UNIVBRIS_20040604.pdf</a>
3 Radar Systems	<a href="#">Application_Sensing_Radar_TNO_FOI_20051205.pdf</a>
4 Radiometry/radioastronomy	<a href="#">Application_Sensing_Radioastro_CHALMERS_20050426.pdf</a>
5 WB SAR	<a href="#">Application_Sensing_wbSAR_FOI_20051212.pdf</a>
6 Square kilometer Array	<a href="#">Application_Sensing_SKA_CHALMERS_20040601.pdf</a>



### 3.3 Antenna Types

#### 3.3.1 Antenna Type Description

The Antenna Type part of the database gives a description of a broad range of WB radiators. Each antenna type has a dedicated document including the following sections:

1. Header including Name, Responsible Revision
2. Antenna Definition
3. Principle of Operation
4. Typical Performance
5. Technologies
6. Classical Publication
7. Pictures of Antennas

The Antenna Types are organized in the following groups:

1. Planar Technology Antennas
2. Waveguide and Horn Antennas
3. Wire Antennas
4. Travelling Wave Antennas
5. Fractal Antennas
6. Related Technologies

#### 3.3.2 Planar Antennas

ANTENNA TYPE	File name
1 Patch Antenna	<a href="#">AntennaType_Planar_Patch_UNIVBRIS_20040604.pdf</a>
2 Annular Slot Antenna	<a href="#">AntennaType_Planar_Annularslot_UNIVBRIS_20040604.pdf</a>
3 Printed Dipole Antenna	<a href="#">AntennaType_Planar_Dipoles_UNICAL_20050104.pdf</a>
	<a href="#">AntennaType_Planar_MultibandDipole_UKARL_20051215.pdf</a>
4 Aperture Antenna	<a href="#">AntennaType_Planar_Aperture_UKARL_20041119.pdf</a>
5 PIFA	<a href="#">AntennaType_Planar_PIFA_LIVU_20051030.pdf</a>
	<a href="#">AntennaType_Planar_TriPIFA_LIVU_20050420.pdf</a>
	<a href="#">AntennaType_Planar_Monopole&amp;PIFA_LIVU_20040722.pdf</a>
6 Curl Antenna	<a href="#">AntennaType_Planar_CurlAnt_UMLV_20040511.pdf</a>
7 Bowtie Antenna	<a href="#">AntennaType_Planar_BowTie_ICCS_20041205.pdf</a>
8 Inverted F Antenna	<a href="#">AntennaType_Planar_Inverted-F_ICCS_20051205.pdf</a>
9 Elliptical Monopole	<a href="#">AntennaType_Planar_EllipticalMonopole_LIVU_20050715.pdf</a>
10 Semi Circular Disc	<a href="#">AntennaType_Planar_SCDA_LIVU_20050910.pdf</a>
11 PEC Element	<a href="#">AntennaType_Planar_PEC_SAABERICSSON_20040510.pdf</a>
12 Biomorphoc Antenna	<a href="#">AntennaType_Planar_Biomorphoc_UPC_20051213.pdf</a>
13 Connected Array	<a href="#">AntennaType_Planar_ConnectedArray_TNO_20051205.pdf</a>

### 3.3.3 Waveguide and Horn Antennas

ANTENNA TYPE	File name
1 Hard WG & Horn	<a href="#">AntennaType_Waveguide_Hardhorns_CHALMERS_20050630.pdf</a>
2 Horn	<a href="#">AntennaType_Waveguide_ConicalHorn_SATIMO_20051125.pdf</a>
3 Corrugated Horn	<a href="#">AntennaType_Waveguide_CorrugatedHorn_SATIMO_20051125.pdf</a>
4 TEM Horn	<a href="#">AntennaType_Waveguide_TEMhorn_FOI_20051212.pdf</a>
5 Ridged Horn	<a href="#">AntennaType_Waveguide_DualRidgeHorn_SATIMO_20051125.pdf</a>
6 WG w./w.o. Dielectric	<a href="#">AntennaType_Waveguide_WG_TNO_20040529.pdf</a>

### 3.3.4 Wire Antennas

ANTENNA TYPE	File name
1 Helix Antenna	<a href="#">AntennaType_Wire_Helix_SAABERICSSON_20040609.pdf</a>
2 Dipole Antenna	<a href="#">AntennaType_Wire_Dipole_UMLV_20040523.pdf</a>

### 3.3.5 Travelling Wave Antennas

ANTENNA TYPE	File name
1 Log Periodic Antenna	<a href="#">AntennaType_TravWave_LogPeriodic_UNICAL_20041130.pdf</a>
2 Spiral Antenna	<a href="#">AntennaType_TravWave_Spiral_UKARL_20041217.pdf</a>
3 Leaky Lens Antenna	<a href="#">AntennaType_TravWave_LeakyLens_TNO_20051205.pdf</a>
4 Vivaldi (Tapered Slot)	<a href="#">AntennaType_TravWave_Vivaldi_FOI_20051212.pdf</a>

### 3.3.6 Fractal Antennas

ANTENNA TYPE	File name
1 Prefractal Antenna	<a href="#">AntennaType_Fractal_Prefractal_UPC_20051213.pdf</a>

### 3.3.7 Related Antenna Technologies

ANTENNA TYPE	File name
1 Tunable Antenna	<a href="#">AntennaType_Related_TunableAntenna_UMLV_20040519.pdf</a>
2 EBG	<a href="#">AntennaType_Related_EBG_TNO_20051205.pdf</a>
3 Baluns	<a href="#">AntennaType_Related_Baluns_UNIVBRIS_20040604.pdf</a>

## **4 CROSS REFERENCES**

All Antenna Types in the database have potential for use in many of the defined Applications. The table below shows the strongest relations between Applications and Antenna Types.

Antenna Type:	Patch	Annular Slot	Printed dipole	Curl ant	Bow tie	Inverted F	PEC elem	Hard wg & horns	Horn	Corrugated horn	TEM horn	Ridged horn	WG & Dielectric filled wg	Helix antenna	Dipole	Log periodeic	Spiral	Leaky lens	Vivaldi	Fractal antennas	Tunable antennas	EBG	Baluns
Application:																							
<b><u>Navigation:</u></b> GNSS Terminal	X													X									
<b><u>Mobile Communication:</u></b> Ultra WB Communication Mobile Satellite Terminal Handheld Terminal Portable Satellite Terminal Base station Indoor Communication WLAN Bluetooth	X	X				X			X					X									
<b><u>Satellite Communication:</u></b> TT&C Satellite ant. Satellite Communication, space Multibeam Sat. Communication, space	X									X				X									
<b><u>EMC and Test:</u></b> EMC/RFC Field Sensors Test Range Probe									X			X				X		X					
<b><u>Sensing (Remote and NF):</u></b> GPR and WPR Medical Imaging Applications Radar Systems Radiometry/Radioastronomy WB SAR Square kilometer Array	X										X								X				
	X							X				X						X					
									X					X									
															X								
																X							