

# Ultra Wide Band (UWB) Compatibility Study

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**UWB Colloquium**  
**23rd July 2002**  
IEE, Savoy Place, London

# UWB Compatibility Study

## CEPT PT SE24

- **CEPT PT SE24 UWB Study**

To investigate the interference potential of various Pulsed UWB technology on existing and planned services

Laboratory measurements and theoretical calculations.

- **UWB Interference and victim receiver bandwidth**

Noise - like (Receiver BW < UWB PRF)

Pulse - like (Receiver BW > UWB PRF)

- **UWB Signal characteristics for Interference tests**

PRF (1/5/10 MHz)

Modulation type > PPM



# UWB Compatibility Study

## CEPT PT SE24

- Victim Services

Broadcast services (T-DAB / DVB-T)

Radio Astronomy (Passive services)

Earth Exploration Satellites (Active & Passive)

GPS

UMTS

Galileo

PCN

Aeronautical services

COFDM ENG/OB

SRDs

5GHz HIPERLAN



# Compatibility Study

## RA Contribution to CEPT

To assess the UWB interference into

- (1) DVB-T
- (2) TDAB (MODE 1 & 2)
- (3) PCN (GSM)
- (4) Bluetooth

- **Objectives**

- (1) C/I Ratios (based on UWB power falling into victim receiver's IF BW)
- (2) Minimum separation distances
- (3) Maximum permissible E.I.R.P. for UWB



# UWB Interference into DVB-T (1)

- **Digital Terrestrial TV**

COFDM (multi carrier modulation) - 2k & 8k FFT

QPSK - 16QAM - 64QAM

2/3 FEC

1/32 Guard interval

7.61 MHz BW

\* UK Mode (2k FFT, 64 QAM, 2/3 FEC, 1/32 Guard Interval)

- **Conducted Measurements**

Objective measurements (BER tests)

Failure criteria - BER of  $2 \times 10^{-4}$  (before RS decoder)



# UWB Interference into DVB-T (2)

- **C/I Results**

6.5 dB (QPSK)

11.6 dB (16 QAM)

19.4 dB (64 QAM) \*

- **Protection Distances** (SE24 Calculations based on free space path loss)

| <u>UWB emission level</u>          | <u>MUS</u> | <u>MUS+10dB</u> |
|------------------------------------|------------|-----------------|
| EMC/FCC Part 15 limit (-41dBm/MHz) | 12m        | 4m              |
| SE24 Modified FCC mask             | <1m        | <1m             |
| Proposed CEPT Mask                 | <1m        | <1m             |



# UWB Interference into DAB (1)

- **Terrestrial Digital Audio Broadcasting**

Design for fixed, portable and mobile reception

ETSI Standard (EN 300 401)

COFDM - DQPSK

1.5 MHz BW

5/6 Near CD quality Programs per Block

Receiver Sensitivity : -81dBm - (CENELEC standard)

-90dBm (typical receiver performance)

- **Frequency allocations** : VHF (band 3) (217-230 MHz)  
L band (1.5GHz)



# UWB Interference into DAB (2)

- **C/I Results**

9.6 - 12.5 dB

- **Protection Distances** (SE24 Calculations based on free space path loss)

| <u>UWB emission level</u>          | <u>MUS</u> | <u>MUS+10dB</u> |
|------------------------------------|------------|-----------------|
| EMC/FCC Part 15 limit (-41dBm/MHz) | 22 m       | 7 m             |
| SE24 Modified FCC mask             | <1m        | <1m             |
| Proposed CEPT Mask                 | <1m        | <1m             |



# UWB Interference into Bluetooth (1)

- A global standard for wireless connectivity connecting mobile phones, computers, laptops,
- Low Power - Low Cost radio links (Voice and Data )
- **Technology**  
2400 - 2483.5 MHz ISM Band > ETS 300 328  
Fast Frequency Hopping system
  - over 79 channels - 1MHz spacing
  - 625 $\mu$ s timeslot
  - pseudo random hopping sequences
  - frequency separation at least 6MHz
  - Time division duplex (TDD)



# UWB Interference into Bluetooth (2)

- **C/I Results**

17 dB (Voice)

19 dB (data-file transfer test)

20 dB (BER Tests)

- **Protection Distances** ((SE24 Calculations based on free space path loss)

| <u>UWB emission level</u>          | <u>MUS</u> | <u>MUS+10dB</u> |
|------------------------------------|------------|-----------------|
| EMC/FCC Part 15 limit (-41dBm/MHz) | 2.6 m      | 0.8 m           |
| SE24 Modified FCC mask             | <1m        | <1m             |
| Proposed CEPT Mask                 | <1m        | <1m             |



# UWB Interference into PCN/GSM (1)

## 2nd Generation Pan European Cellular System

- GSM (800MHz) / PCN (1800 MHz)
- GFSK, 270kb/s,
- TDMA (8 user per channel)
- Receiver Sensitivity (-102 dBm)
- **Conducted Measurements**
  - GSM test set
  - C/I Measurements
  - Failure Criteria (mobile station receive quality 4 with traffic channel BER ~ 2%)



# UWB Interference into GSM (2)

- **C/I Results**

9 dB

- **Protection Distances** ((SE24 Calculations based on free space path loss))

| <u>UWB emission level</u>          | <u>MUS</u> | <u>MUS+10dB</u> |
|------------------------------------|------------|-----------------|
| EMC/FCC Part 15 limit (-41dBm/MHz) | 41 m       | 13 m            |
| SE24 Modified FCC mask             | <1m        | <1m             |
| Proposed CEPT Mask                 | <1m        | <1m             |



# UWB Interference into PCN (3)

- **C/I Results**

9 dB

- **Protection Distances** (SE24 Calculations based on free space path loss)

| <u>UWB emission level</u>          | <u>MUS</u> | <u>MUS+10dB</u> |
|------------------------------------|------------|-----------------|
| EMC/FCC Part 15 limit (-41dBm/MHz) | 21 m       | 6.6 m           |
| SE24 Modified FCC mask             | <1m        | <1m             |
| Proposed CEPT Mask                 | <1m        | <1m             |



# Summary

- Pulsed UWB-PPM (Noise like interference)

- UWB emission level

EMC/Part 15 limit (-41dBm/MHz) >> Sharing under worst case scenario may not be possible (DVB-T/PCN/TDAB/Bluetooth)

Proposed CEPT (SE24) mask >> Separation distances <1m

- Effect of different UWB-PRF (1/5/10 MHz) >> 2-3 dB

- Further Measurements

UWB- HIPERLAN (5GHz)

- ITU-R SG 1 Working Party 1A/1B

Technical study and regulatory issues

