

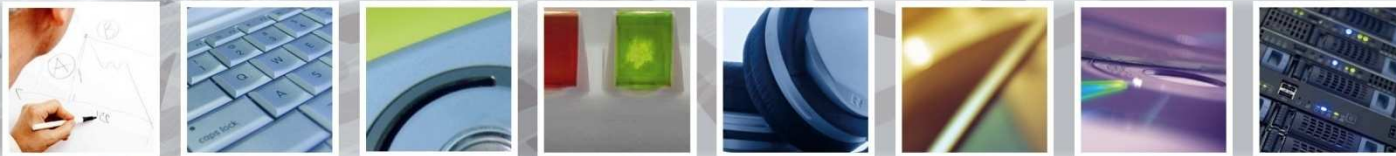
Project Walter ETSI Workshop

Problem of measurement in a noisy
environment

Alan Dearlove

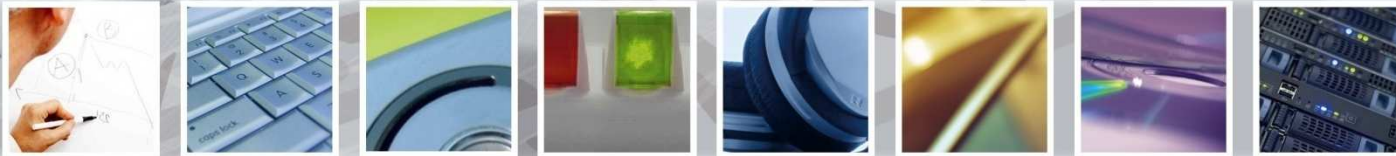
Project Technical Director

Held at ETSI 6th – 7th October 2009



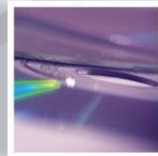
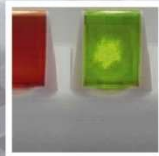
Agenda

- ✓ Components of noise
- ✓ Noisy environments
- ✓ Measurement requirements
- ✓ Conducted measurements
- ✓ Radiated measurements
- ✓ Sensitivity calculations
- ✓ UWB Limits



Agenda

- ✓ Measurement System Sensitivities
- ✓ Improvement of System Sensitivities
- ✓ Combined radiated limits
- ✓ Separation distances
- ✓ Temperature
- ✓ Duty cycle
- ✓ Limitations and conclusions



Components of noise

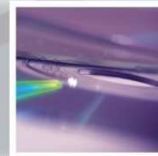
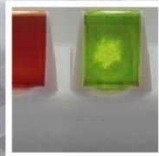
✓ Receiver noise:

○ Internal:

- Local Oscillator noise (Phase noise)
- Mixer noise
- Amplifier noise

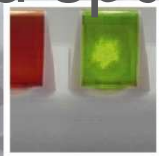
○ External:

- Man made
- Cosmic



Noisy environments

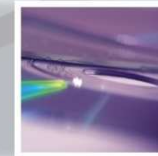
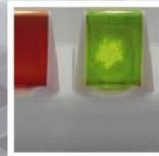
- ✓ Natural phenomena:
 - Sunspot activity
 - Cosmic activity
- ✓ Manmade:
 - EMC
 - EMP
- ✓ Equipment:
 - EMC and spurious emissions



walter[®]

Measurement requirements

- ✓ Signals to be measured:
 - +6dB above noise floor of instrumentation
- ✓ Measurement environment:
 - Test sites
- ✓ Temperature:
 - Environmental, nominal and extreme
 - Noise temperature



walter[®]

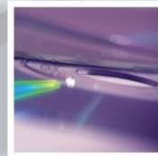
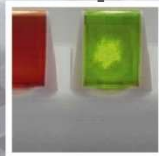
Conducted measurements

✓ Preferred method:

- Radio equipment
- Nominal impedance
- Improved sensitivity of measurement
- Improved measurement uncertainty

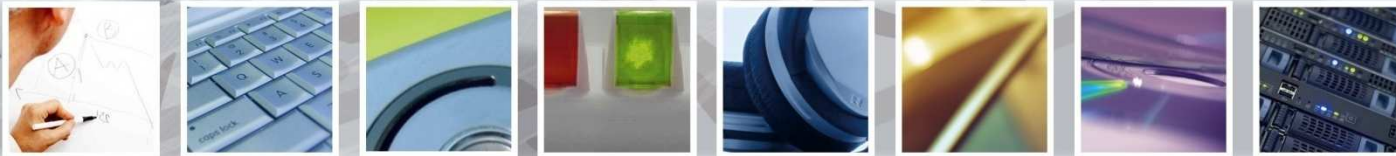
✓ Limitations:

- Integral antennas and known antennas
- Nominal impedances



Radiated measurements

- ✓ Use of antennas:
 - Calibrated measurement antennas required
- ✓ Separation distances:
 - Calibration of antennas
 - Equipment physical size
- ✓ Path-loss:
 - Varies over frequency range



Sensitivity calculations

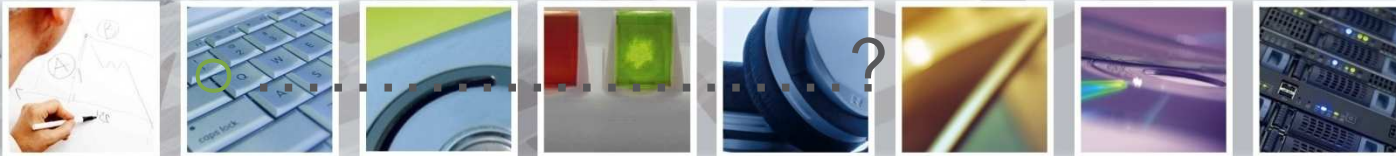
✓ Specifications:

- Limits ([Review of RF Measurements for Walter V1+.ppt](#))
- Bandwidth

✓ Equipment:

- Noise figure ([Test UWB calcs.xls](#))
- Amplification

✓ Improvements:



UWB limits EN 302 065

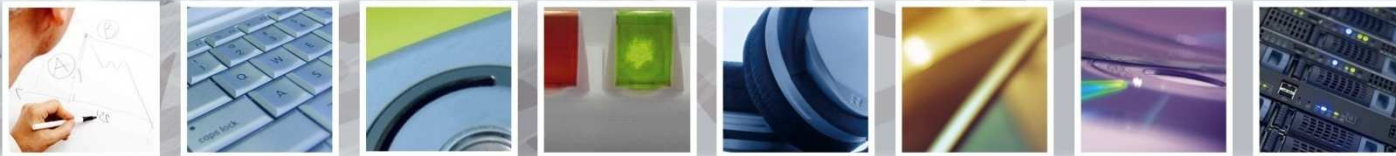
✓ Specifications:

○ Conducted:

- Radio parameters
- DAA

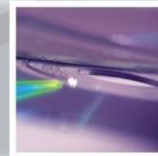
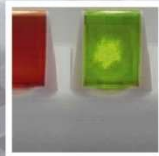
○ Radiated:

- Radio parameters
- DAA



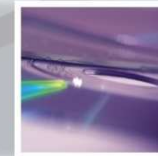
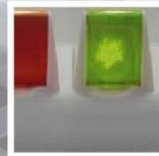
Test Limits

- ✓ Signal power - -41.3 dBm/MHz
- ✓ Lowest limit - $-90 \text{ dBm/MHz @ 1.6 GHz}$
- ✓ Limit beyond 10.6 GHz - -85 dBm/MHz



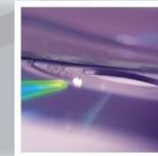
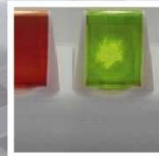
Measurement System Sensitivities

- ✓ Frequency range - 30MHz to 40 GHz
- ✓ Operational frequency – 3.1-10.6 GHz
- ✓ Limits – below 1.6 GHz to above 10.6 GHz
- ✓ Bandwidth
- ✓ Radiated combined limits:
 - Spec limit + path loss + antenna gain + amp
- ✓ Temperature



Improvement of sensitivities

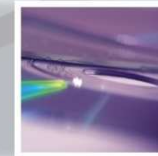
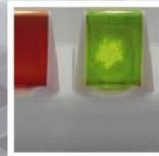
- ✓ Amplifiers
- ✓ Noise temperature



walter[®]

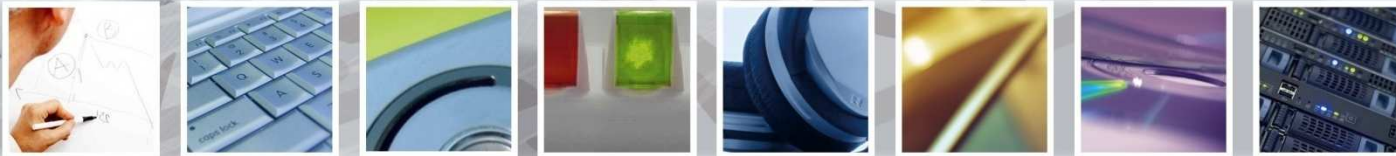
Combined radiated limits

- ✓ Specification limits
- ✓ Path loss
- ✓ Amplifier (LNA)
- ✓ Antenna gain
- ✓ Cable losses
- ✓ Review of RF Measurements for Walter
V1+.ppt



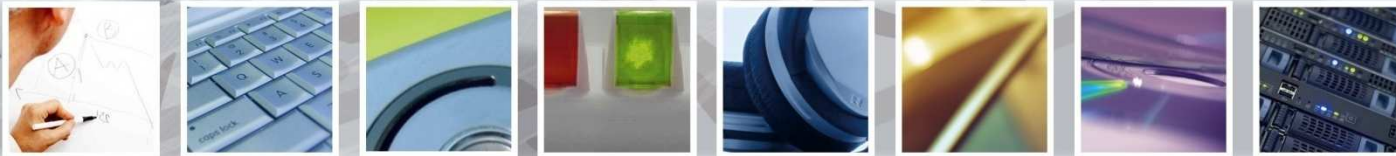
Separation distances

- ✓ Far field
- ✓ Normal 3 metres
- ✓ Improvement at 1 metre
- ✓ But.....
- ✓ Physical size of antenna and EUT



Temperature

- ✓ Normal temperature 293k (20 degrees C)
- ✓ Reduced temperature reduces noise
- ✓ Measurements at 20k ([WALTER Docs\Low Temp_photo.doc](#))
- ✓ Measurements at 233k



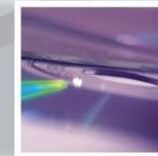
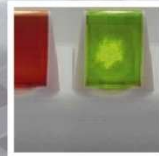
Duty cycle

- ✓ Test mode
- ✓ Low Duty Cycle specified
- ✓ But.....
- ✓ Duty cycle related to power is NOT included in standards ([Review of RF Measurements for Walter V1+.ppt](#))
- ✓ Average power is dependant upon:
 - Duty cycle
 - Frame length
 - Transmitter operation (mode)



Limitations and conclusions

- ✓ Normal transmitter power can be measured
- ✓ Duty cycle should be included
- ✓ Specify a test mode
- ✓ Limits below 1.6 GHz cannot be tested
- ✓ Limits above 10.6 GHz can be tested but with difficulty
- ✓ Limits above 18 GHz cannot be tested
- ✓ Limits to be reviewed by ETSI and ECO



walter[®]



Contacts

Coordinator

Franck Le Gall (inno)

Contact@walter-uwb.eu

+334 923 884 18

Presenter

Alan Dearlove

alan@ctltd.eu

+441296770166

<http://www.walter-uwb.eu>
