In-Building Mobile Coverage Systems and Deployment

Ulf Lofberg, WIG Operations Manager
MENA
Date February 2011
Agenda

In-Building Mobile Coverage Systems and Deployment

• Wireless Infrastructure Trends
• In-Building RF Distributed Antenna Systems for GSM/UMTS/LTE
• In-Building System Requirements
• In-Building Deployment Options
Wireless Infrastructure Trends
Wireless Infrastructure Trends

• Dedicated In-Building Coverage becomes a MUST
  – New mobile commercial services assigned to high frequency bands
    • UMTS on 2100MHz & LTE on 2600 MHz
    • Building penetration losses increase
  – Mobile users increase dramatically
  – Wireless bandwidth and capacity requirement increase dramatically
• Distributed Antenna Systems (DAS) are used to create the In-Building coverage
• Multiple Operators share the same In-Building infrastructure (DAS)
• Multiple wireless systems and frequency bands share the same In-Building infrastructure (DAS)
Low E-Glass coatings work by reflecting or absorbing IR light (heat energy). This same coating also reflects radio waves, causing significant in-building wireless coverage problems.

With both solar and thermal control, you get dramatic energy savings.
In-Building Coverage Problems

Without an In-Building Solution!

- Uncertain coverage! - Unknown capacity!
In-Building Coverage Solution

With a dedicated In-Building Solution!

- Defined coverage! - Defined capacity!
## Frequency Bands and Distribution

### Frequency bands for wireless systems in the UAE

<table>
<thead>
<tr>
<th>EMEA Standards</th>
<th>Operators</th>
<th>Frequency band [MHz]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tetra</td>
<td>Police &amp; Civil Defence</td>
<td>400</td>
</tr>
<tr>
<td>EGSM/EDGE</td>
<td>Etisalat &amp; du</td>
<td>900</td>
</tr>
<tr>
<td>DCS/EDGE</td>
<td>Etisalat &amp; du</td>
<td>1800</td>
</tr>
<tr>
<td>UMTS/HSPA</td>
<td>Etisalat &amp; du</td>
<td>2100</td>
</tr>
<tr>
<td>LTE</td>
<td>Etisalat</td>
<td>1800 or 2600</td>
</tr>
<tr>
<td>LTE</td>
<td>du</td>
<td>2600</td>
</tr>
<tr>
<td>WLAN WiFi 802.11 (b/g/a/n)</td>
<td>ADSIC/Etisalat/du</td>
<td>2400</td>
</tr>
<tr>
<td>WLAN WiFi 802.11 (b/g/a/n)</td>
<td>ADSIC/Etisalat/du</td>
<td>5725</td>
</tr>
</tbody>
</table>

### Distribution

<table>
<thead>
<tr>
<th>Indoor Distribution</th>
<th>Injected into active DAS</th>
<th>Injected into passive DAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tetra</td>
<td>Separate DAS</td>
<td>Separate DAS</td>
</tr>
<tr>
<td>EGSM</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>DCS</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>UMTS</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>LTE</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>WLAN</td>
<td>Separate DAS</td>
<td></td>
</tr>
</tbody>
</table>
In-Building RF Distribution Systems
GSM/UMTS/LTE
In-Building Distributed Antennas Systems
Passive Distributed Antennas Systems

- Multi band antennas
- Multi band power splitters
- Coaxial cables (1/2”, 7/8”, 1 ¼”, 1 5/8”)
- Base Stations or RF Repeater

DAS systems can be shared between operators
Shared Passive DAS
Active Distributed Antennas Systems

- Multi band antennas
- Multi band power splitters
- Coaxial cables (1/2” & 7/8”)
- Base Stations
- Fiber Optical Master Unit
- Fiber Optical Remote Unit
- Fiber Optical Cables (2 – 6 core)

Also Active DAS can be shared by several operators
Active DAS can distribute Multiple operators and Multiple bands to several buildings
Injection Active DAS System

- BTSs
- FO Active DAS & Supervision
- Passive DAS

RF source can be injected into the DAS here, e.g. GSM/UMTS

Or here, e.g. WMTS or WiFi
IBS System Requirements
Wireless System Requirements

Requirements: DAS system for all wireless services that may be used now and in the future:

Technologies:
- Tetra
- EGSM/EDGE
- DCS/EDGE
- UMTS/HSPA/HSPA+/MIMO
- LTE/MIMO
- WLAN WiFi 802.11 (b/g/a/n)
- WLAN WiFi 802.11 (b/g/a/n)

DAS Solution:
- Passive Only
- Active Only (Low Power Active DAS)
- Active & Passive (Hybrid, high power Active DAS)
- Centralized Remote Supervision System for active solution
- Detailed component requirements

Frequencies:
- Exact Frequency bands in the 400MHz band
- Exact Frequency bands in the 900MHz band
- Exact Frequency bands in the 1800MHz band
- Exact Frequency bands in the 2100MHz band
- Exact Frequency bands in the 2600MHz band
- Exact Frequency bands in the 2400MHz band

DAS design to comply to:
- ETSI Standard
- Defined coverage areas
- Operator Key Performance Index Parameters (Receive Level, Quality, Handover)
- Capacity requirements for each system
- Acceptance tests

DAS HAS TO BE FUTURE PROOF, Multi Operator, Multi Band!
IBS System Deployment
Deployment and Licenses I of II

• Traditional IBS deployment
  • Operators deploy, as per regulatory requirements (e.g. GSM or UMTS license)
  • Operator responsible for
    • RF planning (location of RF source and antennas)
    • Implementation
    • RF Performance (Coverage, capacity, data throughput)
    • RF Optimization
    • System Maintenance

Until just recently, operators deployed their own systems, single user DAS
This resulted in multiple DAS in the same building, one for each operator (2-4)
  • Multiple cable runs
  • Multiple Antennas
  • Multiple Maintenance organizations
• Today regulatory authorities, building developers/owners and operators are more and more in favor of sharing the IBS DAS.

• Multi Operator & Multi Band DAS
  • As illustrated before, all operators can share one DAS
    • Less cables and antennas
    • Shared maintenance efforts
  • This equals
    • Less negative impact on the esthetics of the building
    • Less maintenance activities
    • Lower cost for DAS
Neutral Host DAS

- Third party installs the DAS
  - Generic Multi Operator DAS implemented by developer/owner
    - Coaxial cables (star configuration)
    - Antennas (location based on generic guidelines)
    - All cables routed back to the nearest technical room (e.g. maximum 90 meter cable run)
    - Potentially DAS maintenance

- Operators implement
  - Base Stations (GSM/UMTS/LTE)
  - RF plan
  - Vertical cable installation only (no impact on building nor work force)
  - RF Performance (Coverage, capacity, data throughput)
  - RF Optimization
  - Maintenance Base Stations (and potentially DAS)
Example of Pre-Wired DAS

**Complete DAS as implemented by operator**

**DAS pre-wired by developer/owner**

- **Technical room 1**
- **Technical room 2**
Option: Pre-Wiring Offices for DAS

Why Pre-wire?
- Cost savings
  - It can cost 2-4 times as much to wire later
  - One antenna will conservatively cover 5,000 ft², which is 15-20 people.
- Convenience
  - No disruption of work force
  - Easier to install

The Antenna Location Design Rules
- Outside antennas within 20ft of the edge of the building
- Antennas spaced at 100 ft apart
- One antenna per floor within 20 ft of the elevator core
- One back-to-back antenna every 6 floors in the elevator shaft starting on floor 3
- Cable: Star configuration
  - Maximum flexibility for the future RF planning

Pre-Wiring makes life easier for everybody
Goal - Provide a “-75dBm Coverage Blanket”
Omni antennas on a basic 100ft (30m) grid
Perimeter antennas < 20ft (6m) from walls
  If on external wall, utilize directional antenna
One antenna < 20ft (6m) from elevator core
Stairwells
  If open, Omni antenna every 6th floor
  If closed, Omni antenna every 2nd floor

Installation & Certification
Each cable run directly to TR < 300ft (90m)
Install connectors on both ends
Sweep-test for integrity and loss
Attach antennas & document cable paths
Extended warranty

Telecom Room
N-Type male connectors at both ends
90m maximum
Antenna

Wall Organizer

Open Stairwell
Closed Stairwell
Questions?

Ulf Lofberg, WIG Operations Manager MENA