



53 Shades of RED: Antenna Performance

Sven Lundbech
Danish Energy Agency

Agenda

- Introduction
- Antenna (and Receiver) Measurements
- Measurement Results
- Implication for Coverage
- The Way Forward
- Conclusions

Introduction: Coverage Calculation

- Objectives:
 - To report the combined theoretical calculated outdoor speech coverage for all four Danish mobile network operators
 - To report outdoor coverage percentage at postal code area level
 - To update and report on a yearly basis to follow the coverage trend

Introduction(2)

- Objectives(2):
 - Mobile operators to provide calculated field strength values at 100 m x 100 m pixel resolution
 - All mobile operators must use the same propagation model

Introduction(3)

- Challenges
 - Establish go/no-go threshold field strength value(s) for e.g. speech communication
 - Include receiver performance parameters in the coverage calculations
 - Get sensitivity figures for most sold phones

Measurements

- Use standardised methods for measuring Total Isotropic Sensitivity (TIS)
- Measurements carried out in 2012 and 2013 at the University of Aalborg, Denmark
- Reports are in public domain

Measurements

- 32 phones measured (in 2012 + 2013)
- GSM900, GSM1800, UMTS900, UMTS2100 (where applicable)



Results, findings

- Sensitivity varies significantly
 - More than 10 times (10 dB) variation from top to bottom performer in test
 - Some of the most popular smartphones at the time are at the bottom of the list
 - Largest difference in sensitivity is found in the 900 MHz band - and 900 MHz band is still an important band for coverage.

Results, findings(2)

- Phone ranking hitlist, latest results

ranking	Model	Performance	A-G
1	Doro Phone Easy 605	-98.8 dBm	C
2	Samsung S5	-98.5 dBm	C
3	Sony Xperia Z	-98.1 dBm	C
4	Samsung S6	-97.8 dBm	D
5	Sony Xperia Go	-97.7 dBm	D
6	Samsung Galaxy III mini	-97.5 dBm	D
7	LG A250	-97.5 dBm	D
8	Nokia Lumia 620	-97.2 dBm	D
9	Nokia Asha 300	-97.2 dBm	D
10	Sony Xperia 5Z compact	-96.8 dBm	D
11	HTC One	-96.2 dBm	D
12	Huawei Y300	-96.0 dBm	D
13	Nokia 1800	-96.0 dBm	D
14	iPhone 4	-95.8 dBm	E
15	HTC One mini	-95.5 dBm	E
16	LG Optimus	-95.4 dBm	E
17	Huawei Ascend P2	-95.1 dBm	E
18	Nokia Lumia 920	-94.7 dBm	E
19	Samsung Galaxy note II (3G)	-94.5 dBm	E
20	Samsung S4 (4G)	-94.5 dBm	E

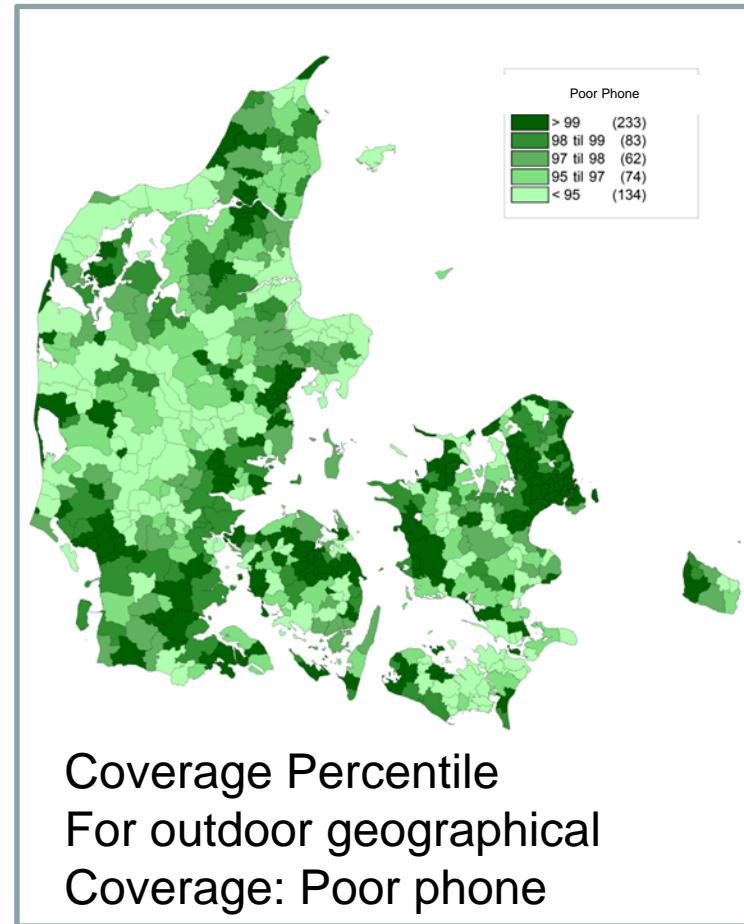
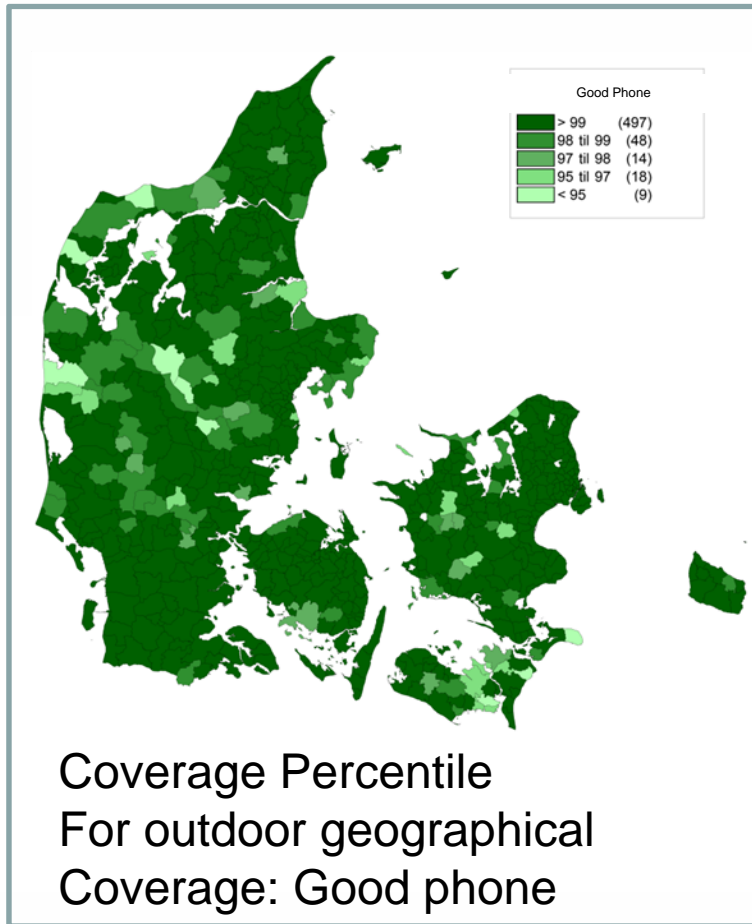
21	Samsung Galaxy note II (4G)	-94.5 dBm	E
22	HTC Desire X	-94.4 dBm	E
23	Samsung S4 mini	-94.0 dBm	E
24	iPhone 6	-93.9 dBm	F
25	Nokia C1-01	-93.9 dBm	F
26	HTC Wildfire S	-93.5 dBm	F
27	iPhone 4s	-93.3 dBm	F
28	Samsung SII	-93.2 dBm	F
29	Nokia C2-01	-93.1 dBm	F
30	iPhone 6S	-93.0 dBm	F
31	Nokia Lumia 820	-93.0 dBm	F
32	iPhone 5C	-92.3 dBm	F
33	iPhone 5S	-90.2 dBm	G
34	Samsung SIII	-89.9 dBm	G
35	iPhone 5	-88.8 dBm	G
36	Nokia Lumia 925 (phone 2)	-88.1 dBm	G
37	Nokia Lumia 925	-88.0 dBm	G

Source: <http://www.dr.dk/nyheder/penge/kontant/saa-daarlig-er-den-nye-iphones-antenne>

Results, findings(3)

- Very significant coverage variation
 - Verified by calculations for outdoor coverage in Denmark for a good and a poor mobile phone
 - Choosing the right mobile phone may make the difference between being able or not being able to make a phone call

Results, findings(4)



Implication for Coverage

- Coverage is phone dependent
 - Danish mobile coverage Survey 2013 - difference in coverage variations for postal code areas, 99% coverage:
 - Good phone: 497 areas covered
 - Poor phone: 233 areas covered
- (Total number of post code areas in Denmark: 586)*
- If coverage is weak: Choose mobile phone with good receiver performance

The Way Forward

- Receiver requirements are stated in the Mandate M/536:
 - *Work undertaken under this standardisation request shall cover all the applicable essential requirements of Directive 2014/53/EU, namely:*
 - *(...) the modified essential requirement set out in Article 3(2), i.e. effective use of radio spectrum and support for the efficient use of radio spectrum so as to avoid harmful interference, which has introduced requirements on receiver performance*

The Way Forward(2)

- More receiver requirements in M/536:
 - *Receiver performance is also of particular importance for mobile terminals, in particular antenna performance, and for communication equipment used in safety of life applications.*

The Way Forward(3)

- As a result of these new receiver requirements...
 - ETSI has to review current receiver requirements...
 - And define possible new receiver requirements/limits where necessary, i.e. (antenna)sensitivity, adjacent channel selectivity, intermodulation attenuation

Conclusions

- Mobile phone coverage is very dependent on phone sensitivity
- Danish coverage survey clearly shows the difference
- No way of getting information for sensitivity
- Users are left in the dark
- Thus: Minimum standards for sensitivity