

**Finnsenderen**

Trådløse mikrofoner

Strålingskalkulator

-- Velg fylke --

-- Velg kommune --

Adresse

Postnr

Søk

Nullstill alt

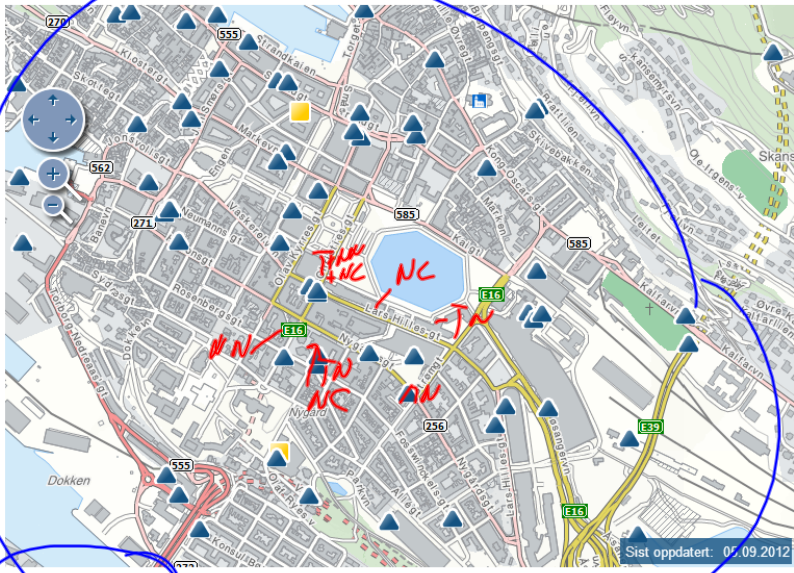
**Vis sendere i kart**

Tegnforklaring

- Radio- og TV
- Mobil

Vis alle

- Radio og TV
- Mobil



Tips en venn Kart Foto Hybrid Panorér Zoom

FM-RADIO (2) ▲ CDMA2000 (2) ▲ GSM (75) ▲ GSM-R (1) ▲ LTE (13)  
▲ UMTS (52)

This scenario was selected to simulate the typical handover in mobile networks.

### Input Parameters

Here are the parameters used, assuming it's in an urban area (really urban? as we discussed, urban is based on Tokyo. Thus I'd rather suggest to use suburban environment).

Frequencies:

- GSM: 1800 MHz
- UMTS: 2100 MHz
- Range between towers: 15 km - very optimistic, typical distances are between 1.5 and 3 km, see <http://www.finnsenderen.no/finnsender>
- Height of transmitters: 150 m - 150 m were old design, now antenna heights are typical 15... 30 m
- Height of receiver: 1.5 m
- Data rate: 12.2 kbps
- Equipment Temperature: 293.15 K (20 celsius)
- Traveling at 60 km/h

*Handwritten notes:* "really urban?" circled in red with arrow pointing to "urban area". "12.2 kbps" circled in red. "150 m" circled in blue. "small add-on to thermal noise" written in red. "noise figure" written in red. "Sensitivity analysis of Hata model" written in green with circled "3". "Missing: SWR, voice, Data, HSPA" written in green with circled "1". "network interface - neighbour cells" written in green with circled "2". A diagram of towers is drawn in blue with "new" written above it.

### Analysis and explanation

Handover between GSM and UMTS, assuming same height of the transmitter towers, and that receiver height is consistent.

- Hit fading margin for GSM at: 9.9745 km, -114.2460 dB.
- Hit fading margin for UMTS at 8.8655 km, -114.4200 dB.
- This gives us a stretch of 3.8400 km where we can perform handover successfully between GSM and UMTS.
- We have around 3 minutes and 50 seconds to complete the handover at current speed.
- Between UMTS/UMTS, we have a stretch of 2.7310 km where we can perform handover.
- We have around 2 minutes and 43 seconds to complete the handover at current speed.

To see the full code and tables, see [Click here to go to Simulations...](#)

### Conclusions

With these parameters we have 3 minutes and 50 seconds to complete handover (GSM - UMTS). The handover would be successful without a break.

Between UMTS/UMTS, we have approximately 2 minutes and 43 seconds to complete a successful handover.

ExamEN UNIK4700h12 - C x Wireless Handover Simul... finnsenderen.no x

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Assuming new value for transmitter height of UMTS (recommended numbers are 30-200m), and assuming that the Hata model does not give entirely wrong results non-recommended parameters are used, we can try to create a better estimate. Using a near 0 value for the 802.11b height (sea level lower than ground level, antenna barely above ground) and the Hata suburban model, we get these results:

Propagation prediction - Hata Suburban

- Fading margin for 802.11b hit at 94.2 m, at signal strength -84.9174.
- UMTS never dips below fading margin.
- Driving speed 20 km/h, walking speed 3 km/h.
- This gives us around 16.96 seconds from when we start driving to we hit the fading margin for 802.11b. For walking, 113.04 seconds.
- We hit -66 dB at 40.3628m. This gives us a time of 7.27 seconds from when we start to drive, or 48.44 seconds if we walk.
- If we want to start handover at -66 dB, these are the times we would use. If we want to finish handover at -66 dB, we must subtract the handover time.

Alternate code: [Scenario\\_2\\_alternate\\_code](#)

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Distance (m)

We never hit the fading margin, and should have no problems doing handovers.

Code for this scenario: [Scenario\\_3\\_code](#)

**Maximum distance**

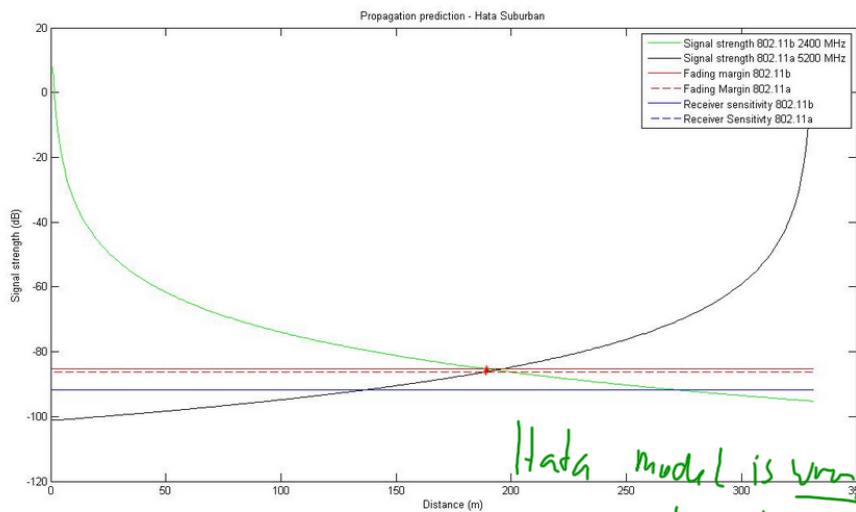
Objective: find maximum distance between APs at 10 Mbit/s data rate for 100 ms handover and 2 second handover. Assume walking speed of 3 km/h.

Scenario3\_b

- Calculating the stretch traveled at 3 km/h in 2 seconds, we get 1.66...m. For 100 ms, we get 0.0833...m.

cwi.unik.no/wiki/File:Scenario3\_b.jpg

speed of 3 km/h.



*Hata model is wrong*

- Calculating the stretch traveled at 3 km/h in 2 seconds, we get 1.66...m. For 100 ms, we get 0.0833...m.
- The max range with these variables gives us (from base to fading margin) 179.3527m for 802.11b and 142.2332m for 802.11a.
- We need these to overlap for at least 1.66...m for the two second handover and at least 0.0833...m for the 100 ms handover.
- We can simply add them together and subtract the handover stretch to find the maximum distance.
- This gives us a maximum range of ~329,9192m for the 2 second handover and ~331,5026m for the 100 ms handover.
- The difference corresponds to the difference between the handover stretches.

*1.7 1.90 0.1m by at least 7-3dB*

*330m ~7-2m 332m*

*100 : 200m?*

**Scenario 4**

Handover between UMTS and UMTS, assuming same height of the transmitter towers, and that receiver height is consistent. Objective is to find the maximum distance between transmitters for various handover times and various traveling speeds.

To do this, we need the distance traveled during handover. See the table below.

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I could only find the distance between the transmitters rounded up/down to the nearest ten meters. Trying for the nearest whole meter, my laptop ran out of memory.

See table below for results:

Max distance between transmitters [km]	Available handover stretch [m]
19.96	67.8905
19.99	37.8905
20	27.8905
20.02	7.8905
20.03	-2.1095

*See finnsender*

Comparing the two tables, we get:

Speed	2 sec handover	100 ms handover
120 km/h	~19.96 km	~20.02-20.03 km
60 km/h	~19.99-20 km	~20.02-20.03 km
3 km/h	~20.02-20.03 km	~20.02-20.03 km

As we can see, with a 2 second handover the maximum distance varies with up to ~70 meters, and with a 100 ms one it only varies with a few meters (less than ten, probably less than five).



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