

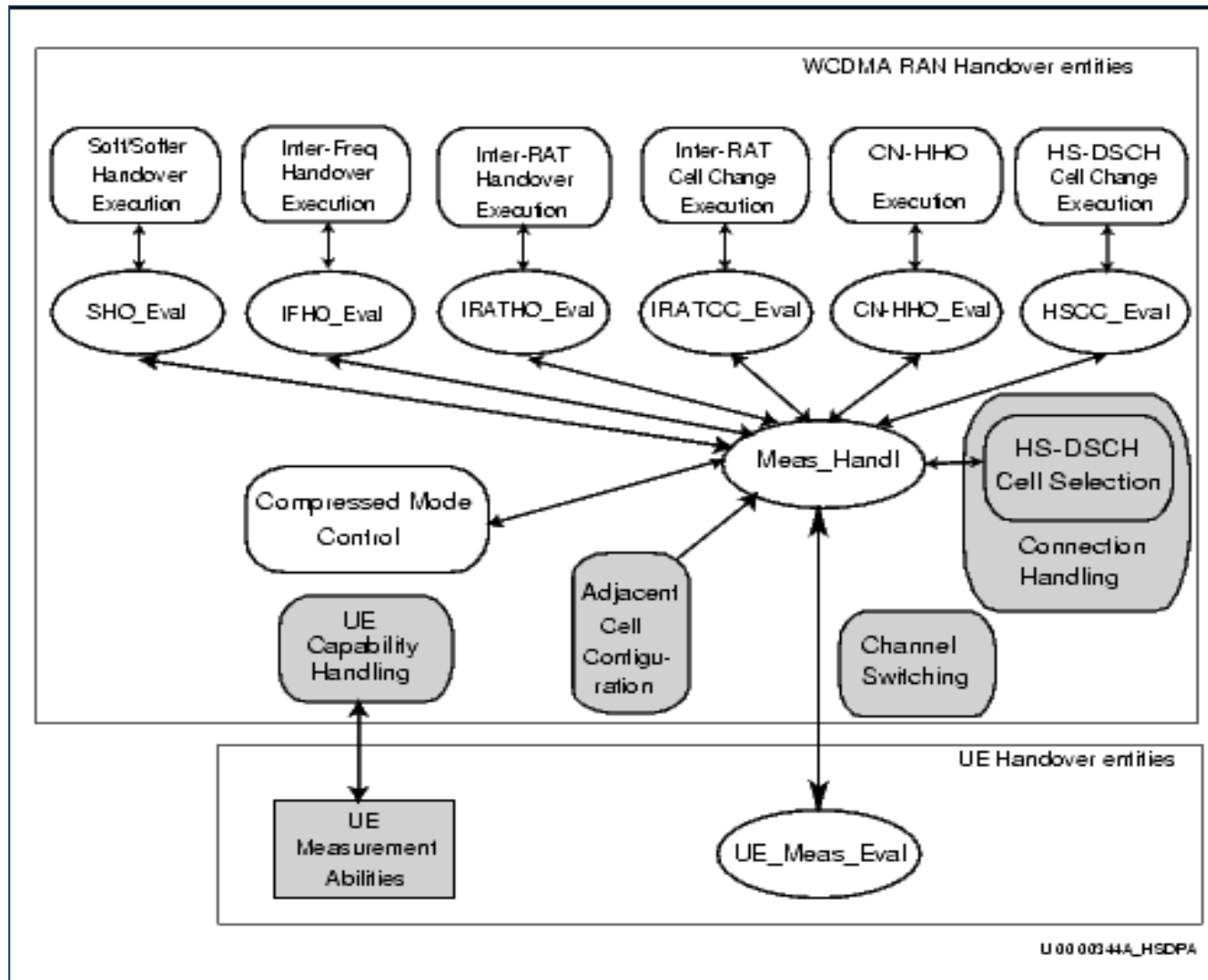
HANDOVER

Overview

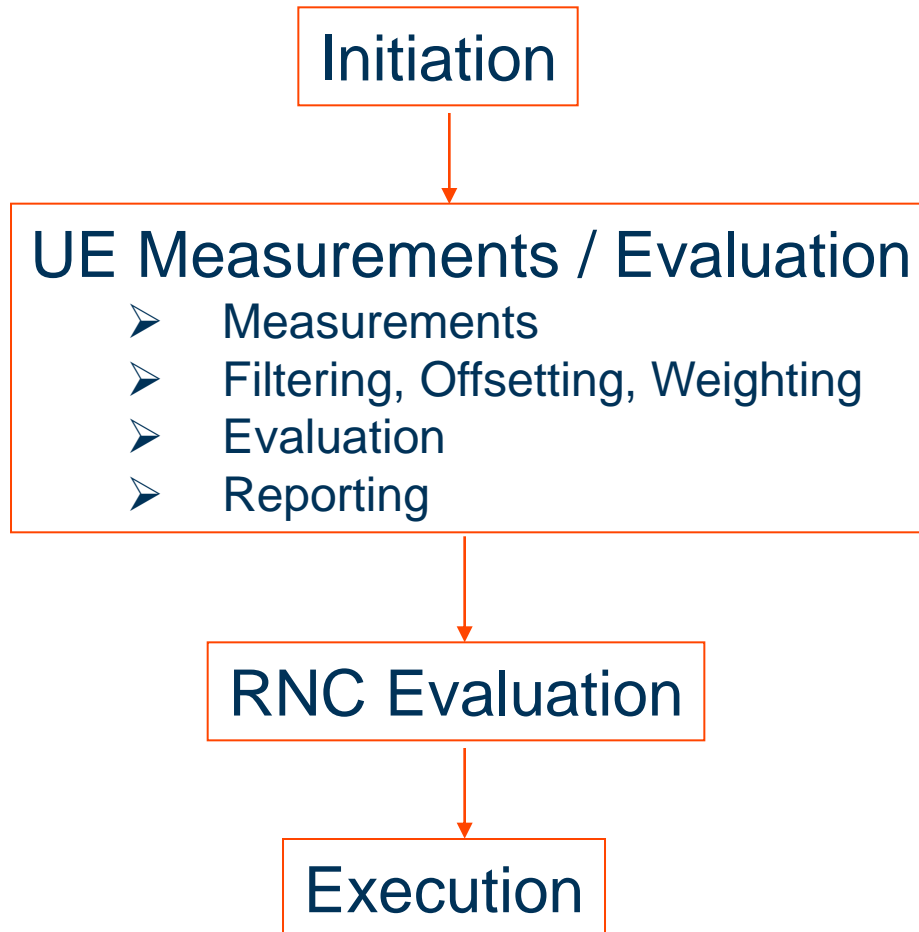
Types of Handover

- Handovers are needed to maintain calls when moving between cells in active/dedicated mode (CELL_DCH Mode).
- Cell reselection is the procedure used in idle or when connected in common channels (Cell_FACH mode) when moving between cells
- Types of handover
 - Soft/Softer Handover (among Different RBS/Same RBS on the same WCDMA Carrier)
 - IFHO (among Different WCDMA Carriers)
 - IRAT HO (Inter Radio Access Technology Handover - Voice)
 - IRAT Cell Change (Inter Radio Access Technology Handover Cell Change – Packet)
 - Service Based Handover (IRAT HO (Speech RAB only) to GSM based on service needs like coverage)
 - CNHHO – CS Hard HO to another RNS based on core network measurements (Optional feature)
 - HS-DSCH Cell Change (HSDPA Mobility)

Handover Entities



Overall Process



Initiation

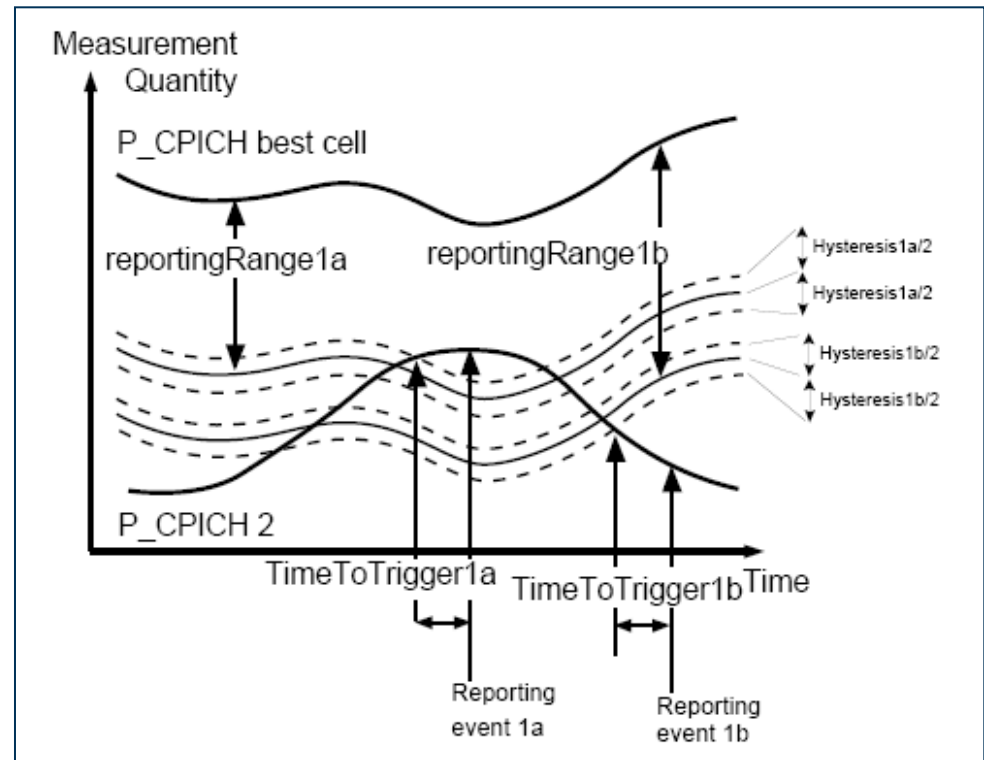
- Event Based triggering where UE is involved in the decision.
- Evaluation and reporting can be based on CPICH Ec/No or CPICH RSCP.
 - SHO , CNHHO : CPICH Ec/No is default
 - HSCC Evaluation : CPICH RSCP is default
- For IRAT HO and IFHO, Ue Tx (UL) power can also be taken as an input

Measurements

- From the Ue perspective all the cells are divided into one of these subsets according to 3GPP
 - **Active Set (AS):** The cells involved in soft handover and measured by the UE
 - **Monitored Set (MN):**
 - The monitored set is created from the neighbor cell lists of all the cells in the Active Set
 - The max number of cells in each set is 32.
 - **Unmonitored set:** cells excluded from MN set because MN set is full. UE is not ordered to measure them.
 - **Detected Set (DN) :** The intra frequency cells detected by the UE but not part of Active Set or monitored set. (Can then be an Unmonitored or a Missing neighbor)

Event 1a, Primary CPICH enters Reporting Range

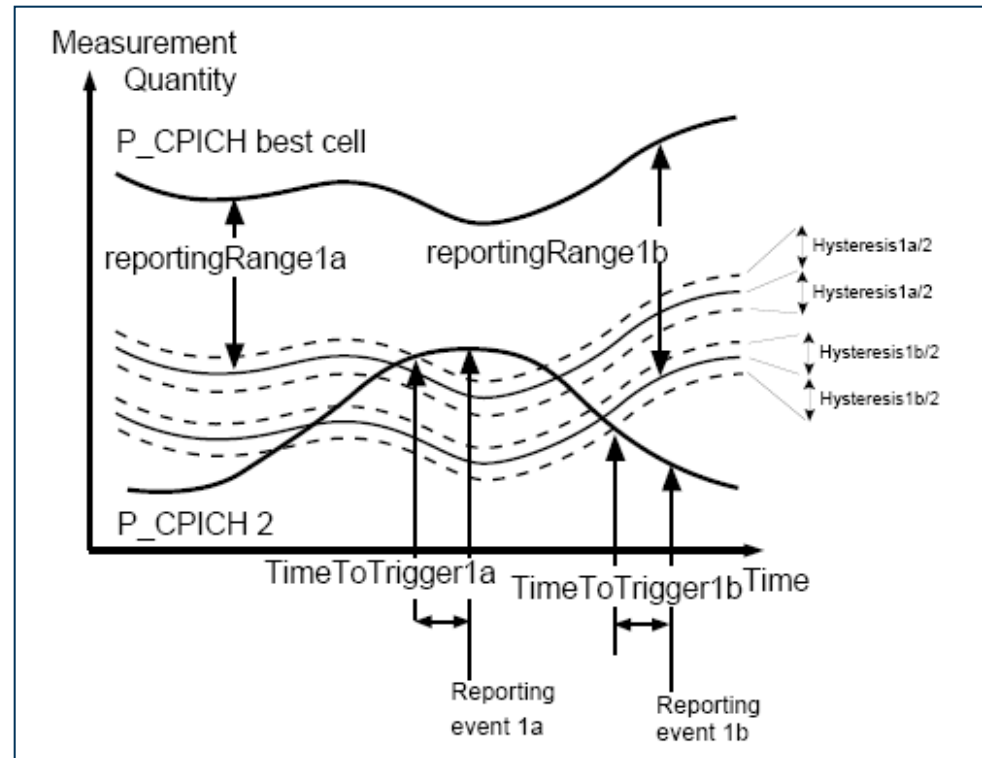
- Reported Cell not in AS
- Hysterisis and Time to trigger used to prevent ping pong reports
- If more than 1 cell is reported, best cell in terms of E_c/N_o is taken into consideration
- If AS is not full, Cell is Added otherwise worst cell is replaced (event 1c)



➤ Both event 1a and 1b are depicted here.

Event 1b, Primary CPICH leaves reporting range

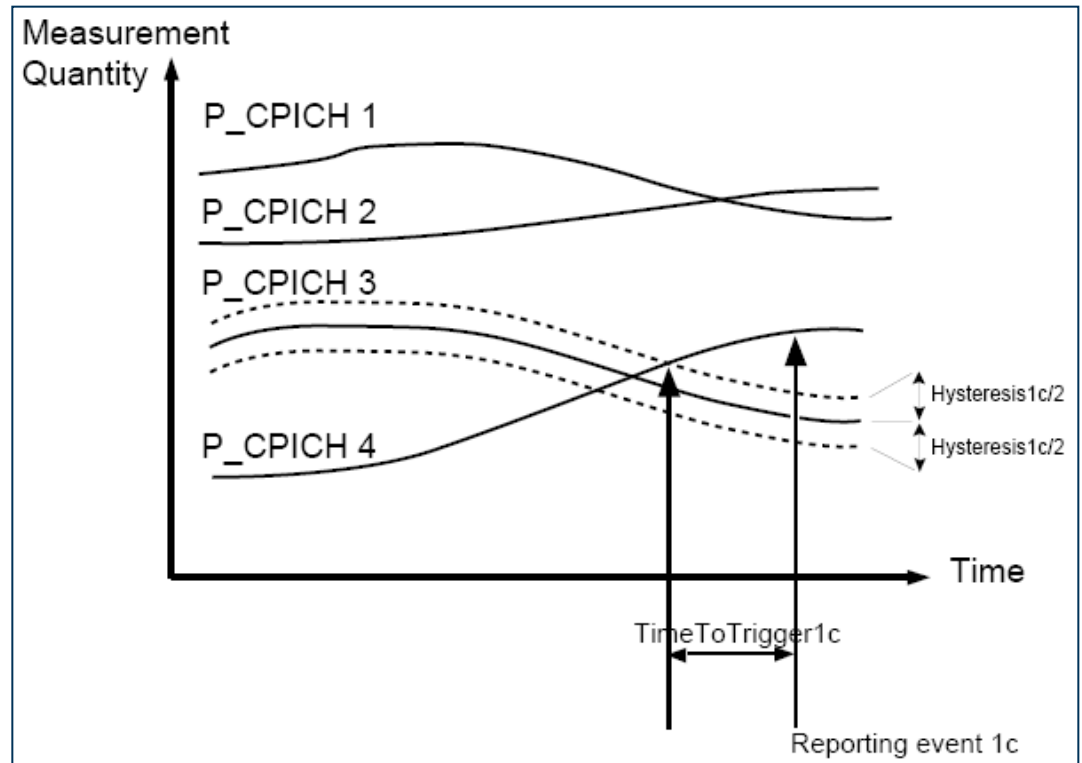
- Reported Cell is in AS
- Hysteresis and Time to trigger used to prevent ping pong effect.
- If more than 1 cell is reported only 1 cell is removed at a time but the last cell is never removed



➤ Both event 1a and 1b are depicted here.

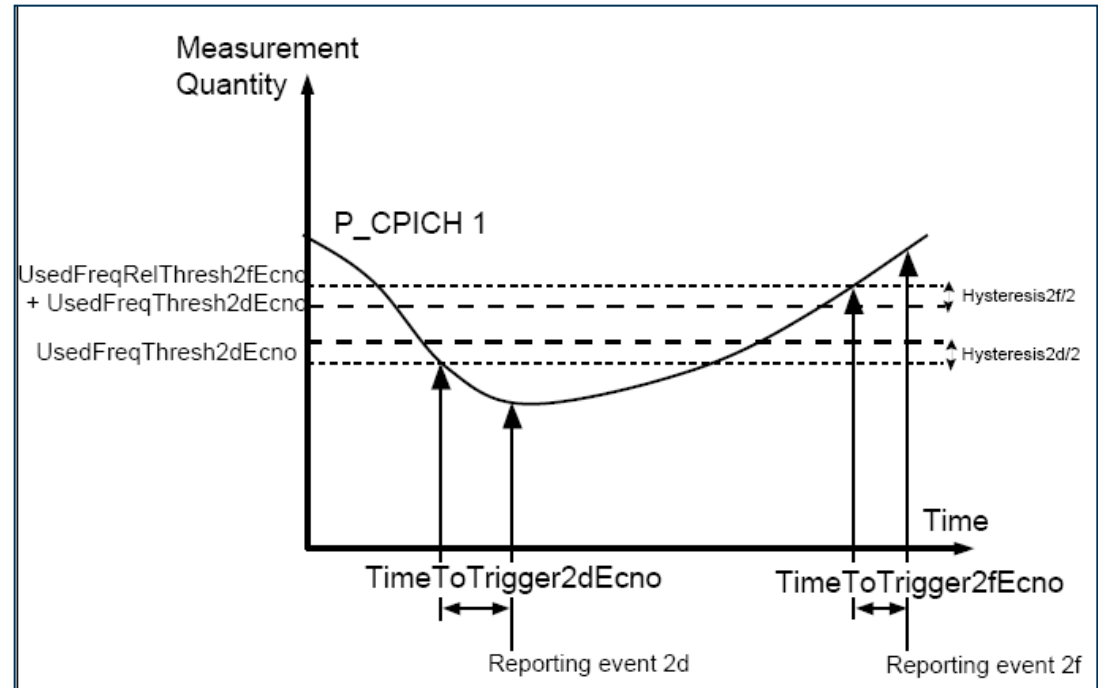
Event 1c, A non-active primary CPICH becomes better than an active Primary CPICH

- Reported cell is not in AS
- AS is full
- Worst cell is replaced.
- Hysteresis and TimeToTrigger used to prevent ping pong
- If more than 1 cell is reported only 1 cell with best Ec/No is taken into consideration



Event 2d, Estimated Quality of current frequency is below a threshold

- Threshold is either RSCP or EcNo
- Will be used to trigger IRAT(or IFHO) measurements
- Hysteresis and Time to trigger used to prevent ping pong effect.
- The consequent measurements for IRAT (or IFHO) will be based on whether 2d was triggered on RSCP or EcNo

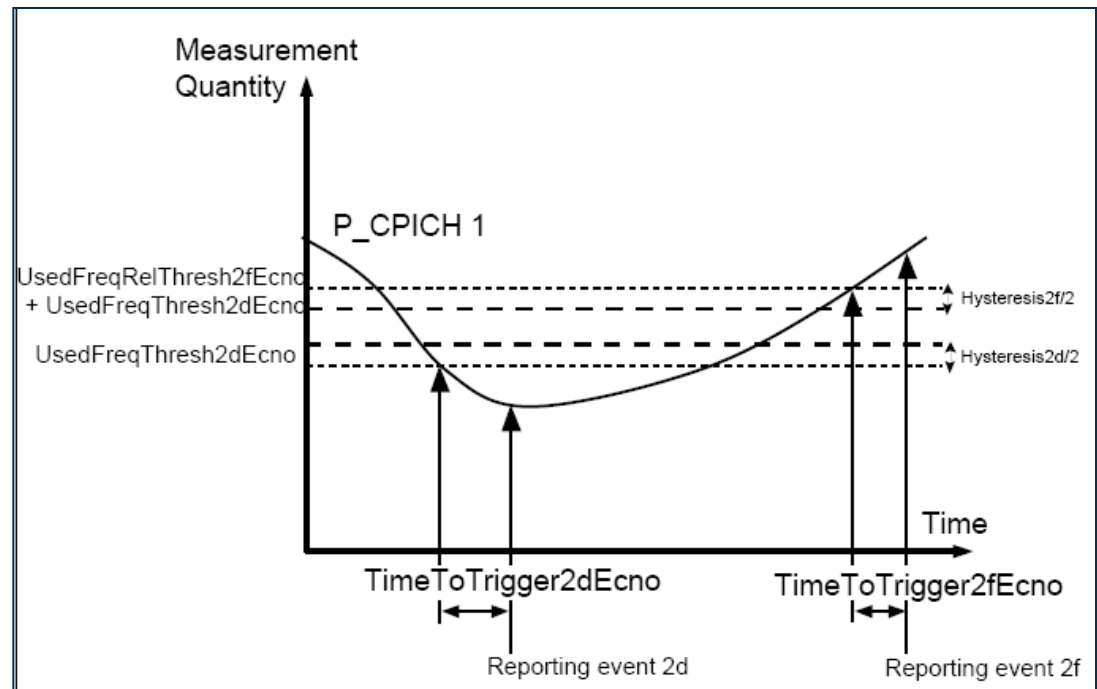


Note: Only EcNo based threshold is shown in above figure

➤ Action: UE enters Compressed Mode and starts measuring IRAT (or IFHO) neighbors

Event 2f, Estimated Quality of current frequency is above a threshold

- Both RSCP and EcNo thresholds have to be triggered.
- Hysteresis and Time to trigger used to prevent ping pong effect.
- If Event 2f is triggered measurements for IFHO and IRAT HO are stopped.

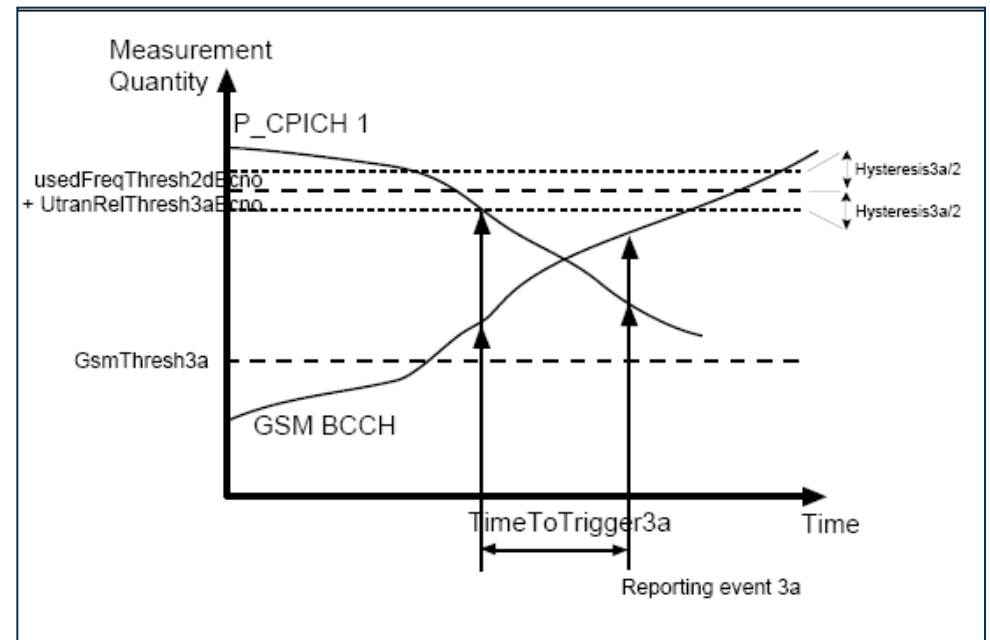


Note: Only EcNo based threshold is shown in above figure

➤ Action: UE exits Compressed Mode and stops measuring IRAT (or IFHO) neighbors

Event 3a, Estimated quality of current used frequency is below a certain threshold and estimated quality of the other system is above a certain threshold

- Measurement quantity is either RSCP or EcNo based on which triggered event 2d
- Hysterisis and Time to trigger used to prevent ping pong effect.
- SRNC gets resources from GSM and handover is performed
- BSIC has to be decoded before handover can be performed.



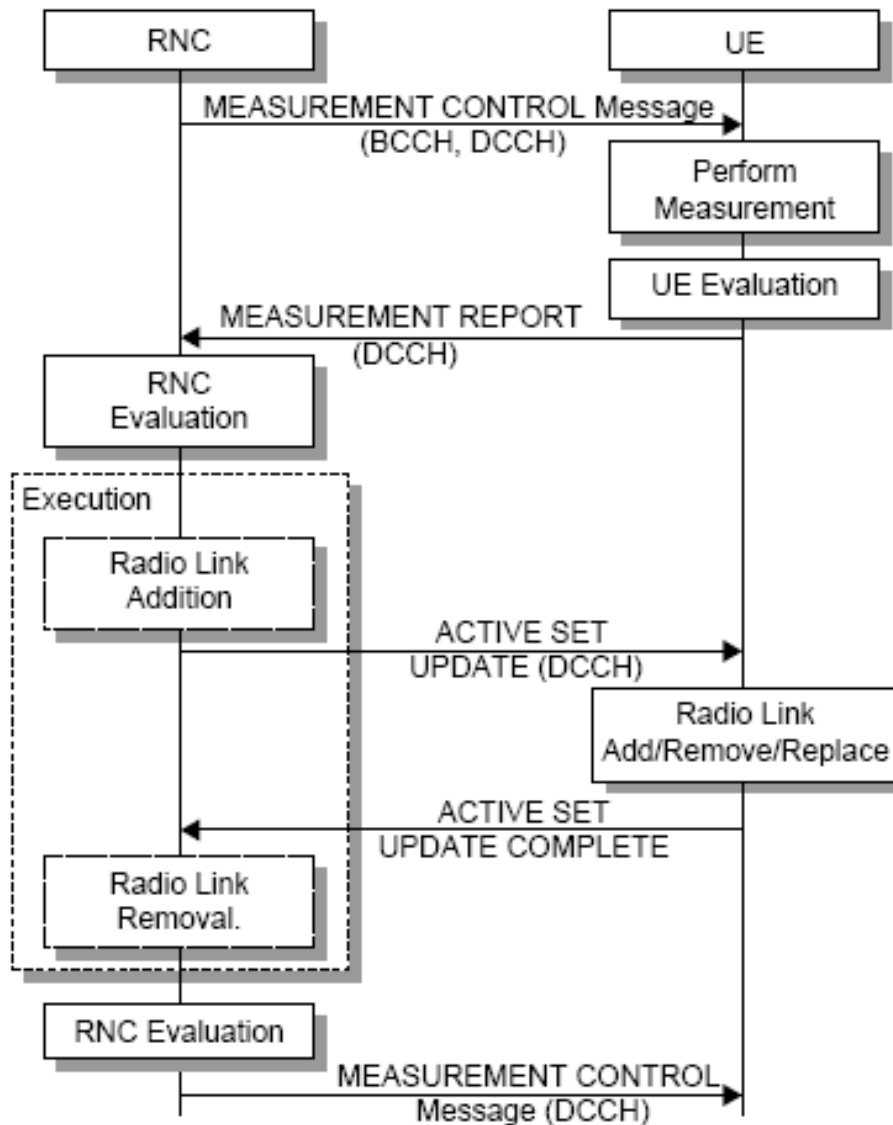
Note: Only EcNo based threshold is shown in above figure

➤ Action: UE asks to perform IRAT HO on a selected GSM cell

Evaluations

- Based on the measurement reports received , the RNC will check whether cell is valid or not .
- An invalid cell is one which is not part of any Active, Monitored , or Unmonitored list (ex: missing neighbor)
- When UE reports an Invalid cell the connection is dropped when this cell becomes *releaseConnOffset* dBs stronger than the best cell in the AS. This is to prevent the invalid cell to create too much UL interference as it cannot be power controlled by the cells in AS.

SHO Process

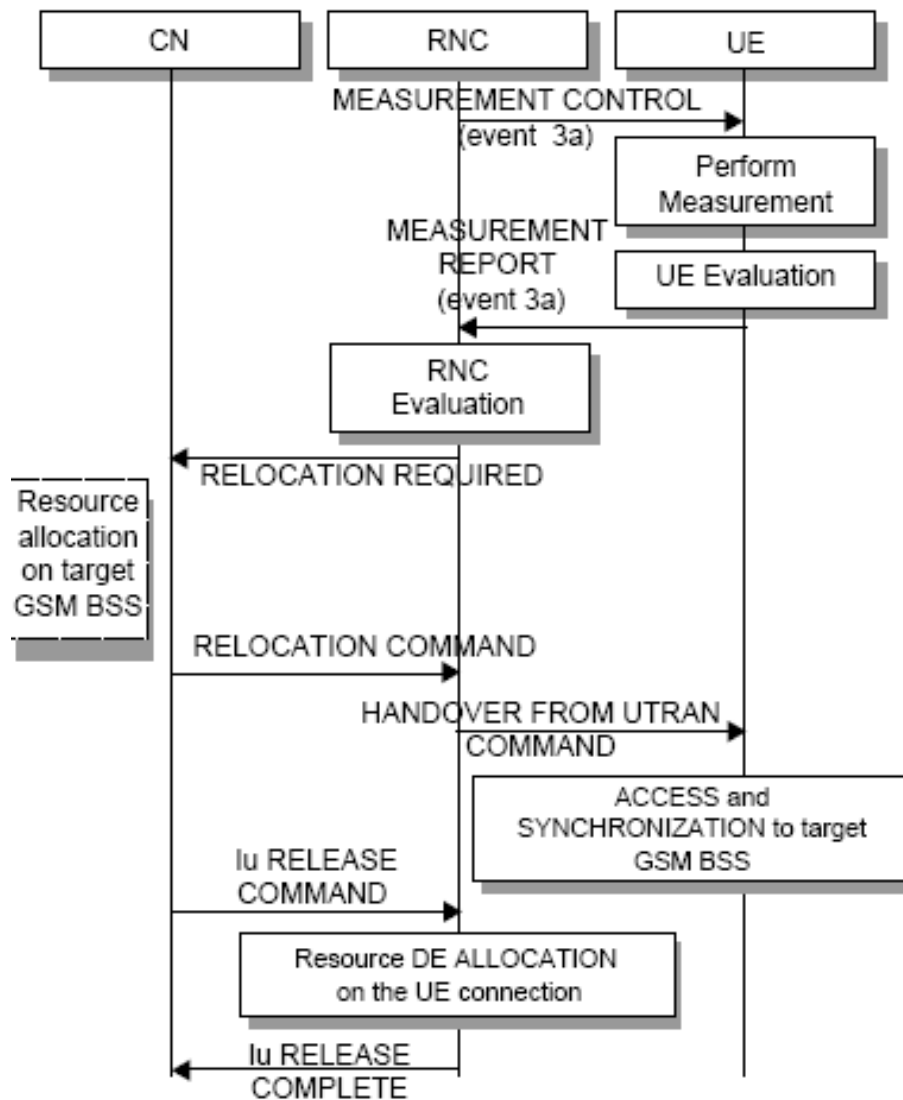


End result of the process is one of the following

- Radio Link addition
- Radio Link removal
- Combined Radio Link addition and Radio Link removal
- New proposal rejection, actual Active Set is maintained
- Connection is released

➤ Measurement Control (which contains the list of cells the UE has to measure) might not be sent in case there is no change in the Monitored set from previous state.

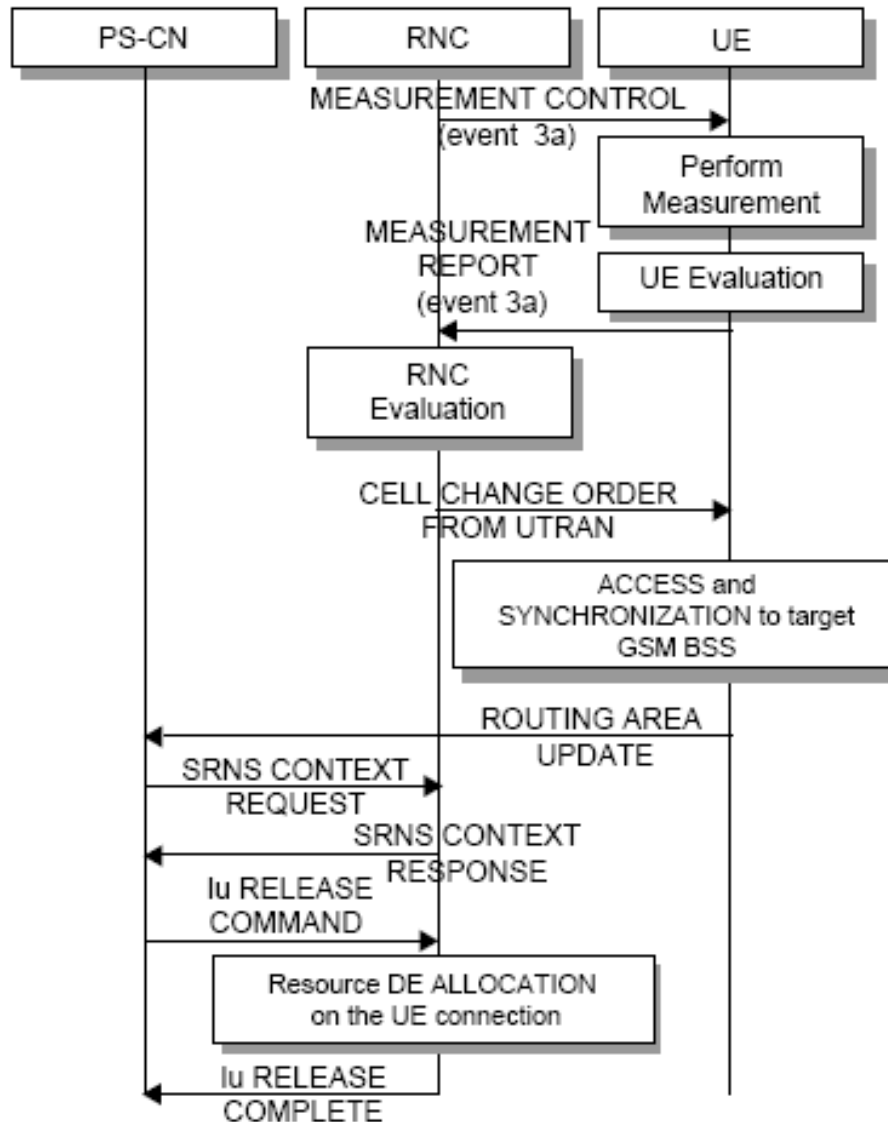
IRAT Process



End result of the process is one of the following

- Hand over the UE connection to a GSM/GPRS cell. That is, the UE is finally connected to the GSM/GPRS cell and WCDMA RAN resources related to the UE connection are released.
- The UE connection remains on the WCDMA RAN due to a handover to GSM/GPRS failure.

IRAT Cell Change Process



End result of the process is one of the following

- The UE, in CELL_DCH state, changes cell and continues connected to a Packet-Switched service in the new GSM/GPRS cell.
- The UE, in CELL_FACH state, reselects cell and the UE contacts the new GSM/GPRS system.
- The UE remains in the WCDMA RAN connected to a Packet-Switched service, due to Inter-RAT Cell Change failure

SUPPORTING SLIDES

Event 2b, Estimated Quality of current frequency is below a threshold and estimated quality of non – used frequency is above a threshold

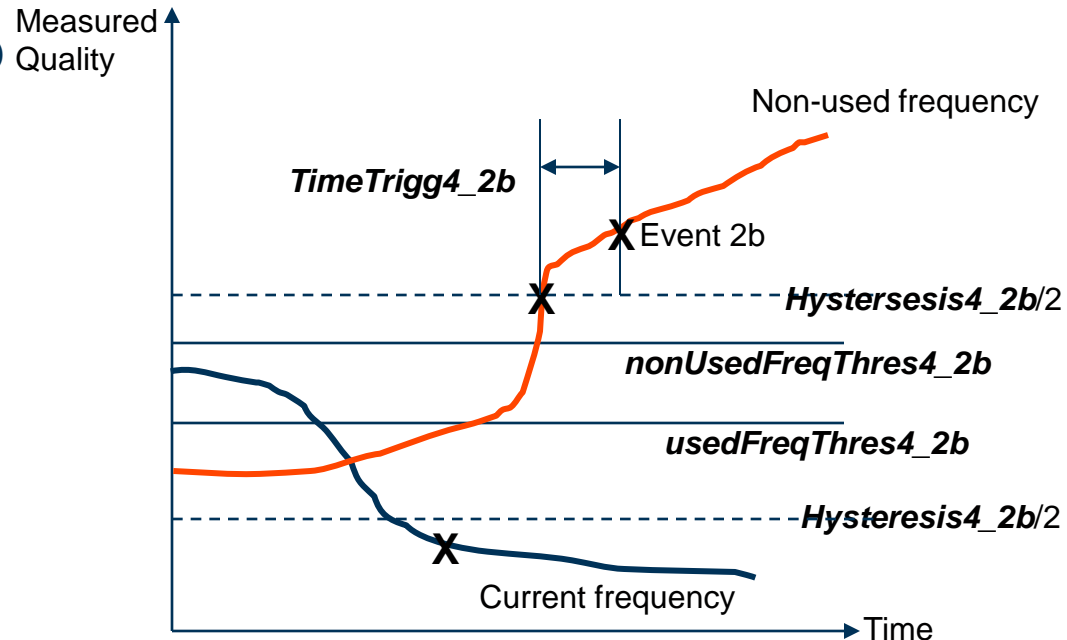
1. Event 2b is triggered if 2 conditions are satisfied

a) Initial trigger for event 2d for IFHO eval

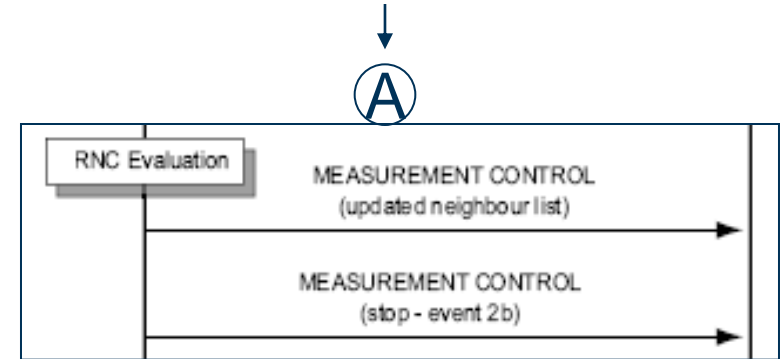
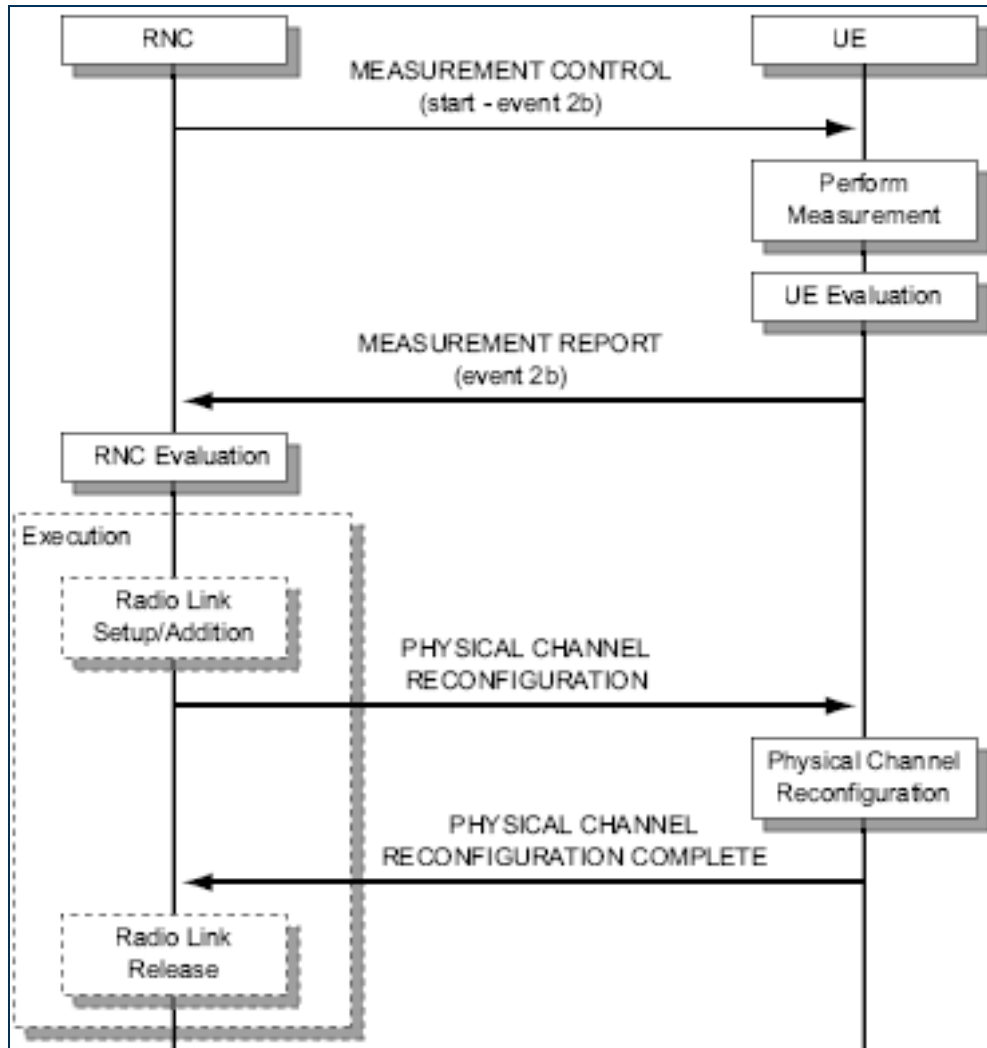
b) Estimated quality of non used frequency is above absolute thresholds (includes both RSCP and EcNo) given by

(NonUsedFreqThresh4_2bEcno + Hyst4_2b/2 and NonUsedFreqThresh4_2bRscp + Hyst4_2b/2, during a time at least equal to timeTrigg4_2b)

2. SRNC gets resources from the indicated cell using the other frequency and handover is performed.



IFHO Process



End result of the process is one of the following

- Handover the UE connection to a new WCDMA RAN frequency succeeds. Resources related to the old Active Set are released.
- The UE connection remains on the old Active Set on the source frequency due to a handover failure.

Event 6a, The Ue Tx Power becomes larger than an absolute threshold

- If the Ue Tx power is higher than a threshold, defined by ueTxPowerThresh6a for a time at least equal to timeTrigg6a , UE sends a measurement report for 6a.
- No hysteresis is used in this evaluation
- This is used to trigger IFHO or IRAT HO based on parameter settings. Only RSCP based measurements are triggered.
- An additional threshold utranRelThreshRscp is used when IFHO and IRAT HO is triggered based on event 6a

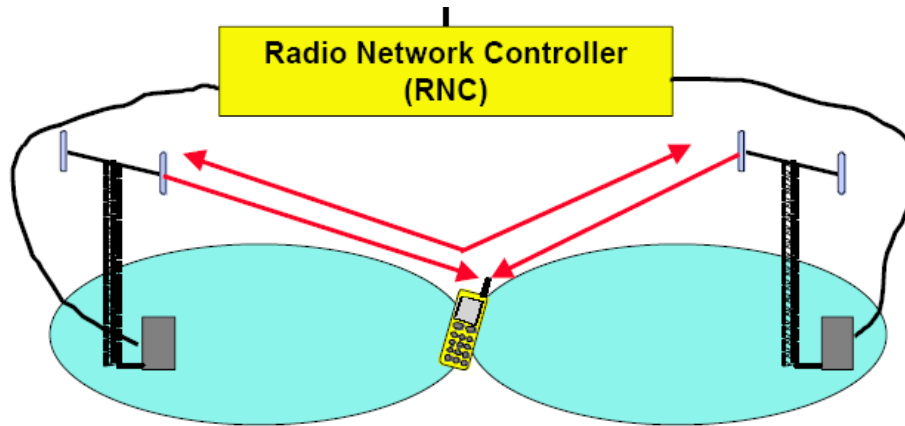
Event 6b, The Ue Tx Power becomes less than an absolute threshold

- When the Ue TX power becomes less than an absolute threshold ueTxPowerThresh6b for a time at least equal to timeTrigg6b , event 6b is triggered.
- No hysteresis is used in this evaluation
- When SRNC receives this measurement report, IFHO/IRAT HO evaluations are stopped.

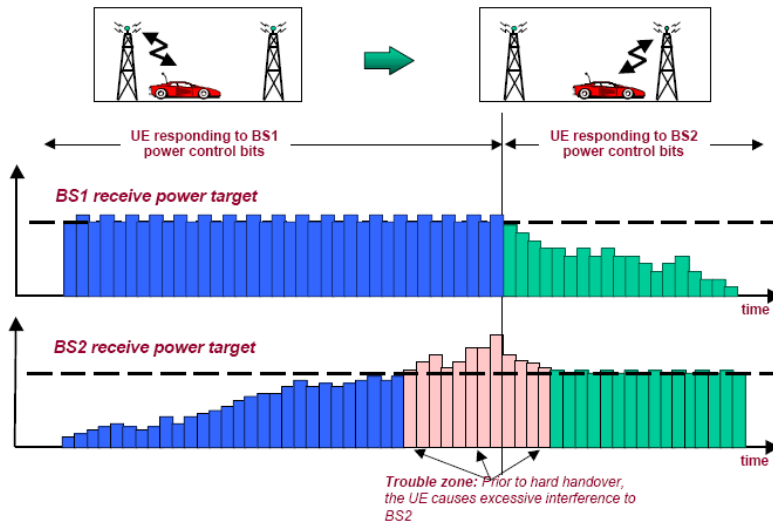
Soft/Softer Handover – Most common handover

- In DL, the UE performs maximum ratio combining In RAKE receiver leading to
 - Protection against fading
 - Power needed by Node B is lower , leading to reduction of DL interference and better system capacity
- In the UL , selection combining is performed in case of Soft handover and maximum ratio combining in case of softer handover leading to
 - Less power transmitted by the UE leading to reduced UL interference and better system capacity

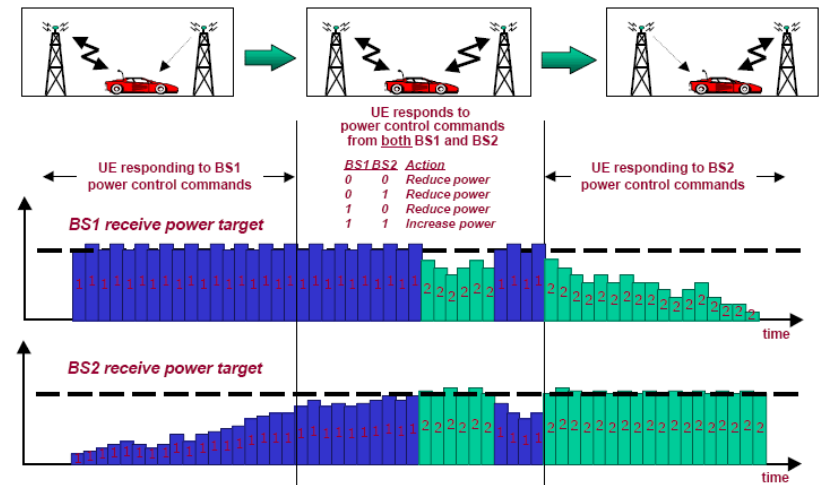
Soft handover – Example of Advantage



Power Control without Soft Handover



Power control with Soft Handover





TAKING YOU FORWARD