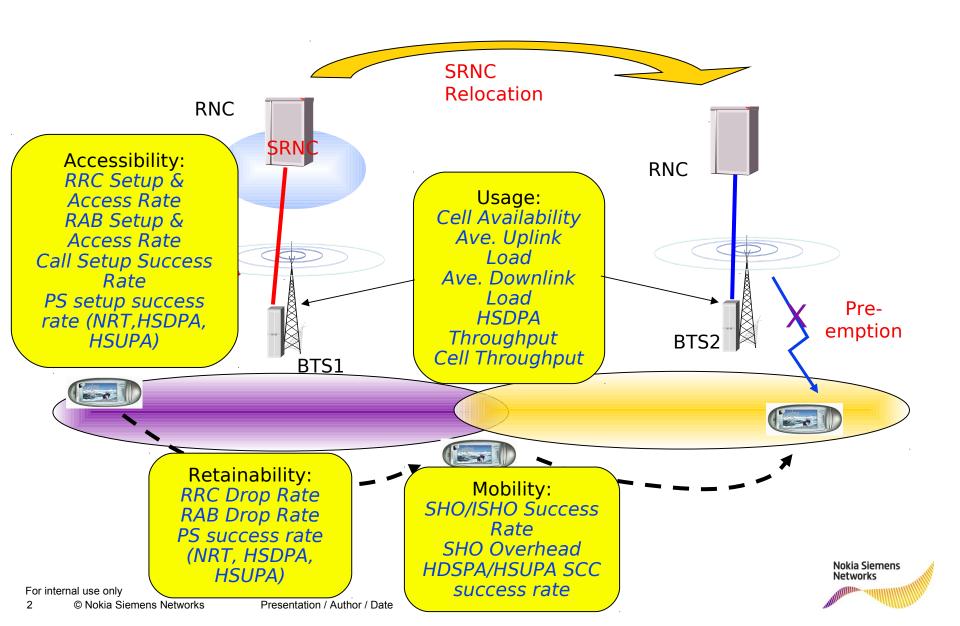
## WCDMA: KPI ANALYSIS & OPTIMIZATION

**Nitin Agarwal** 

**Network Planning& Optimization** 



## Illustration on RAN KPI-RU20



## **Genuine Call Setup Failure Scenarios**

- RF issue
  - Interference / Dominance / Coverage
  - Missing neighbour
- System Issue BTS
  - No response to "RRC Connection Request"
  - "RRC Connection Reject" to "RRC Connection Request"
- System issue RNC
  - "CC Disconnect" after "Call Proceeding" due to "DL RRC Connection Release"
- Core NW
  - "CM Service Abort" after "CM Service Request"
- System issue (test number)
  - "CC Disconnect" after "CC Progress"



## **Genuine Drop Call scenarios**

#### RF issue

- Interference / Dominance / Coverage
- Missing Neighbours

### System issue BTS

- Sudden "CC Disconnect" due to "DL RRC Connection Release"
- Sudden drop to idle, no disconnect messaging

## System issue RNC

Sudden "CC Disconnect" due to "DL RRC Connection Release"



## **KPI Definitions**

#### The KPIs to be monitored from the RAN could be:

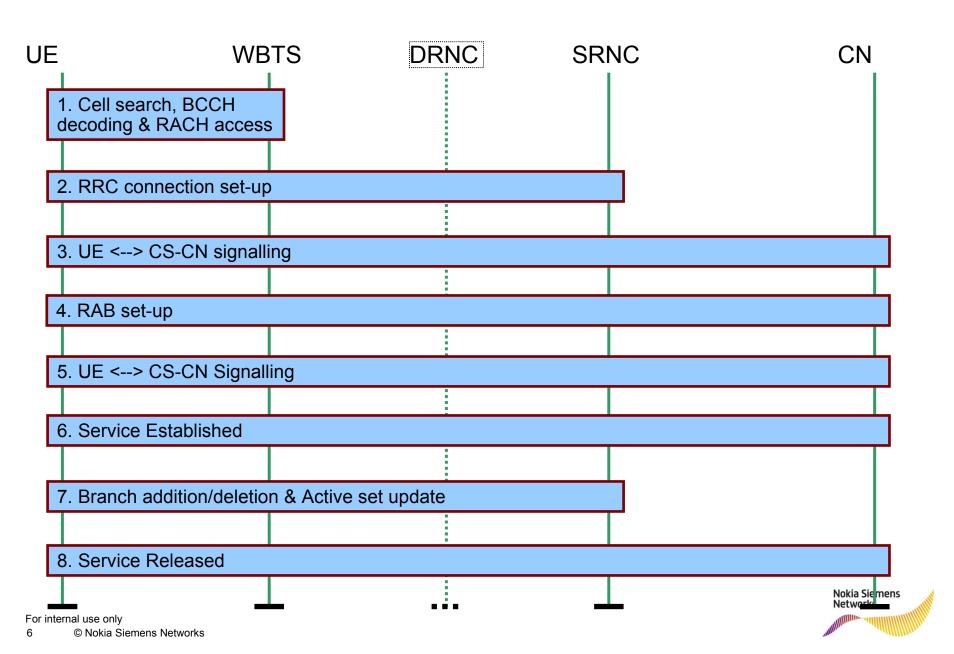
- Cell availability
- Call Setup Success Rate (CSSR)
- Call Drop rate
- SHO/ISHO/HSPA SCC success rate
- Packet Session setup/success rate (NRT, HSDPA, HSUPA)

#### In NOLS:

- RNC counter description
- NetAct DB description for RNC measurements
- WCDMA RAN Key Performance Indicators
- Key Indicator Changes
- Measurement Changes



## **AMR CS Call Phases**



## **Base Station Alarms**

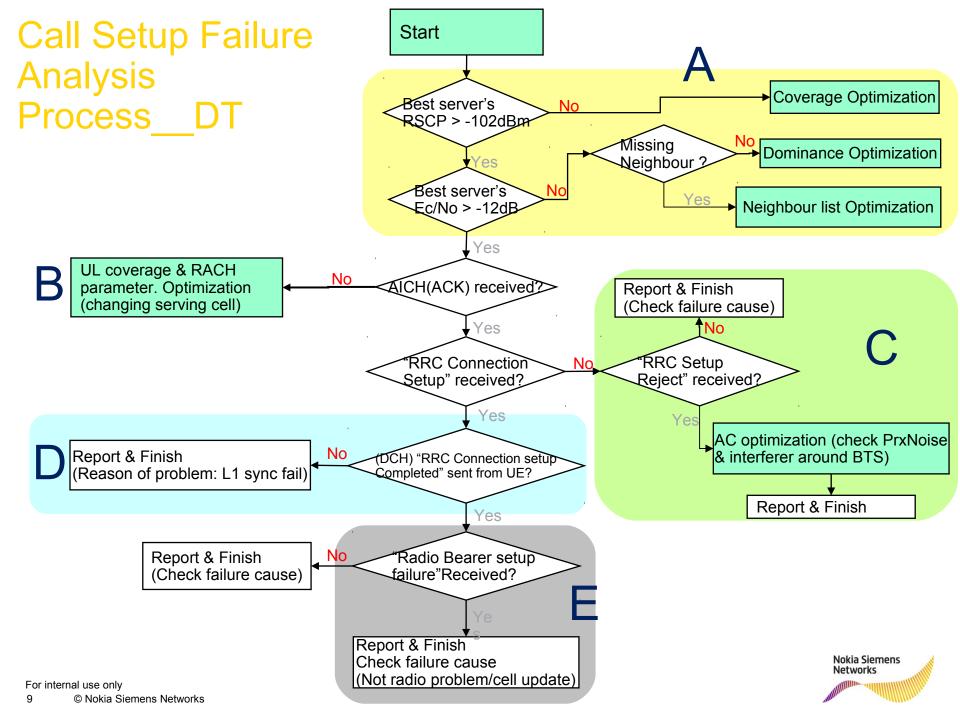
Alarm Number	Alarm Text
7401 - 7425	"External, user defined alarms"
7650	7750 FAILURE IN WCDMA WBTS O&M CONNECTION
7651	BASE STATION OPERATION DEGRADED
7652	BASE STATION NOTIFICATION
7653	CELL FAULTY
7654	CELL OPERATION DEGRADED
7655	CELL NOTIFICATION
7660	BASE STATION LICENCE EXPIRED
7661	BASE STATION LICENCE NOTIFICATION
7665	BASE STATION LICENCE TRANSMISSION ALARM
7740	BEATING WCDMA BTS ALARM
7750	FAILURE IN WCDMA BTS O&M CONNECTION
7761	RNW O&M SCENARIO FAILURE
7762	RNW DATABASE OPERATION FAILURE
7771	WCDMA CELL OUT OF USE
7772	HSDPA CONFIGURATION FAILED
7775	INCONSISTENCY IN WCEL CONFIGURATION PARAMETERS
7776	HSDPA FAILURE IN WCEL
7778	WCDMA BTS DEDICATED MEASUREMENT FAILURE
7780	HSUPA FAILURE IN WCEL
7782	HSUPA CONFIGURATION FAILED
7799	RNC RADIO NETWORK TEST ALARM



## Alarm Examples Related to Access Transmission

- 7651 BASE STATION OPERATION DEGRADED, WSC oven oscillator fault
  - The oven oscillator adjusting area has reached its limit value.
- 7652 BASE STATION NOTIFICATION, Step change of oven oscillator control more than 10% of maximum control range
  - The DAC word has changed more than 204 steps. If the ratio between the reference frequency from lub and the reference oscillator frequency of the BTS is too large, this alarm is generated. The reference clock from lub or WSC/WMC can be unstable.
- 7651 BASE STATION OPERATION DEGRADED, Transmission clock missing
  - Calculating the DAC word is stopped when the fault is active. If a cancel arrives, tuning is re-started. The Base Station can function properly for some time when calculating the DAC word is stopped.
- 7651 BASE STATION OPERATION DEGRADED, Fault in O&M and DSP SW interface
  - SFN synchronization is lost. Illegal SFN value in downlink. The WSP does not receive frame number from the Wideband Application Manager Unit (WAM), or the frame number is faulty.
- 7651 BASE STATION OPERATION DEGRADED, ATM overflow
  - Unable to allocate AAL2 resources. The reason for this could be lack of transmission capacity.

Networks



# Call setup failures – Missing Neighbour



Missing neighbour analysis over the whole route (3G-3G, 3G-2G)

Search for failures due to missing 3G-3G neighbours Search for failures due to missing 3G –2G neighbours

It is suggested to place 2G scanner to the test vehicle



# Call Setup Failure Analysis- Block B -

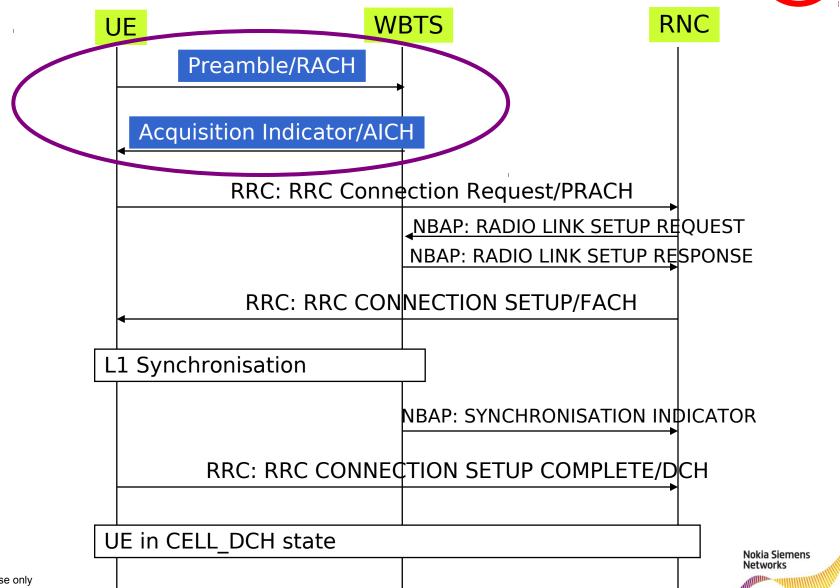


- The purpose of this activity is to check the Random Access Process is working adequately by investigating whether AI (Acquisition Indicator) has been received through DL AICH
- If AICH was not received by UE, the cause of the problem can be classified into:
- Inadequate RAN parameter related to Random Access: RAN parameter settings for pre-amble transmission or open loop power control information is not correct.
- UL Coverage limit: UL coverage of UE is smaller compared to serving cells DL coverage so that UE's Tx power cannot reach serving cell.



## Call Setup Failure Analysis- Block B -

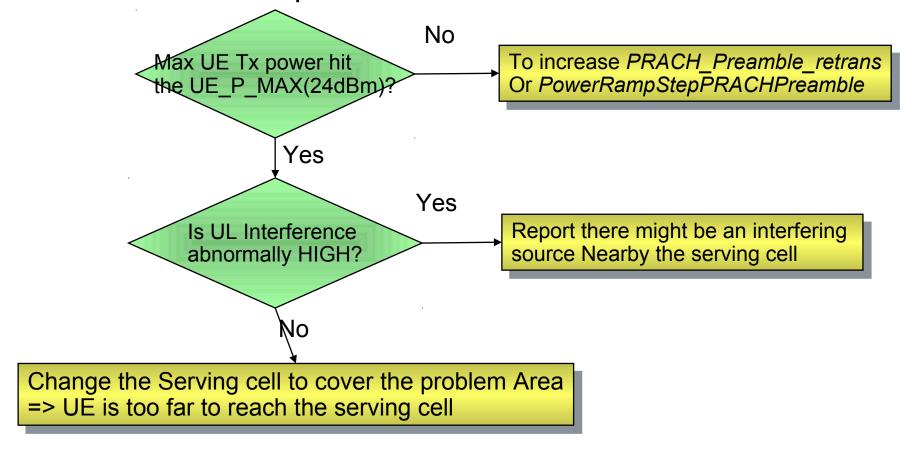




# Call Setup Failure Analysis- Block B-



## Solutions for RACH optimisation



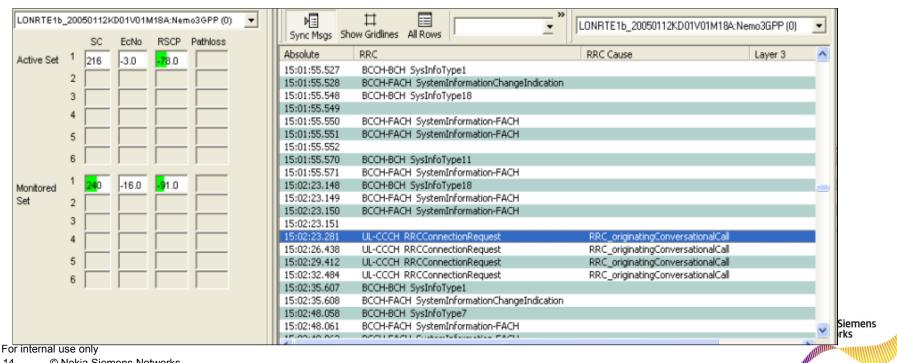


## Call setup failures – System issue BTS



#### No response to "RRC Connection Request"

- Good RF conditions
- Wrong MHA settings or cable loss settings can cause the site not to "hear" the UE
- PrxNoise statistics, receive link parameters and HW units to be checked (faulty MHA, wrong MHA parameters, wrong cable / feeder loss parameters, faulty units)



## Call setup failures – System issue BTS



## "RRC Connection Reject" after "RRC Connection Request"

- Good RF conditions
- Admission Control can reject too many (or admit too many) connection requests due to wrong PrxNoise measurements.
- PrxNoise statistics, receive link parameters and HW units to be checked

Absolute	RRC	Layer 3	
11:18:58.297	BCCH-BCH SysInfoType1		
11:18:58.297	BCCH-BCH SysInfoType2		
11:18:58.299	BCCH-BCH SysInfoType7		
11:18:58.299	BCCH-BCH SysInfoType18		
11:18:58.421	UL-CCCH RRCConnectionRequest		
11:18:58.565	DL-CCCH RRCConnectionReject		
11:19:01.564	UL-CCCH RRCConnectionRequest		
11:19:01.705	DL-CCCH RRCConnectionReject		
11:19:04.704	UL-CCCH RRCConnectionRequest		
11:19:05.090	DL-CCCH RRCConnectionSetup		
11:19:05.385	UL-DCCH RRCConnectionSetupComplete		
11:19:05.389	UL-DCCH InitialDirectTransfer	MM CM Service Request	
11:19:05.540	UL-DCCH MeasurementReport		
11:19:06.039	UL-DCCH MeasurementReport		
11:19:06.259	DL-DCCH ActiveSetUpdate		
11:19:06.271	UL-DCCH ActiveSetUpdateComplete		ļ.
11:19:06.419	UL-DCCH MeasurementReport		

# **Call Setup Failure Analysis**



UE has the appropriate DL/UL coverage but if RNC does not allow to set up the RRC connection of the requested RAB (Radio Access Bearer), Call setup will fail.

Admission Control (AC) is involved in RRC connection setup. AC can reject RRC reject RRC connection Setup due the DL Load, UL load or DL Spreading codes

### Marginal Load Area:

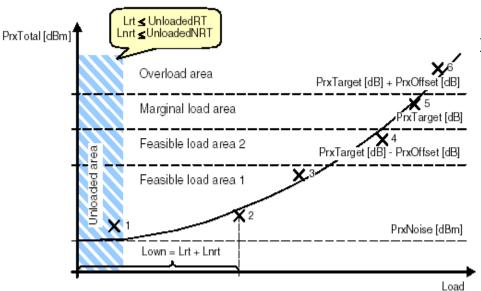
 If measured UL (PrxTotal) or DL (PtxTotal) load exceeds target thresholds (PrxTarget and PtxTarget) AC can still admit new RAB to the cell if a new non-controllable load keeps below target thresholds (in practice this means that AC can admit only new controllable load RABs i.e. NRT RABs)

#### Overload Area:

 If measured UL (PrxTotal) or DL (PtxTotal) load exceeds overload thresholds (PrxTarget + PrxOffset and PtxTarget + PtxOffset) then AC can't admit more RABs to the cell



### **UL Interference Performance Indicators**



- PrxTotal values are presented according to table on right
- BTS reports total UL interference (RSSI) with a resolution of 0.1 dB with the range [-112, ...,-50] dBm
- The correct value in dBm can be obtained by formula:

$$-112.0$$
dBm + (RSSI\_LEV)/10

**X** = collected sample of PrxTotal measurement

- Sample 1 : Unloaded
- Sample 2 : Feasible load area 1
- Sample 3 : Feasible load area 1
- Sample 4 : Feasible load area 2
- Sample 5 : Marginal load area
- Sample 6 : Overload area

```
RSSI LEV 000:
                   RSSI < -112.0 dBm
RSSI LEV 001:
                   -112.0 dBm <= RSSI < -111.9 dBm
RSSI LEV 002:
                   -111.9 dBm <= RSSI < -111.8 dBm
RSSI LEV 619:
                   -50.2 dBm <= RSSI < -50.1 dBm
RSSI LEV 620:
                   -50.1 dBm <= RSSI < -50.0 dBm
RSSI_LEV _621:
                   -50.0 dBm <= RSSI
```



### **UL Interference Performance Indicators**

 The PrxTotal measurements are divided into classes according to following criteria:

CLASS	AREA	INCREMENTED IF
CLASS 0	Unloaded	(Lrt= <unloadedrt) (lnrt="&lt;UnloadedNRT)&lt;/td" and=""></unloadedrt)>
CLASS 1	Feasible_Load_Area_1	(PrxTarget -PrxOffset >= PrxTotal ) AND ((Lrt>UnloadedRT) OR (Lnrt>UnloadedNRT))
CLASS 2	Feasible_Load_Area_2	(PrxTarget > PrxTotal > PrxTarget -PrxOffset) AND ((Lrt>=UnloadedRT) OR (Lnrt>= UnloadedNRT))
CLASS 3	Marginal_Load_Area	(PrxTarget + PrxOffset > PrxTotal >=PrxTarget) AND ((Lrt>UnloadedRT) OR(Lnrt> UnloadedNRT))
CLASS 4	Overload_Area	(PrxTotal >= PrxTarget + PrxOffset) AND ((Lrt>UnloadedRT) OR (Lnrt>UnloadedNRT))

 Based on the 'INCREMENT IF' criteria the CLASS is selected and the measurement result is assigned to the corresponding class and the amount of samples in the class is put into the PRXTOT\_DENOM\_0

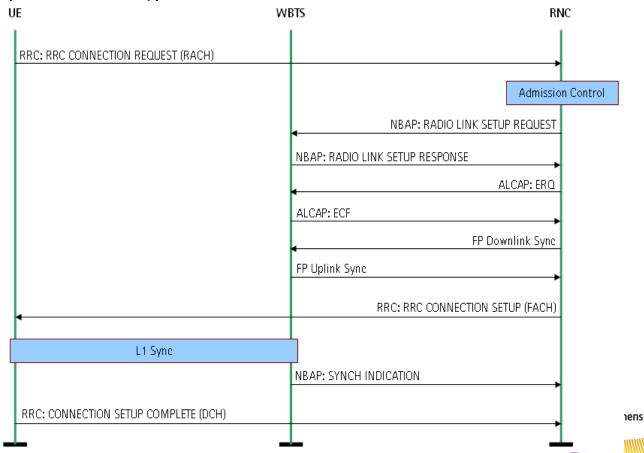


# **Call Setup Failure Analysis**



## To check if Layer 1 Synchronization (slot/frame sync) has failed

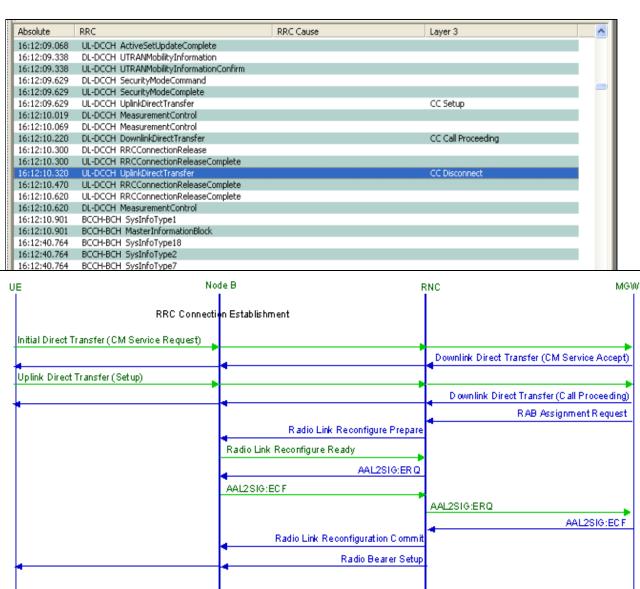
If "RRC Connection Setup" was received by UE but UE does not send "RRC Connection Setup Completed", we will report "L1 synchronization failure" and have to check L1 system messages.



## Call setup failures – System issue RNC

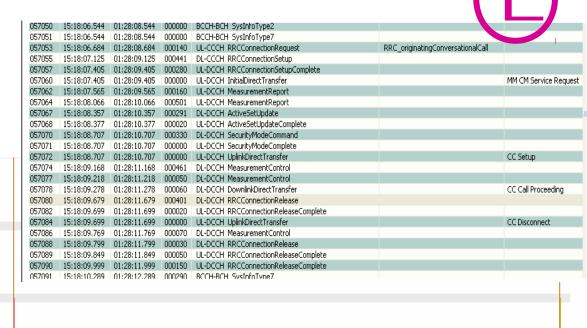


- "CC Disconnect" after "Call Proceeding"
- Good RF conditions
- Failures in RAB setup occur between the "RAB Assignment Request" being received from Core Network and the RAN sending out Radio Bearer Setup. Therefore the failure is between BTS and Core Network.



# Call setup failures – System issue RNC

- "CC Disconnect" after "Call Proceeding" (cont.)
- An example (site shows) high values on counter "RAB STP\_FAIL\_CS\_VOI CE\_BTS" during the drive test
- In the recent check the counter showed no failures





## Call setup failures – Core NW



"CM Service Abort" after "CM Service Request"

Good RF conditions

"Security Mode Command"message not received by UE, thus the failure is believed to be at Core Network.

Ш	037040	17:20:17:275	01:23:31.273	0000
	057041	17:26:17.415	01:23:51.415	0001
	057042	17:26:17.415	01:23:51.415	0000
	057044	17:26:17.415	01:23:51.415	0000
	057048	17:26:17.916	01:23:51.916	0005
	057049	17:26:18.226	01:23:52.226	0003
	057052	17:26:18.226	01:23:52.226	0000
	057054	17:26:18.386	01:23:52.386	0001
	057057	17:26:18.887	01:23:52.887	0005
	057059	17:26:18.907	01:23:52.907	0000
	057060	17:26:18.917	01:23:52.917	0000
	057062	17:26:19.218	01:23:53.218	0003
	057063	17:26:19.228	01:23:53.228	0000
	057067	17:26:22.302	01:23:56.302	0030
	057069	17:26:22.352	01:23:56.352	0000
	057070	17:26:22.462	01:23:56.462	0001
	057072	17:26:22.462	01:23:56.462	0000
	057074	17:26:22.482	01:23:56.482	0000
	057076	17:26:22.623	01:23:56.623	0001
	057077	17:26:22.673	01:23:56.673	0000
	057078	17:26:22.783	01:23:56.783	
	057080	17:26:23.073	01:23:57.073	
	057081	17:26:23.093	01:23:57.093	U
	057082	17:26:23.113	01:23:57.113	
	057083	17:26:23.113	01:23:57.113	
	<			

001010	IT IEO IIT IEIO	OTILOIOTILIO	000000	Decir Derr Systmorypon			
057041	17:26:17.415	01:23:51.415	000140	BCCH-BCH SysInfoType7			
057042	17:26:17.415	01:23:51.415	000000	BCCH-BCH SysInfoType18			
057044	17:26:17.415	01:23:51.415	000000	UL-CCCH RRCConnectionRequest	RRC_originatingConversationalCall		
057048	17:26:17.916	01:23:51.916	000501	DL-CCCH RRCConnectionSetup			
057049	17:26:18.226	01:23:52.226	000310	UL-DCCH RRCConnectionSetupComplete			
057052	17:26:18.226	01:23:52.226	000000	UL-DCCH InitialDirectTransfer		MM CM Service Request	
057054	17:26:18.386	01:23:52.386	000160	UL-DCCH MeasurementReport			
057057	17:26:18.887	01:23:52.887	000501	UL-DCCH MeasurementReport			
057059	17:26:18.907	01:23:52.907	000020	DL-DCCH ActiveSetUpdate			
057060	17:26:18.917	01:23:52.917	000010	UL-DCCH ActiveSetUpdateComplete			Į,
057062	17:26:19.218	01:23:53.218	000301	DL-DCCH_UTRANMobilityInformation			
057063	17:26:19.228	01:23:53.228	000010	UL-DCCH_UTRANMobilityInformationConfirm			
057067	17:26:22.302	01:23:56.302	003074	DL-DCCH MeasurementControl			
057069	17:26:22.352	01:23:56.352	000050	DL-DCCH MeasurementControl			1
057070	17:26:22.462	01:23:56.462	000110	DL-DCCH RRCConnectionRelease			
057072	17:26:22.462	01:23:56.462	000000	UL-DCCH RRCConnectionReleaseComplete			1
057074	17:26:22.482	01:23:56.482	000020	UL-DCCH UplinkDirectTransfer		MM CM Service Abort	
057076	17:26:22.623	01:23:56.623	000141	UL-DCCH RRCConnectionReleaseComplete			
057077	17:26:22.673	01:23:56.673	000050	DL-DCCH RRCConnectionRelease			
057078	17:26:22.783	01:23:56.783					



- RRC: Initial Direct Transfer message is sent using acknowledged mode RLC to the CS core domain. Routing is to be based upon the local P-TMSI
- The NAS message is not read by the RNC but is forwarded to the multimedia gateway. The NAS message includes the IMSI as a UE identity
- The SCCP: Connection Request message establishes the connection orientated signalling link in the same way as it was for the RRC connection phase. This does not reserve any resources for the AMR call itself.
- . The Connection Confirm message identifies the RNC with a destination local reference which is the same as the source reference within the Connection Request message
- The Connection Confirm message identifies the CS core with a source local reference
- The CS core sends a RANAP: Location Reporting Control message to the RNC requesting information regarding the location of a particular UE
- The RANAP: Common ID message specifies the IMSI belonging to the UE
- The Security Mode Command message triggers the start or stop of ciphering and integrity protection.

# **Cell Availability**

- There is also Optional Cell availability KPI, which counts Cell Availability from network point of view. Situation where WCELL is blocked by User are excluded from the formula.
- RNC 727a Cell Availability KPI, excluding blocked by user state (BLU), Counts Cell availability from **network point** of view:

$$Cell\_Availability\_excluding\_BLU\_state = \frac{100*sum(AVAIL\_WCELL\_IN\_WO\_STATE)}{sum\begin{pmatrix} AVAIL\_WCELL\_EXIST\_IN\_RNW\_DB\\ -AVAIL\_WCELL\_BLOCKED\_BY\_USER \end{pmatrix}$$

#### M1000C179 AVAILABILITY WCFLL BLOCKED BY USER

# of samples when WCELL is BLU State. Counter M1000C180 is always updated along with this counter

Counter is updated with the value 1 once in approx. 5 seconds when the WCELL is in BLU state



## **CSSR** definition

CSSR for a specific service is calculated the following way:

CSSR any service = RRC connection setup & access X RAB setup & access any service

RRC part

RAB part



### Low in CSSR?

## Identify call setup failure phases

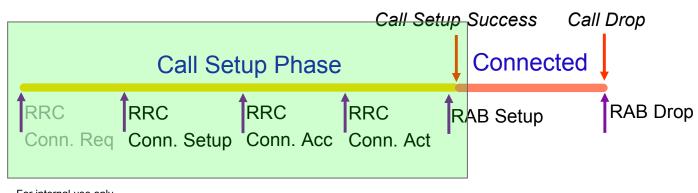


#### **Call Setup Phases**

CSSR affected if any of the followings take

#### place.

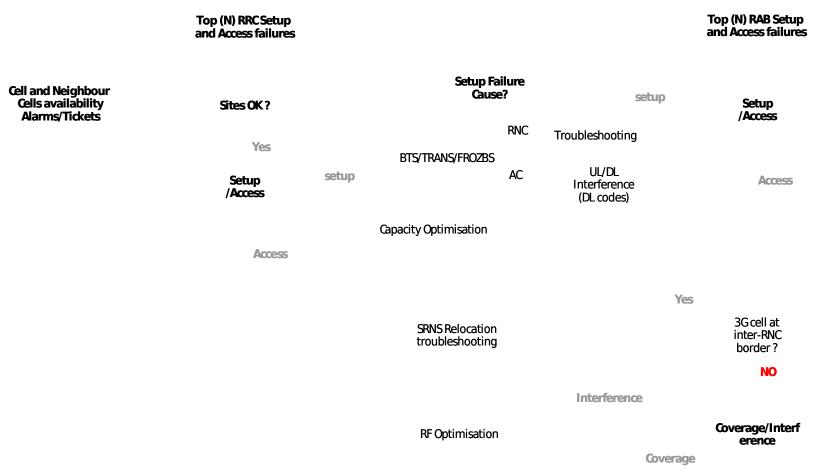
- 1. RRC Conn. Setup Fail
- RRC Conn. Access Fail
- RAB Setup Fail
- 4. RAB Setup Access Fail





### Low in CSSR?

## RRC/RAB Setup & Access Analysis Process Flow Chart





# Call Setup Success Rate (CSSR)

#### Poor CSSR could be a result of

- Poor coverage or dominance or interference issues in Radio interface
- Capacity issues in Radio or lub interface
- Configuration issues in WBTS (parameters or HW)

CSSR is essentially RRC Setup Success \* RAB Setup Success

(or successful PS session setups in case of PS call)

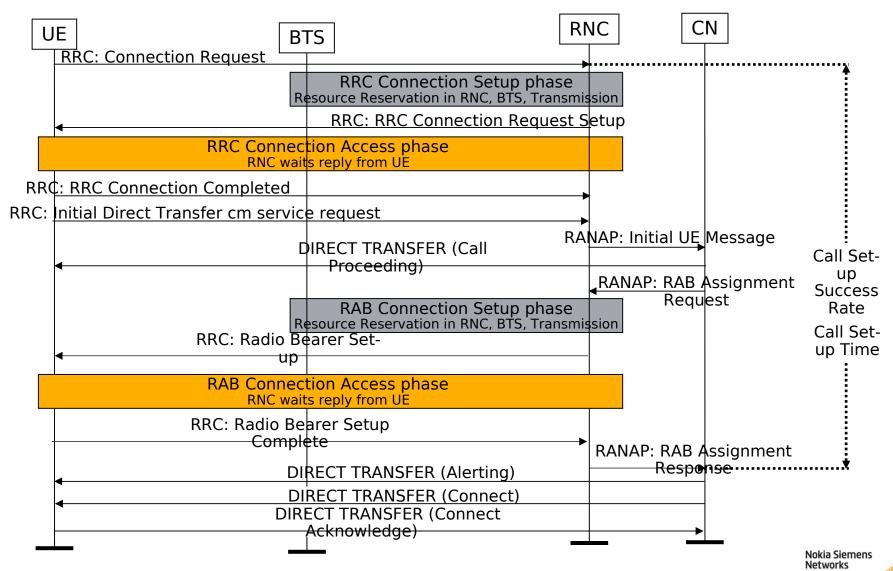
CSSR covers all the steps from the initial RRC connection request from the UE to the network, through the RRC setup phase and the RAB setup phase, and until user data is starting to get transferred.

#### The CSSR formulas are for different traffic classes like:

- CS voice calls (RNC 565 f)
- CS video calls (RNC 566e)
- PS RT Streaming Calls (RNC 575 d)
- PS NRT Calls (Interactive & Background) (RNC 576d)



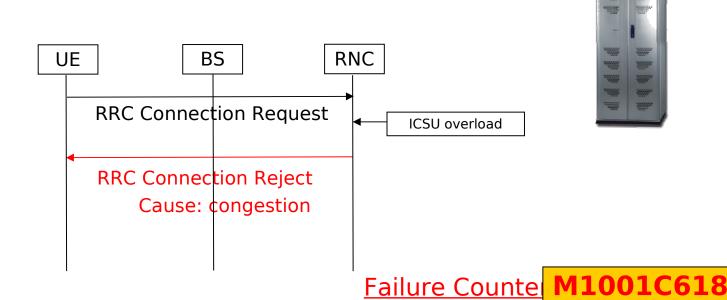
# **Definition of Call Set-Up Success Rate (CSSR)**



## RRC connection set up failure RRC Connection is rejected ICSU can not process the call

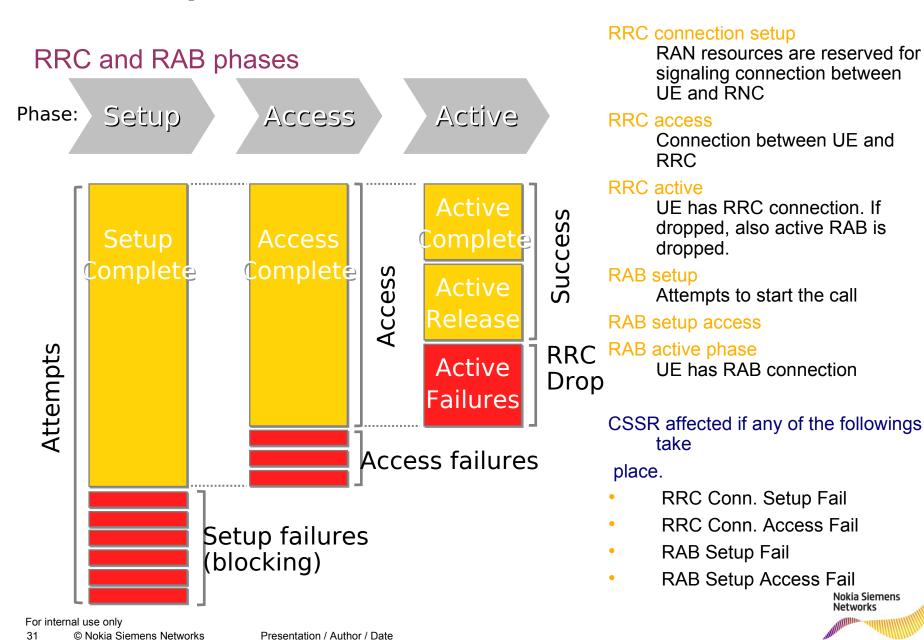
processing power on ICSU unit

oming call request can not be handled due to lack of ICSU processing hand free" is RNC internal clear code.

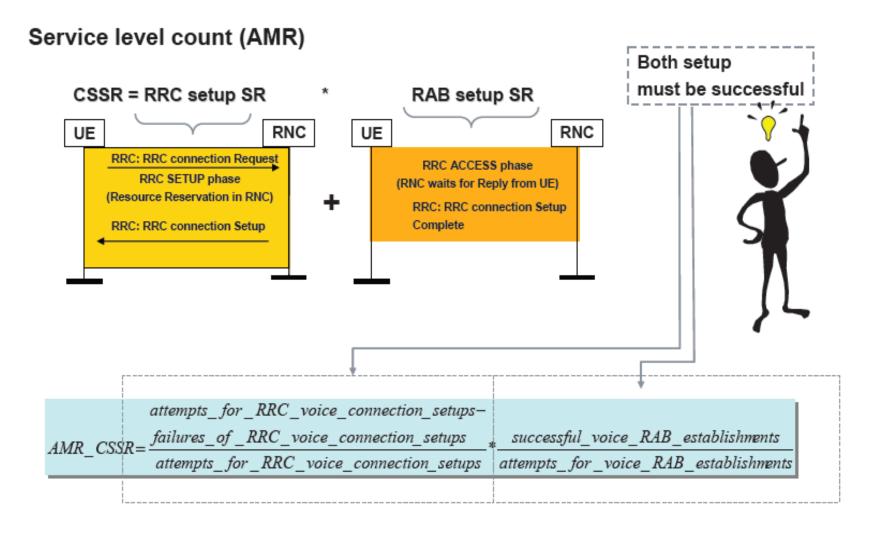




## **Call Setup Failures**



# Call setup Success rate -CSSR





# Call Setup Success Rate (CSSR)

#### CSSR KPI for CS voice from end user perspective (RNC 565f)

```
100*(sum(MOC CONV CALL ATTS - MOC CONV CALL FAILS
                    + MTC CONV CALL ATTS - MTC CONV CALL FAILS
                    + EMERGENCY CALL ATTS - EMERGENCY CALL FAILS
                    - RRC ACC REL_EMERGENCY - RRC_ACC_REL_MO_CONV
                    - RRC ACC REL MT CONV)
                                                                        * (sum(RAB _ ACC _ COMP _ CS _ VOICE)
        AMR \quad CSSR = -
                  sum(MOC CONV CALL ATTS + MTC CONV CALL ATTS
                                                                           sum(RAB STP ATT CS VOICE))
                  + EMERGENCY CALL ATTS - RRC ATT REP MO CONV
                  -RRC ATT REP MT CONV-RRC ATT REP EMERGENCY
                  - RRC ACC REL EMERGENCY - RRC ACC REL MO CONV
                                                                                                     RAB
RRC
                  -RRC ACC REL MT CONV-RRC CONN STP REJ EMERG CALL)
                                                                                                     part
```

RRC request repetitions done by UE after RRC reject are excluded from denominator (not necessarily seen as failures from the user's perspective)

Emergency calls re-directed to GSM layer are excluded from denominator

The occurred cell re-selections are subtracted both from the numerator and denominator because they are not considered as call attempts from mobile enduser point of view. The UE has made a new RRC connection via another cell and Attempts-counter is updated in the new cell for the new attempt.



## PACKET CALL SETUP SUCCESS RATE

#### Service level evaluations (PS/Release 99)

Packet Call: SSSR - Rel99



$$PS\_SSSR = \frac{successful\_PS\_DCH\_allocations}{attempts\_for\_PS\_DCH\_allocations}$$

RAB established
PS decides about Cell\_DCH or Cell\_FACH



# PS Call Setup Success Rate (CSSR)

RNC\_576d- Packet Call Setup Success Ratio [%] over the reporting period. Includes both Interactive and Background PS calls

```
100*(sum(MOC_INTER_CALL_ATTS-MOC_INTER_CALL_FAILS
             +MOC BACKG CALL ATTS-MOC BACKG CALL FAILS
             +MTC INTER CALL ATTS-MTC INTER CALL FAILS
             +MTC BACKG CALL ATTS-MTC BACKG CALL FAILS
             +EMERGENCY CALL ATTS-EMERGENCY CALL FAILS
             -RRC ACC REL_INTER-RRC_ACC_REL_MO_BACKG
                                                                 (sum(RAB ACC COMP PS INTER
             -RRC\_ACC\_REL\_MO\_INTER-RRC\_ACC\_REL\_MT\_BACKG) _{\star}+RAB\_ACC\_COMP\_PS\_BACKG)
    PS CSSR =
                                                                  sum(RAB _ STP _ ATT _ PS _ INTER
             sum(MOC _ INTER _ CALL _ ATTS + MOC _ BACKG _ CALL _ ATTS
             MTC INTER CALL ATTS + MTC BACKG CALL ATTS
                                                                  +RAB\_STP\_ATT\_PS\_BACKG)
             -RRC ATT REP INTER-RRC ATT REP MO INTER
             -RRC\_ATT\_REP\_MO\_BACKG-RRC\_ATT\_REP\_MT\_BACKG
             -RRC\_ACC\_REL\_INTER-RRC\_ACC\_REL\_MO\_BACKG
RRC
                                                                                           RAB
             -RRC ACC REL MO INTER-RRC ACC REL MT BACKG))
                                                                                            part
```

RRC request repetitions done by UE after RRC reject are included in the formula

\* The occurred cell re-selections are subtracted both from the numerator and denominator because they are not considered as call attempts from mobile end-user point of view. The UE has made a new RRC connection via another cell and Attempts-counter is updated in the new cell for the new attempt.

\*\*Nokia Siemens Nokia Siem

### Low in CSSR: Failure Counters

#### RRC Conn Setup & Access Analysis

#### RRC\_CONN\_STP\_FAIL\_AC

Check UL Interference, DL Power & Code occupancy if there is need to upgrade radio capacity

#### RRC\_CONN\_STP\_FAIL\_BTS

Evaluate NBAP counters (radio link reconf. Failures) and KPIs for troubleshooting BTS resources Check BTS configuration in terms of CE allocation – Use Channel Element (5001) Counters in order to evaluate lack of Channel Elements

Expand the Capacity or decrease the traffic offered to the site until the problem is solved In case BTS is not responding delete and re-create COCO

#### RRC\_CONN\_STP\_FAIL\_TRANS

Evaluate Number of reconfiguration failure due the transmission

Check COCO Configuration

Expand the capacity or decrease the traffic offered to the site until the problem is solved

#### RRC\_CONN\_STP\_FAIL\_RNC

Typically RNC fault or Incoming SRNC Relocation Failure (inter-RNC border) Required ICSU log tracing if no RNC fault or SRNC relocation problem Communicate the problem to Care department

#### RRC\_CONN\_STP\_FAIL\_RNTI ALLO FAIL

RNC decides to reject RRC connection request due to RNTI allocation failure caused by RRMU overload



### Low in CSSR: Failure Counters

#### RRC Conn Setup & Access Analysis

#### RRC\_CONN\_STP\_FAIL\_IUB\_AAL2\_TRANS

Updated when there is shortage or blocking of AAL2 resource
A subset of RRC\_CONN\_FAIL\_TRANS which include ERQ/ECF fail due to some reason such as DMPG
problem in RNC + ERQ/ECF fail due to transport resource needed in RNC between RNC/MGW

#### RRC\_CONN\_ACC\_FAIL\_RADIO

Dominant failure causes due to wrong UL or DL coverage

UL Coverage -> Check if cell is affected by an external interference (Thermal Noise measurements).

DL Coverage -> Tune SCCPCH Power if UE does not receive the RRC Setup Message

-> If UE does not synchronize, reduce N312 from 2 to 1 (depends on UE model) or tune CPICHToRefRABOffset vs.

**Qqualmin** (or Qrxlevmin)

#### RRC CONN ACC FAIL MS

UL Coverage -> Tune Cell Dominance (or CPICH) in order to balance UL and DL (if UL interference if not the cause). Check if cell is affected by an external interference (Thermal Noise measurements).



#### Low in CSSR: Failure Counters

# RAB setup & Access Fail Root Cause Analysis: RT and NRT (I/B) domains RAB STP FAIL XXX AC

Check UL Interference, DL Power & Code occupancy if there is need to upgrade radio capacity using the already distributed

Nokia Capacity Check BO report.

Check PrxTarget / PrxOffset / of the affected cells

#### RAB\_STP\_FAIL\_XXX\_BTS

Evaluate NBAP counters (radio link reconf. Add failures) and KPIs for troubleshooting BTS resources Check BTS configuration in terms of CE allocation – Use Channel Element (5001) Counters in order to evaluate lack of Channel Elements

Expand the Capacity or decrease the traffic offered to the site until the problem is solved.

In case BTS is not responding delete and re-create COCO

#### RAB\_STP\_FAIL\_XXX\_TRANS

Evaluate Number of reconfiguration failure due the transmission Check M1005C128 CANC\_ADD\_SRNC\_TRAN\_STP\_FAIL Check RAB\_STP\_FAIL\_XXX\_IUB\_AAL2, M1001C531-C533 Check COCO Configuration

#### RAB\_STP\_FAIL\_XXX\_RNC

Typically RNC fault or Incoming SRNC Relocation Failure (inter-RNC border)
Required ICSU log tracing if no RNC fault or SRNC relocation problem
Communicate the problem to Care department



#### Low in CSSR: Failure Counters

# RAB setup & Access Fail Root Cause Analysis: RT and NRT (I/B) domains

RAB\_ACC\_FAIL\_XXX\_UE

Evaluate Cell resource Prx and Ptx parameters (same as RAB\_STP\_FAIL\_XXX\_AC Case)

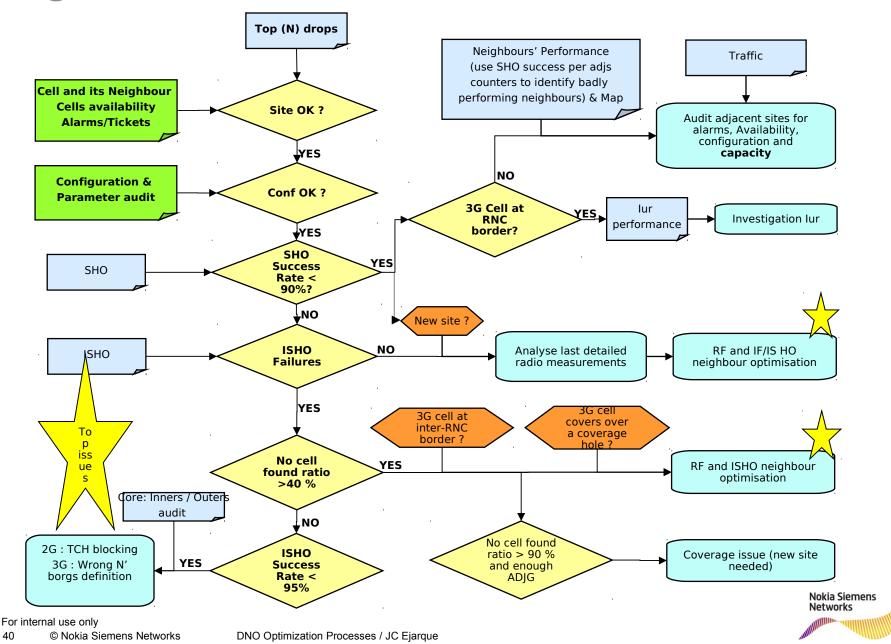
#### RAB\_ACC\_FAIL\_XXX\_RNC

Typically RNC fault or Incoming SRNC Relocation Failure (inter-RNC border) Required ICSU log tracing if no RNC fault or SRNC relocation problem Communicate the problem to Care department.

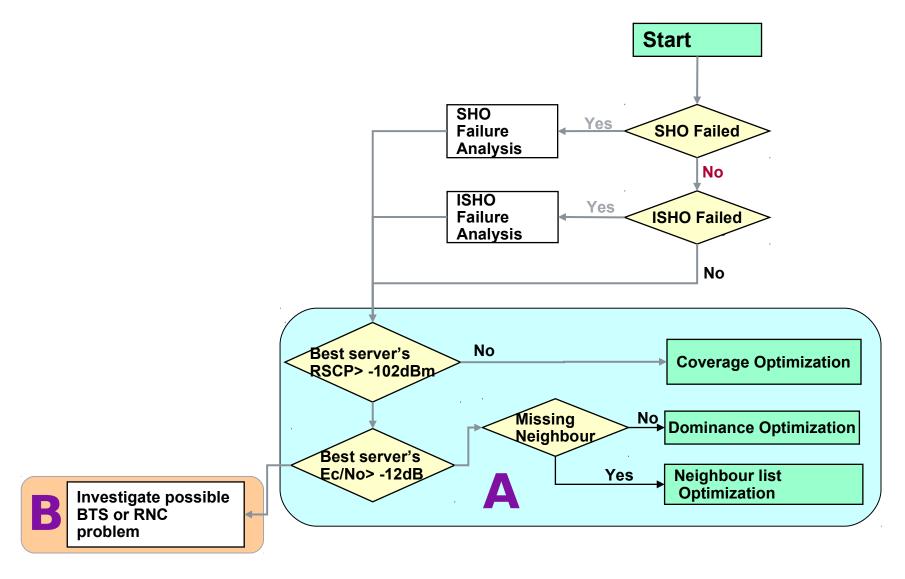


### High in DCR?

40

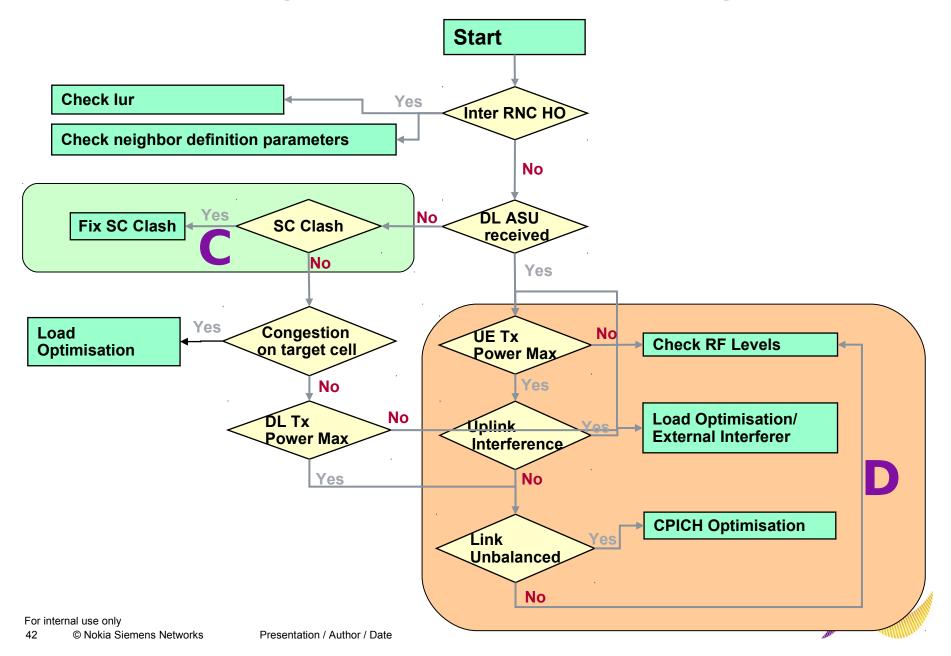


### Call drop analysis process





### Call Drop Analysis process – SHO Analysis



### Drop call failures – RF issue



RF drops mostly due to poor dominance or interference

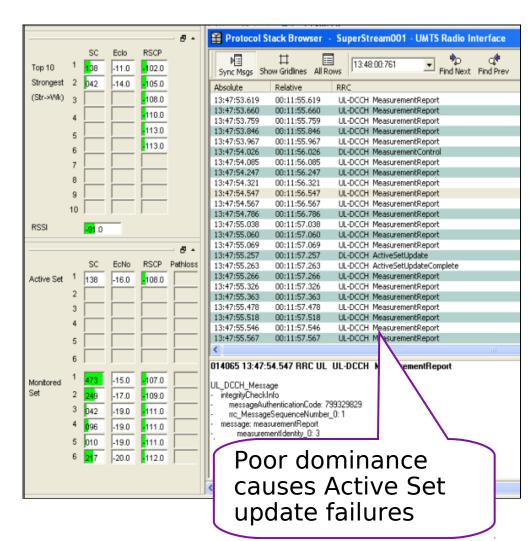
Poor coverage could lead to ISHO, although poor dominance or interference can cause ISHO to fail.

Rapid field drop can cause drop due to coverage

Poor dominance or interference can cause Compressed Mode (CM) to start even if RSCP is still good.

In CM UE transmits with higher power (more interference) and spends less time on 3G (less accurate measurement reporting)

Poor dominance or interference can lead to Active Set update failures and eventually to drop call.

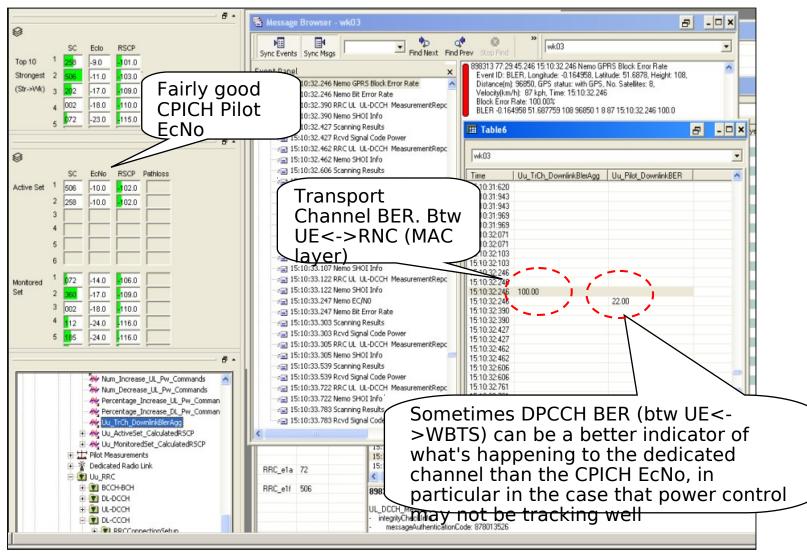




### Drop call failures – RF issue



Nokia Siemens Networks

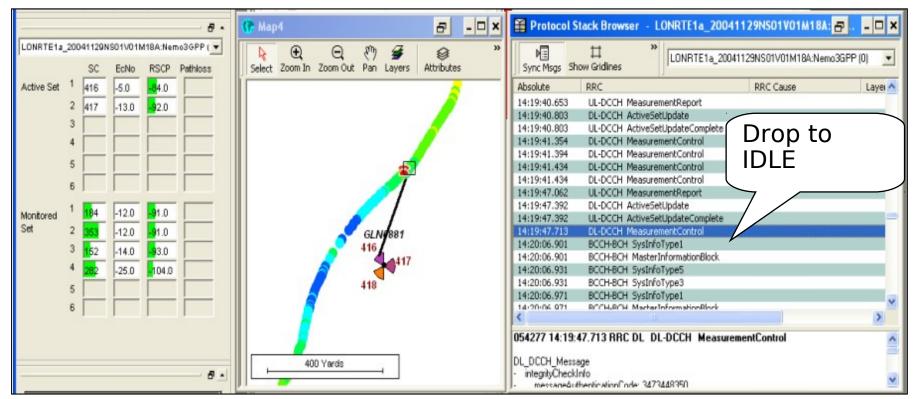


# **Drop Call Failures – System issue BTS**



#### Sudden drop to idle, no disconnect messaging

- Site malfunctions to be checked
- In the example below site had faulty unit (WTR)





# **Drop Call Failures – System Issues RNC**



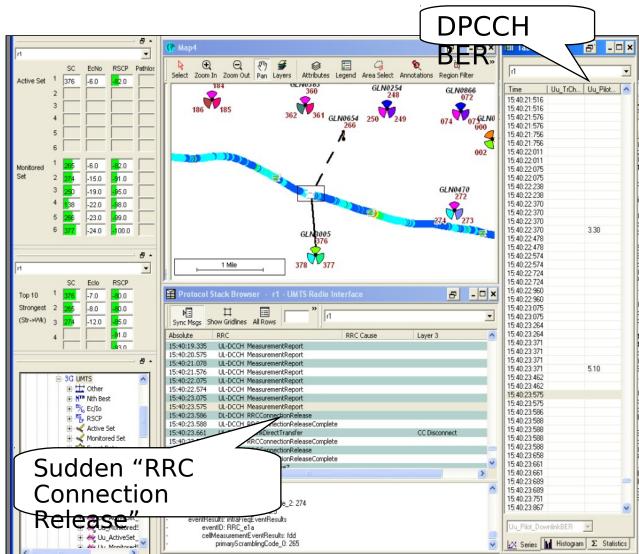
"CC Disconnect" due to "DL RRC Connection Release"

No response to UL Measurement Reports

In the example site had no alarms, good RF & BER

Not able to add SC265 to Active Set, next call on the same cell => no failure.

Difficult to troubleshoot if the failure does not happen systematically => follow up in the next weeks drive / do a separate drive test in the area





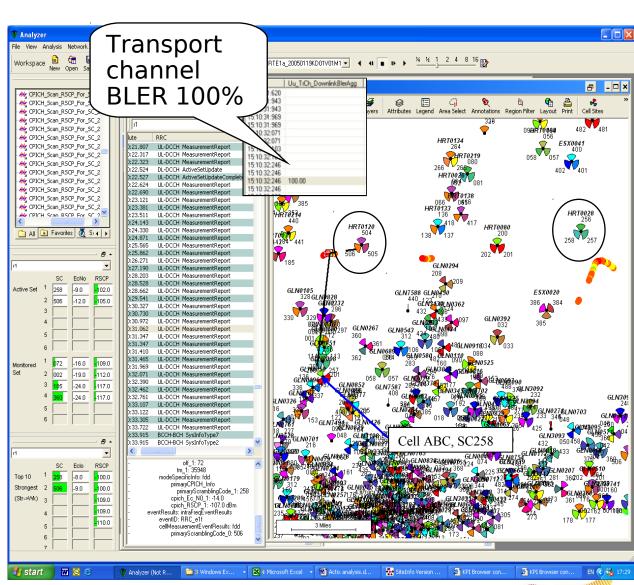
# **Drop call failures (SC conflict)**



Sudden drop to idle mode (no disconnect messaging)

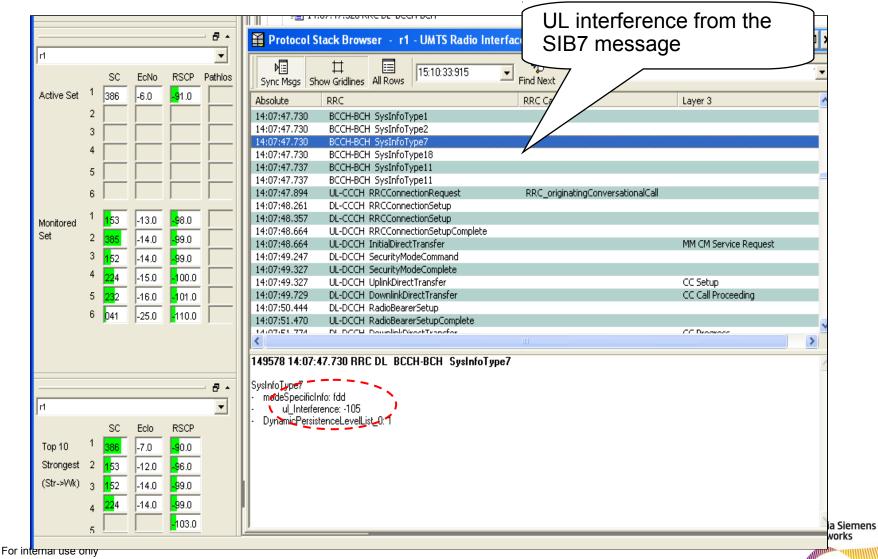
Cause of the failure: overshooting site and SC reuse

Short term solution to add overshooting neighbour in ADJS definitions



### **Drop call failures – Uplink Interference**





# Drop call failures – System issue RNC or BTS?

"CC Disconnect" due to "DL RRC Connection Release" is just a consequence of failure which can be due to different reasons

- From UE point of view L3-messaging does not identify the point of failure distinctly
- BTS or RNC failure? => Suspect BTS first, then RNC

#### Rule out BTS failures

- Check the site performance from Counters (lub, Service level, cell resources SHO, etc) and that site is carrying traffic
- PrxNoise, receive link parameters, alarms
- SC-reuse
- UE performance ?

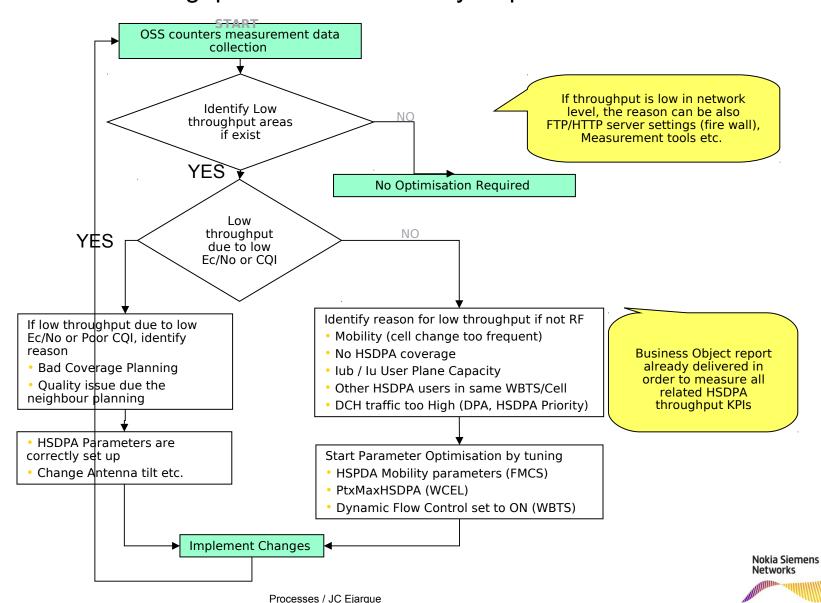
Identified causes for Active Set Update failure

- "Deaf" sites (PrxNoise)
- Faulty HW
- SC-reuse



### **HSDPA** low throughput?

Low HSDPA throughput root causes analysis process



# ISHO Analysis 2G – 3G

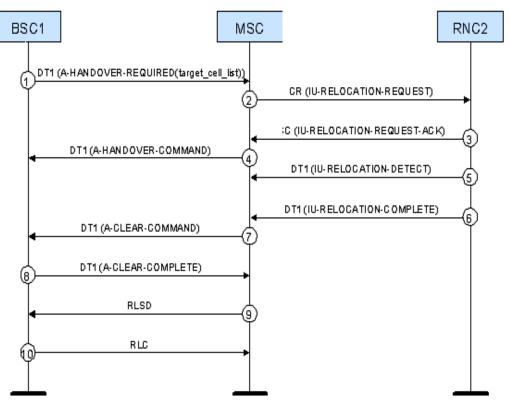
#### **RNC Counters Analysis**

IS\_HHO\_IN\_PREP\_REQ IS\_HHO\_IN\_PREP\_SUCC IS\_COMPL\_TARGET\_RNC IS\_HHO\_IN\_PREP\_UNSUCC\_TRL IS\_HHO\_IN\_PREP\_UNSUCC\_RNL IS HHO IN PREP UNSUCC PROT

#### **BSC Counters Analysis**

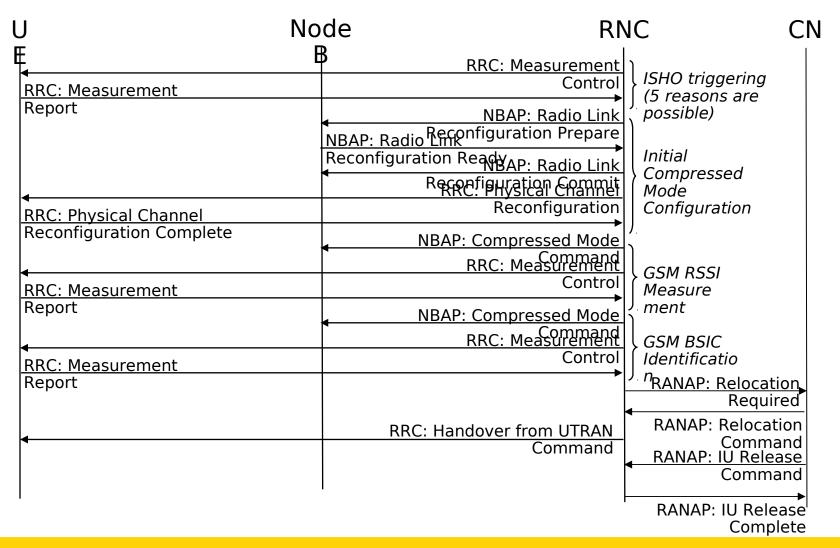
MSC TCH HO WCDMA RAN ATT MSC GEN SYS WCDMA RAN HO COM MSC\_END\_OF\_HO\_TO\_WCDMA\_RAN

#### Intra-GSM handover



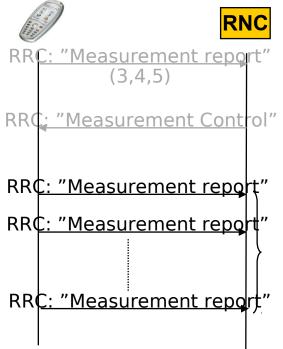


# ISHO 3G -> 2G - AMR Signaling Flow



BSIC verification always performed for AMR calls – no interrupt in voice call

#### **ISHO 3G - 2G**



•If the RNC does <u>not find</u> a suitable cell, one of the following counters are updated:

```
IS_HHO_NO_CELL_UL_DCH_Q_(N)RT
IS_HHO_NO_CELL_UE_TX_PWR_(N)RT
IS_HHO_NO_CELL_DL_DPCH_(N)RT
IS_HHO_NO_CELL_CPICH_RSCP_(N)RT
IS_HHO_NO_CELL_CPICH_ECNO_(N)RT
```

- These counters are updated when <u>either</u>:
- No suitable GSM target cell is found in terms of RSSI (RxLev)
- Target cell is suitable (RSSI) but BSIC verification fails
- And;
- Maximum number of measurement reports have been received

Triggered in the reference cell when:

- 1) GsmMaxMeasPeriod measurement reports are received with an rx level not suitable
- 2) GsmMaxMeasPeriod measurement reports are received with a BSIC not verified



### **RU10 Reporting Suite**

- RNC level system program added
- Corrections to Capacity report
- Modifications to Service level report (Streaming class added+ some other corrections)

Report Topic Name	Report Name	Report ID
1. System Program	System Program RNC Level	RSRAN084
1. System Program	System Program Cell Level	RSRAN000
2. Capacity	RNC Capacity	RSRAN068
<ol><li>Capacity</li></ol>	Node B Capacity	RSRAN066
<ol><li>Capacity</li></ol>	Cell Capacity	RSRAN067
<ol><li>Capacity</li></ol>	NRT Radio Bearer Statistics	RSRAN013
3. Service Level	Service/Session Accessibility Analysis	RSRAN073
<ol><li>Service Level</li></ol>	Service/Session Retainability Analysis	RSRAN079
3. Service Level	RAB Holding Times	RSRAN021
<ol><li>Service Level</li></ol>	Service Summary	RSRAN003
4. Traffic	Allocated Traffic Amounts (R99 + HSPA)	RSRAN070
4. Traffic	Cell Data Volume and Throughput at RNC	RSRAN077
4. Traffic	Traffic Summary	RSRAN026
4. Traffic	Used CE Capacity per RB Type in RNC	RSRAN022
4. Traffic	Utilization Shares of Total Traffic Allocation Amounts	RSRAN071
5. Mobility and Handover	Active Set Size for NRT-RT Traffic	RSRAN078
	HSPA Serving Cell Change	RSRAN033
5. Mobility and Handover		RSRAN044
	Inter-System Handover per Cause	RSRAN019
	Inter-System Handover Performance	RSRAN023
•	Inter-System Handover Reasons	RSRAN018
5. Mobility and Handover	•	RSRAN045
•	Load Based HO Related Resources	RSRAN047
•	Load Based IFHO/ISHO Performance	RSRAN048
•	Load Based IFHO/ISHO Triggering	RSRAN049
	Service Based IFHO/ISHO Performance	RSRAN050
5. Mobility and Handover	•	RSRAN046
5. Mobility and Handover	Soft Handover Performance	RSRAN028



### **RU10 Reporting Suite**

 Modifications to KPIs due to streaming class + 64 HSDPA users/cell

Report Topic Name	Report Name	Report ID
8. Transport	ATM Interface Traffic Load	RSRAN081
8. Transport	ATM VCC Traffic Load	RSRAN083
8. Transport	ATM VPC Traffic Load	RSRAN082
8. Transport	FTM Packet Transport Performance	RSRAN076
8. Transport	FTM Performance	RSRAN072
8. Transport	Iu-PS Throughputs	RSRAN064
8. Transport	lub Throughputs	RSRAN080
8. Transport	Traffic on AAL5	RSRAN031
8. Transport	Traffic on ATM Layer	RSRAN029
8. Transport	Traffic on Physical Medium Sub-Layer	RSRAN030
8. Transport	Transport Resource Reservations	RSRAN069
7. HSPA	Channel Switching and HSPA Layering	RSRAN075
7. HSPA	CQI Distribution	RSRAN039
7. HSPA	HSPA Code and Modulation Usage	RSRAN034
7. HSPA	HSPA Power Distribution	RSRAN074
7. HSPA	MAC-hs Efficiency	RSRAN040
7. HSPA	MAC-hs Retransmissions by Code and Modulation Usage	RSRAN041
7. HSPA	Number of HSPA Users and UE capability	RSRAN051
6. Signalling	NBAP Signalling	RSRAN027
6. Signalling	RRC Signalling	RSRAN038



#### **Summary**

An understanding of the various signalling flows together with the information contained in different messages and counters is an essential element in the optimisation engineers' toolbox

