Call Drop Tests

Richard Maiden & Kyle Li - Altera Corporation
Nikhil Kumar – Rohde & Schwarz

13th October 2015

Question

- Occasional bit errors in CPRI are passed through
  - Resulting in occasional IQ sample errors
  - No call drop
- Packet based CPRI/IQ data
  - Entire packet will be dropped (based on FCS error)
- Question:
  - How many samples/packets need to be dropped before the link is dropped

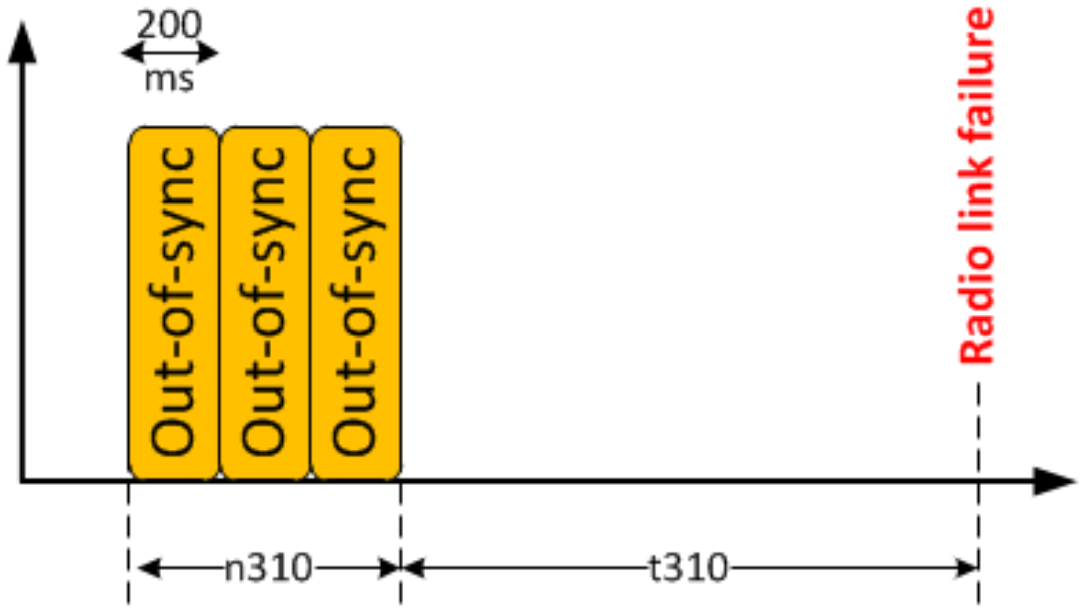
UE Behavior (3GPP TS 36.331 v8-12)

5.3.11 Radio link failure related actions

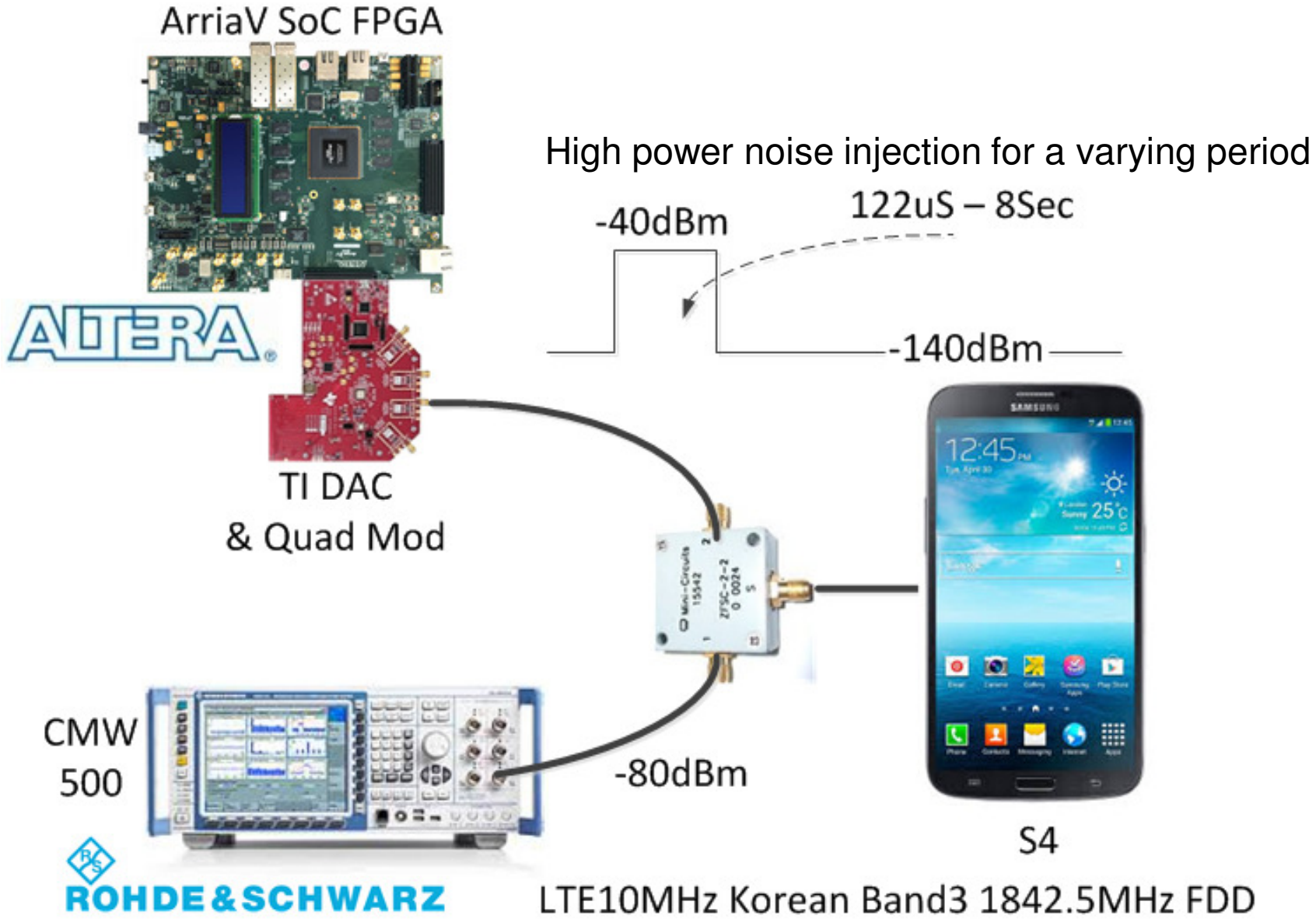
- If the UE can not successfully decode 20 consecutive frames in down link (200 ms) it will send 1 out-of-sync indication.
- 5.3.11.1 Detection of physical layer problems in RRC_CONNECTED
  - 1> **upon receiving N310 consecutive "out-of-sync" indications** from lower layers while neither T300, T301, T304 nor T311 is running:
    - » 2> **start timer T310**;
- 5.3.11.3 Detection of radio link failure
  - 1> **upon T310 expiry**; or upon T312 expiry;
  - 1> upon random access problem indication from MAC while neither T300, T301, T304 nor T311 is running; or
  - 1> upon indication from MCG RLC that the maximum number of retransmissions has been reached for an SRB or for an MCG or split DRB:
    - » 2> **consider radio link failure to be detected**;
- 5.4.2.3 Reception of the RRCConnectionReconfiguration by the UE
  - 1> **If** the RRCConnectionReconfiguration message does not include rlf-TimersAndConstants set to setup:
    - » 2> use the default values specified in 9.2.5 for timer T310, T311 and constant N310, N311;
- 9.2.5 Default values timers and constants
  - T310=ms1000, n310=n1

UE Behavior

- Out-of-sync after 20 frames (200ms)
- Count n310 times (default 1 time)
- Wait t310 ms (default 1000ms)
- Declare RLF



Test Setup


ArriaV SoC FPGA
ALTERA
TI DAC
& Quad Mod
High power noise injection for a varying period
-40dBm
122uS – 8Sec
-140dBm
CMW
500
-80dBm
S4
ROHDE&SCHWARZ
LTE10MHz Korean Band3 1842.5MHz FDD

Test conditions example

- No auto re-establishment
  - Done by hand
- No retransmission / HARQ

- Example (order of magnitude)
  - 24bits per sample (3 octets)
  - Jumbo packet of 9000 octets or 3000 samples
  - 10MHz LTE @ 15.36MSps
  - 3000 samples @ 15.36MSps= 195uS of CPRI traffic

Test 1 : Call Drop

- Default T310 = 100ms & N310 = 1 (100x1=100ms)
- Noise Length — Result
  - 122us — passed
  - 245us — passed
  - 490us — passed
  - 980us — passed
  - 2ms — passed
  - 4ms — passed
  - 8ms — passed
  - 16ms — passed
  - 32ms — passed
  - 48.8ms — passed 6 tests
  - 51ms — passed 8 tests
  - 52.2ms — failed after 5th test
  - 53.6ms — failed after 3rd test
  - 64ms — failed after 2nd test
  - 128ms — failed immediately

Test 2 : Call Drop & RSRP

- Default T310 = 0ms & N310 = 1 (100x1=0ms)
- Noise Length — Result
  - 122us — passed
  - 245us — passed
  - 490us — passed
  - 980us — passed
  - 2ms — passed
  - 4ms — passed
  - 8ms — passed
  - 16ms — passed
  - 32ms — passed
  - 40ms — passed
  - 45ms — passed RSRP Degraded (as reported by mobile)
  - 50ms — passed RSRP Degraded (as reported by mobile)
  - 52.2ms — failed after 11th test
  - 64ms — failed after 3nd test
  - 128ms — failed immediately

Observations

- Out-of-sync should not be declared by UE until 200ms
  - Only 50ms of noise caused out-of-sync
  - We can only presume that the UE was unable to regain lock for a further 150ms

Summary

- TS136.31 Parameters **(defaults)**
  - out-of-sync 200ms (20 CRC frame failures)
  - T310 Enumeration = 0,50,100,200,500,**1000**,2000
  - N310 Enumeration= **1**,2,3,4,6,8,10,20
- Worst case would be T310=ms0, N310=n1
  - Instantly report after a single out-of-sync
  - Shortest time is actually driven by the 200ms
  - We observed S4 declared with 50ms of noise
- Conclusion
  - Based on simple tests in this example
    - LTE10, 3 octets/sample & 3000 samples/packet
  - Radio Link Failure / Drop=52ms / 195us = 266 Packets
  - UE reported degradation= 40ms / 195us = 205 Packets

Thank-you