DEVICE TESTING AND CERTIFICATION LIFE CYCLE

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Introduction

• The Aim of this presentation is (From A Device perspective)
  • Go through the various phases in new technology: Core standards development, Test definition, Test Implementation and Certification by taking an example of recently concluded/activated 3GPP technology NB-IoT
  • Introduce the various SDO (3GPP) groups involved in Core Standards for devices
  • Test Prose Development in RAN5 (to guarantee Device Interoperability)
  • TTCN development of Conformance tests by ETSI TF160
  • Introduction to GCF & NB-IoT certification requirements in GCF
# 3GPP Organization

## TSG RAN
- **Radio Access Network**
  - **RAN WG1**
    - Radio Layer 1 spec
  - **RAN WG2**
    - Radio Layer 2 spec
    - Radio Layer 3 RR spec
  - **RAN WG3**
    - lub spec, Iur spec, lu spec
    - UTRAN O&M requirements
  - **RAN WG4**
    - Radio Performance
    - Protocol aspects
  - **RAN WG5**
    - Mobile Terminal
    - Conformance Testing
  - **RAN WG6**
    - GSM EDGE
    - Radio Access Network

## TSG CT
- **Core Network & Terminals**
  - **CT WG1**
    - MM/CC/SM (lu)
  - **CT WG3**
    - Interworking with external networks
  - **CT WG4**
    - MAP/GTP/BCH/SS
  - **CT WG6**
    - Smart Card Application Aspects

## TSG SA
- **Service & Systems Aspects**
  - **SA WG1**
    - Services
  - **SA WG2**
    - Architecture
  - **SA WG3**
    - Security
  - **SA WG4**
    - Codec
  - **SA WG5**
    - Telecom Management
  - **SA WG6**
    - Mission-critical applications

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**ETSI Symposium on**

**Achieving Interoperability – Best Practices in Standardization**

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**motorola**
Global Certification Forum Organization

SG - Steering Group
- CAG Conformance (3GPP/GSMA/OMA/CCSA)
- FTAG Field Trials (GSMA)
- IAG Internet of Things (3GPP/GSMA/oneM2M/oneM2M)
- PAG Performance (3GPP/GSMA/CTIA)
- CAG2/TCAG2 CDMA2000 (3GPP2)

Board of Directors
- GCF Office
- Workshops
- Industry Events
NB-IoT: A Recap

- 3GPP made a major effort in Rel-13 to address the IoT Market
- 3 Flavors of LPWA (Low Power, Wide Area) developed
  1. eMTC: Further LTE Physical Layer Enhancements for Machine Type Communication
  2. NB-IOT: New radio added to the LTE platform optimized for the low end of the market
  3. EC-GSM-IoT: EGPRS enhancements which in combination with PSM makes GSM/EDGE markets prepared for IoT
NB-IoT: A Recap

- 3 Different physical options:
  - **Standalone** – e.g. Re-farming of the GSM spectrum
  - **Guard band**: utilizing the unused resource blocks within a LTE carrier’s guard-band
  - **In-band**: utilizing resource blocks within a normal LTE carrier
- Extended coverage: 164 dB maximum coupling loss (at least for standalone)
- Long battery life: 10 years with 5 Watt Hour battery (depending on traffic and coverage needs)
- Support for massive number of devices: at least 50,000 per cell
- Reduced data rate/bandwidth, mobility support and further protocol optimizations
- 2 different Layer 3 options:
  - Control Plane (CP) – data sent over NAS using UL/DL Information Transfer messages - mandatory
  - User Plane (UP) – RRC Suspend and Resume messages used to keep the context over long periods (described as AS context caching) – optional
NB-IoT technology Phases for Device Certification

1. Study Items
   - IPRs+Extln Inputs
   - 3GPP TSG / WG
2. Stage 1 TR’s
   - 3GPP TSG / WG
3. Stage 2 Overall Req
   - 3GPP TSG / WG
4. Stage 2 TS’s
   - 3GPP TSG / WG
5. Stage 3 Details
   - 3GPP TSG / WG
6. Stage 3 Core TS’s
   - 3GPP TSG / WG
7. MCC TF 160 / SS Vendors
   - MCC TF 160 / SS Vendors
8. TC TTCN/Prop
   - TC TTCN/Prop
9. New WI Prop
   - New WI Prop
10. GCF SG
   - GCF SG
11. ATS
   - ATS
12. TC Verification
   - TC Verification
13. WIP
   - WIP
14. GCF CAG
   - GCF CAG
15. New WI Descpt
   - New WI Descpt
16. WID/DCC
   - WID/DCC
17. Verified ATS
   - Verified ATS
18. Validated TC on TP
   - Validated TC on TP
19. Test Validation
   - Test Validation
20. TP Vendors/Labs
   - TP Vendors/Labs
21. Apply Vldtd+Add TC
   - Apply Vldtd+Add TC
22. Device Vendors/RTOs
   - Device Vendors/RTOs
23.Filed+IoP+Perf TC
   - Filed+IoP+Perf TC

CRTFD Device Compliant to 3GPP
NB-IoT Technology Stage 1 TR’s/Study Items

- Groups involved TSG-RAN (RAN2, RAN3, RAN4), TSG-SA(SA-1,SA-2, SA-3), OLD GERAN (GERAN1, GERAN2)
- Resulted in generation of TR’s
  - SA2 TR 23.877: Study on Machine-Type Communications (MTC) and other mobile data applications communications enhancements,
  - SA2 TR 23.720: Architecture enhancements for Cellular Internet of Things
  - RAN2 TR 25.705 :Study on small data transmission enhancements for UMTS
NB-IoT Technology Stage 2 + 3 TS’s

- Stage 2 to precede Stage 3, but practically overlap
- Stage 2:
  - Captures High Level requirements needed for the NB-IoT
  - Groups involved TSG-RAN (RAN2, RAN3, RAN4), TSG-SA(SA-1,SA-2, SA-3)
  - Resulted in enhancements of Stage 2 TS
    - SA2 TS 23.401, TS 23.682, TS 23.251
    - RAN2 TS 36.300
- Stage 3:
  - Defines detailed requirements for NB-IoT
  - Groups involved TSG-RAN (RAN1, RAN2, RAN4), TSG-CT(CT-1,CT-6)
  - Resulted in enhancements of Stage 3 TS’s
    - CT1 TS 24.301, TS 24.008, TS 23.122
    - CT6 :TS 31.102
    - RAN1: TS 36.201, 36.211, 36.212, 36.213, 36.214
    - RAN4: TS 36.101, 36.133
• RAN5_SIG sub-group specifies all protocol & signaling conformance test cases in ***prose*** (formal test description) in great detail for Requirements in Stage 3 Core Specs. RAN5_RF specifies RF/RRM/Perf conformance test case prose.

• Test Specs enhanced: Signaling 36.523-1/2/3, RF/RRM/Perf: 36.521-1/2/3

• RAN5 also provides to the industry a Signaling reference Abstract Test Suite implementation of the protocol test cases, developed in ***TTCN***, delegated to ***MCC TF160*** with priorities set by RAN5

• MCC TF160 has a well-defined process for ***verification*** of the TTCN implementation of each test case eventually formally agreed by RAN5, are formally released, ready for validation by certification organizations, e.g. GCF

• RF, RRM, Performance test cases are implemented by SS Vendors in-house
Global Certification Forum Organization - Recap

SG - Steering Group

- CAG
  - Conformance
    - (3GPP/GSMA/OMA/CCSA)
- FTAG
  - Field Trials (GSMA)
  - IOP (3GPP/OMA)
- IAG
  - Internet of Things
    - (3GPP/GSMA/oneM2M/……)
- PAG
  - Performance
    - (3GPP/GSMA/CTIA)
- CAG2/TCAG2
  - CDMA2000 (3GPP2)

Board of Directors

- GCF Office
- Workshops
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NB-IoT technology GCF WIP/WID

- Two stage process used to introduce new features into GCF.
  1. Steering Group (SG) approves a Work Item Proposal (WIP), Supported by 4 Full Members.
  2. Conformance Agreement Group (CAG) approves a Work Item Description (WID).
     - WI-257: NB-IoT Protocol Conformance
     - WI-258: NB-IoT RRM
  3. Agreed Work items to be validated by TP Vendors in Labs on at least 2 (exceptionally 1) independent devices
  4. When 80% Priority Test cases (may vary) are Validated Work items gets Activated and hence becomes Mandatory for a device supporting NB-IoT. Currently WI-257, 259 & 266 are active.

Radiocommunication Standardization - Interoperability

e Lenovo company
Device Certification for NB-IoT

- Device implemented as per 3GPP Core requirements can be GCF Certified
- NB-IoT device, needs to pass all applicable test cases from activated NB-IoT Conformance Work items + Other work items (Filed Trial + IoP + Performance) in all/one of the supported NB-IoT Bands
- Its self certification where testing is performed by in-house or Third party RTO (Recognized Test Organizations)
- A compliance folder is uploaded on GCF Web page including necessary details of device implementation and Test’s passed as per GCF certification processes
- Compliance folders of devices certified are accessible to Full Operator Members
- Operators/GCF Office expected to review the Certifications declarations
- If discrepancies/doubts found, operators can question for clarifications, Contest/Challenge a certification
- Contested/Challenged Certification becomes void
- Device Vendors required to maintain Certification through device lifecycle for possible additions of features/technologies

CRTFD Device Compliant to 3GPP
Device NB-IoT: Conclusion

- 54/74 Protocol Test Cases RAN5 Verified, 10 more currently under verification
- More than 3 different devices/chipsets used for RAN5 verification
- 3 out of 4 NB-IoT GCF work items (protocol, RF conformance & USIM/USAT interworking with NB-IoT) are active in GCF
- 5 Modules from 2 different Manufacturers are GCF certified till date
Thank You!

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Back Up
The 3GPP Eco-system

- Developing Recommendations
- Input specs
- Referring to specs (contributed by individual members)
- Developing Wireless LAN/MAN specs
- Referring to specs
- Cross reference of specs
- Partners of 3GPP Referring to 3GPP specs for the local specs
- Cross reference
- Requirements
- Referring to specs
- Developing internet protocol specs
- Developing Mobile application specs
- Market Partners
- Terminal certification based on 3GPP specs

Partners of 3GPP:
- EU
- Japan
- Korea
- China
- North America
- India
Terminology

• Verification (focus on test cases): Assessing that a test specification (test case and test case prose) satisfies an agreed set of verification criteria. Verification is typically handled by test tool/test solution providers.

• Validation (focus on test cases and test platforms): Assessing that a test platform (containing the verified test specifications) satisfy an agreed set of validation criteria. Validation is typically handled by (accredited) test labs.

• Certification (of devices): Assessing that a device satisfies an agreed set of certification criteria. Certification uses validated test platforms and is handled by (accredited) test labs (3rd party certification) or by self-certification.