



GCFTM
Global Certification Forum

GCF Requirements for LTE Devices

Lars Nielsen, GCF General Manager
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Mobile drives the world economy... and interoperability matters.

- Mobile has changed the lives of billions of people around the world
- Mobile's impact is based on the adoption of global standards
- In 2016, the mobile industry generated 4.5% of global GDP
- Mobile interoperability helps the global economy communicate more efficiently

***GCF Certification: because
interoperability matters***

GCF INTRO

Global Certification Forum (GCF)



Operator Members, Associate Operator Members & Subsidiaries

Test once use anywhere networks conformance GPRS Member driven interoperability Certification Manufacturers multi mode field trials standards based HSPA VoWiFi Roaming Acceptance LTE CDMA2000 Machine to Machine NFC DC-HSPA connectivity handsets time to market Carrier Aggregation open market GCF Certified TD-LTE Internet of Things Test labs

- 3GPP partner organisation supported by Operators, Manufacturers and Test Industry worldwide.
 - 300+ members from across the globe.
- Enables the mobile industry to define a certification process for mobile devices implementing 3GPP radio access
 - 3GPP Market Representation Partner
- Provides the assurance of interoperability and device quality

Benefits of GCF



Global Service Interoperability

- ✓ Standardised testing methodologies
- ✓ Implementation alignment with 300+ companies worldwide
- ✓ Key enabler to International Roaming



Lower Device Lifecycle Management Costs

- ✓ Greatly reduces any post-launch issues and after sales support
- ✓ Optimised and modularised testing allows for a low cost base in device commercialisation



Enhanced Customer Experience and Brand

- ✓ Higher quality devices result in increased satisfaction
- ✓ Positive impact on both Operator and OEM brands
- ✓ Levels the playing field for international brands entering new markets

GCF as Legal Entity



Companies House

- Incorporated as not-for-profit company since 2008
 - Global Certification Forum (GCF) Ltd, UK Company # 6594830
 - Private company limited by guarantee and not having a share capital
 - Objects for GCF are:
 - to provide common means for documenting and assessing compliance, with requirements established by GCF, in Products for all interested industry players, and
 - to capture global recognition and acceptance of the assessed compliance in avoidance of multiple testing and cost efficiencies.
- Owned by the members with a guarantee of 1 £ / member
 - New members must sign Declaration of Participation
 - New members must be accepted by existing members
 - Annual General Meeting & Board Meetings
- Finance
 - Members pay yearly membership fee to fund activities of GCF
 - Annual Accounts is public via the UK Companies House

Operator Membership

Requirements & Benefits	Operator (Full Member)	Associate Operators
Propose new requirements	New Work Items require support from 4 Full Members.	Can participate in discussions – but cannot drive new work.
Challenge certifications	✓	✗
Attend GCF meetings	✓	✗ (*)
Voting rights in meetings	✓	✗
Stand for GCF Board	✓	✗
Annual Fee (**)	€ 11,000	€ 0

(*) – 100€ charge per meeting day for Associate Operator Members.

Manufacturer Membership

Requirements & Benefits	Manufacturer (Full Member)	Associate Manufacturer
Quality programme requirement (*)	Must be "Quality Qualified" – i.e. manufacturer's system meets GCF objectives and is accredited to ISO9001.	"To have a quality system in place meeting the requirements of ISO9001".
Assess certification criteria that apply to the device	Can use an in-house ACE.	Must use a 3 rd party ACE.
Test device	Can use own RTO or 3 rd party RTO.	Must use a 3 rd party RTO.
Certify device	✓	✓
Attend GCF meetings	✓	✓
Voting rights in meetings	✓	✗
Stand for GCF Board	✓	✗
Annual Fee (**)	€ 11,000	€11,000/€ 5,500

(*) – a 12 month tolerance period on this requirement may be granted to new members subject to certain terms and conditions.

(**) – Reduced fee applies when embedding GCF Certified Modules

Observer Membership

Requirements & Benefits	Observer	
Recognised Test Organisation	✓	
Test Platform provider	✓	
Certification Interested Party	✓	
Chair Agreement Groups	✓	
Attend GCF meetings	✓	
Voting rights in meetings	✗	
Stand for GCF Board	✗	
Annual Fee (*)	€ 5,500	

GCF Certification

“Test once, use anywhere”

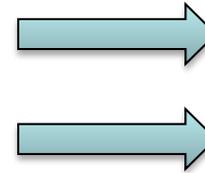
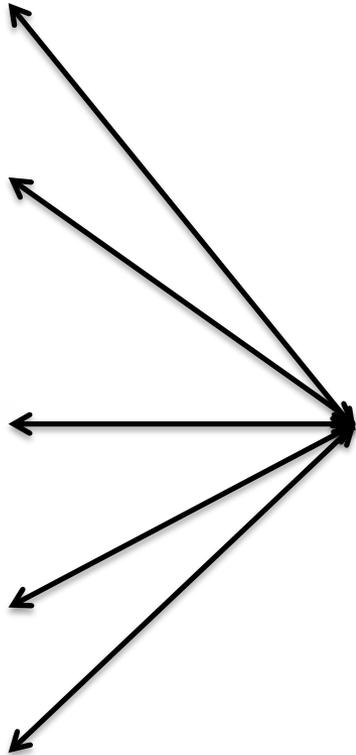
- Complements regulatory schemes (which focus on spectrum utilisation, EMC, user safety, etc.)
- Certification Criteria based on core standards from SOs
- Scheme has expanded to encompass (amongst others):
 - all 3GPP technologies
 - Currently addressing LTE-Advanced / Advanced Pro, NB-IoT & LTE-M
 - Client Applications and Services e.g. RCS, NFC, RSP (Remote SIM Provisioning)
- Test cases agreed by the industry for the industry
 - Relevant to the real needs of operators and device manufacturers
- Focused on:
 - Providing a platform for harmonisation of testing
 - Avoidance of duplication of testing
 - Reducing testing overheads for manufacturers and operators

Global Cooperation to Deliver Certification Criteria and Certified Devices



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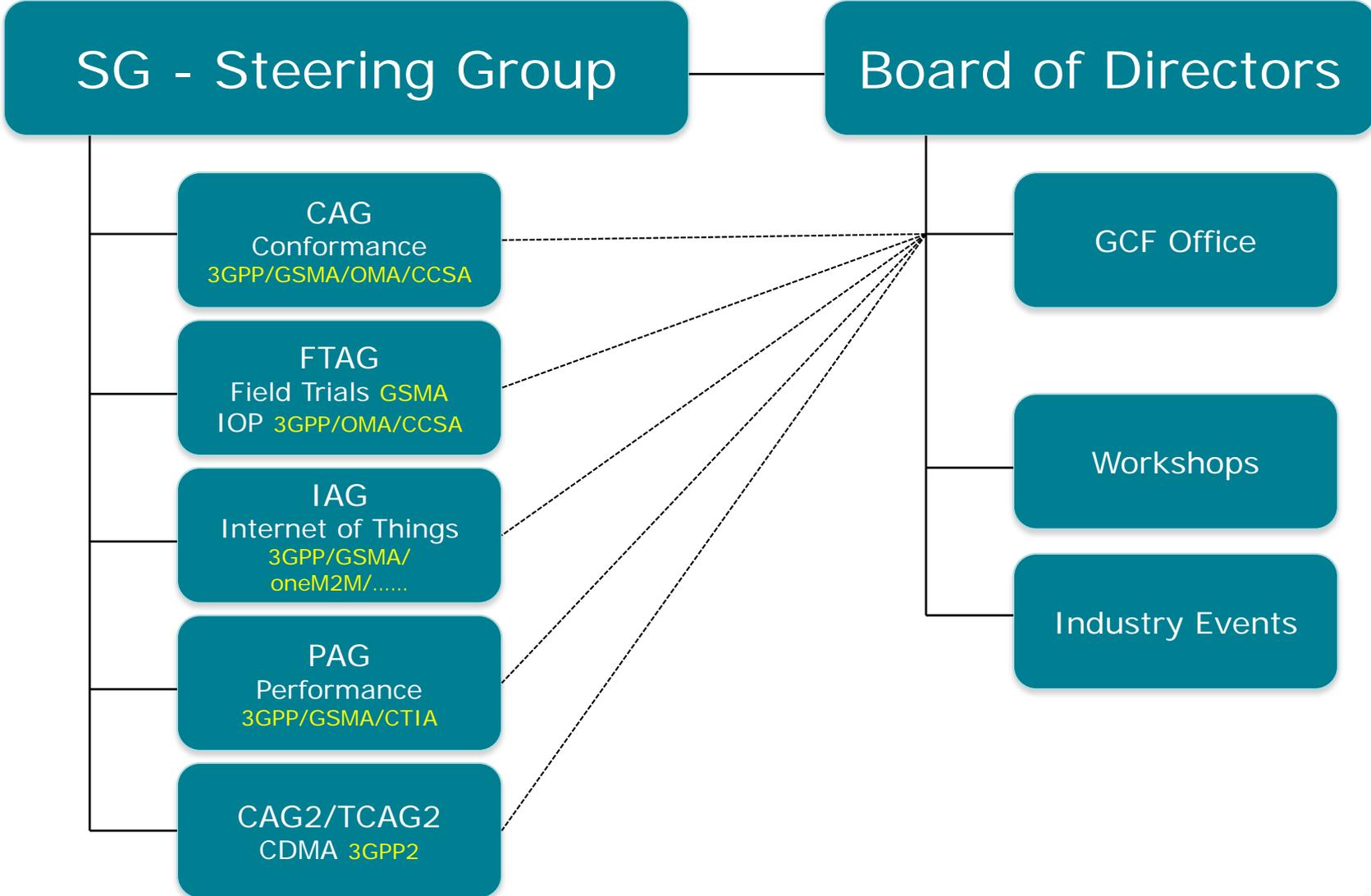


**Certification
Criteria**
**GCF Certified
Products**

Extensive participation from operators, manufacturers and test industry

Standards Organisations

GCF's Working Structure



GCF CERTIFICATION

Quality processes to ensure reliable declarations...

Integrity is ensured through six distinct processes:

1. **Qualification:** Manufacturers are required to demonstrate they have the skills, working practices and resources to participate in the scheme
2. **Definition:** Certification Criteria for new features and requirements are agreed jointly by Operators and Manufacturers
3. **Validation:** Conformance Certification Criteria are independently validated
4. **Assessment:** Each new device tested to demonstrate that all relevant Certification Criteria have been met. Testing includes:
 - Conformance Tests
 - Interoperability tests
 - Field Trials
5. **Declaration:** All GCF Operator members are automatically notified of every new GCF-Certified device
6. **Contest:** Procedures exist which allows operators to challenge a device's certification

GCF Certification Criteria - overview

- GCF certified devices are assessed against a list of tests known as the “GCF Certification Criteria”.
- GCF-CC includes
 - Conformance tests.
 - Interoperability tests.
 - Live network field trials.
- GCF-CC includes requirements relating to GSM, UTRA and E-UTRA technologies, related features, services and other applications (e.g. NFC).

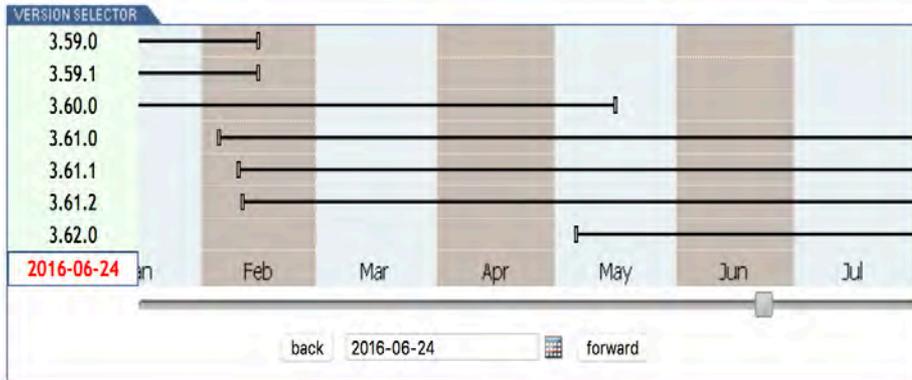


GCF-CC
(a list of tests)



Device certified IF it meets GCF-CC requirements

Versions of GCF-CC



GLOBAL CERTIFICATION FORUM	
Certification Criteria	
Reference:	GCF-CC
Version:	3.62.1
Date:	27 May 2016
Document Type:	Technical
Overlap Period:	The 110 day overlap period(s) for previous version(s) of GCF-CC will end on the following date(s): GCF-CC v3.61.n – 15 August 2016 GCF-CC v3.62.n – 17 October 2016

- GCF's certification criteria are updated 4 times per year.
- When a new version is issued, the previous version can still be used for certifications for 110 days.
- This affords manufacturers and the test industry a grace period when the certification criteria is updated.
- Manufacturers can choose which (in-force) version to use.

What are conformance tests?

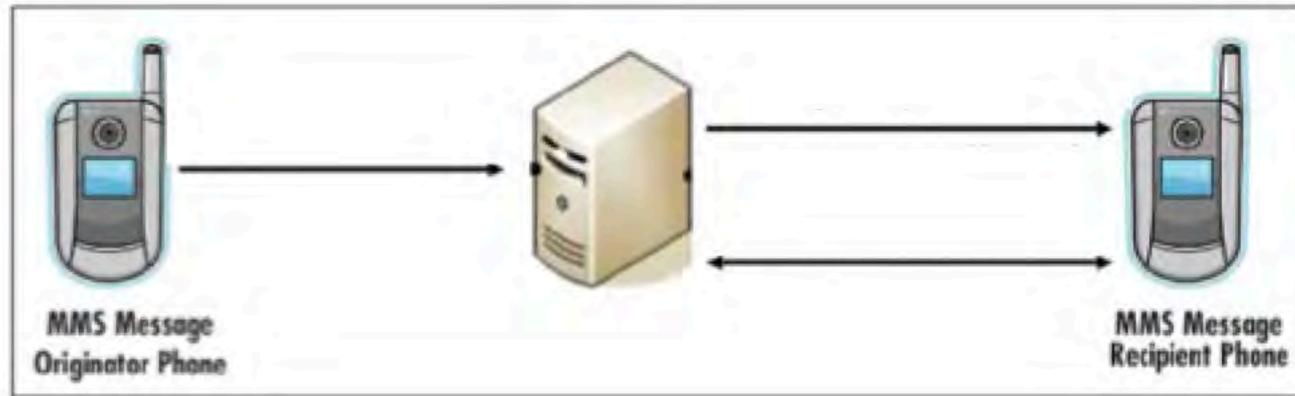
- Conformance tests check that the RF, Radio Resource Management (RRM) and signaling protocols CONFORM to relevant standards.
- Devices are tested against a simulated network in laboratory conditions.
 - 'Network simulators' in GCF are referred to as 'Test Platforms'.



Network simulator
(Test Platform)



What are interoperability tests?



Interoperability Testing

- Interoperability (IOP) testing involves checking (for a specific service / feature) that the device is interoperable with the server and/or other devices that support the feature.

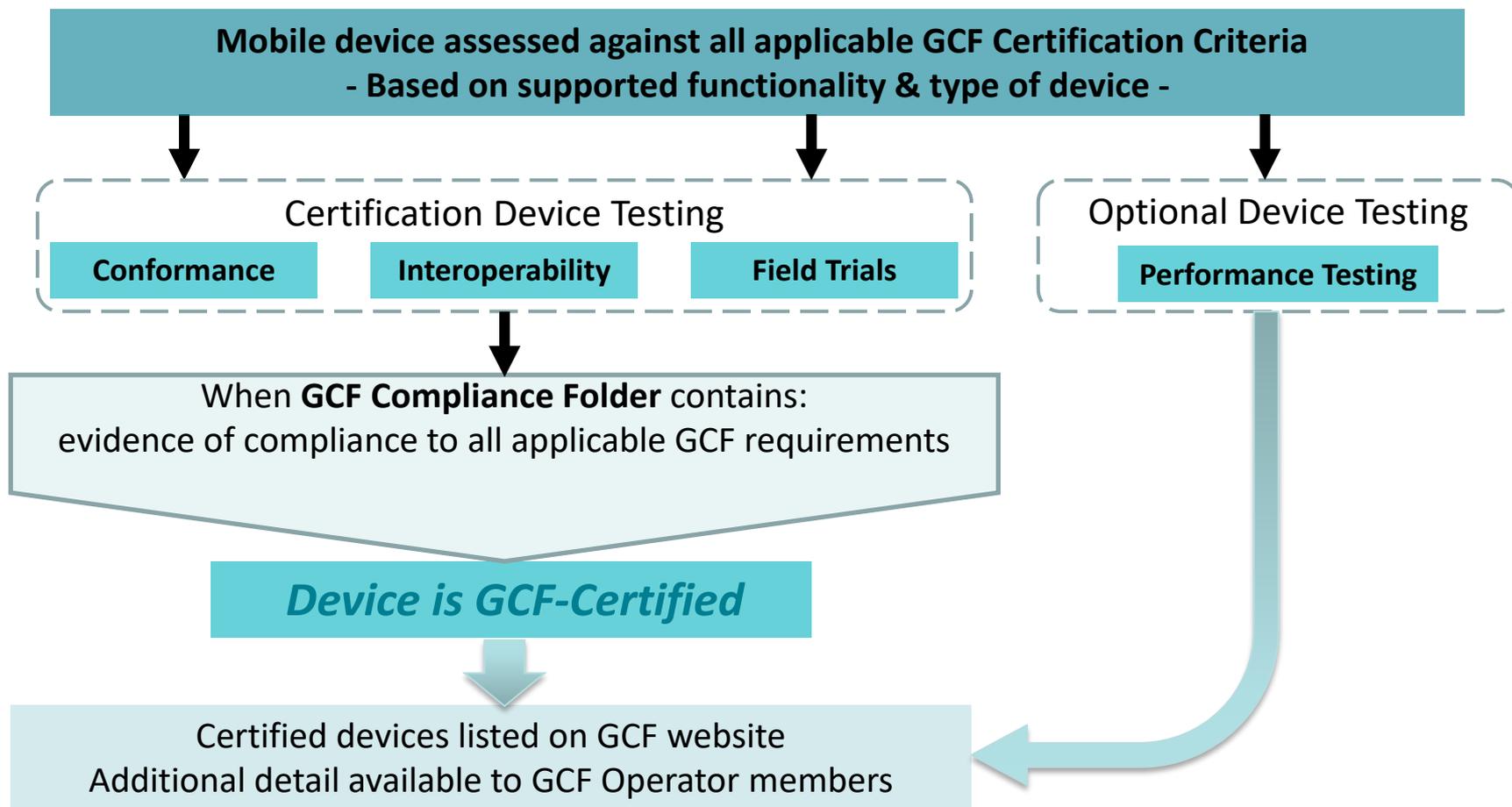
What are live network field trials?

- Field Trials are tests that are executed in live (commercial) networks.
- Devices are driven through a number of networks that are known to use different infrastructure vendors.
- This 'road testing' helps to ensure that the device will work under real network conditions.



Field Trials

How are devices GCF certified?



LTE STATUS

LTE is a key focus of GCF Device Certification

- 3 Key Areas of LTE Testing: Radio Frequency (RF), Radio Resource Management (RRM), and Signaling Protocol

3GPP TS	Testing Area
36.508	Common test environment for UE Conformance Testing
36.521-1	UE RF Conformance Testing
36.521-2	Applicability for UE RF & RRM Conformance (ICS)
36.521-3	RRM Conformance Testing
36.523-1	UE Signaling Protocol Conformance Testing
36.523-2	Applicability for UE Signaling Protocol Conformance (ICS)
36.523-3	Test Suites (TTCN) for UE Conformance Testing

GCF LTE Roadmap



WCDMA Positioning

UTRA FDD enhancements

UTRA absolute priority based reselection

Hybrid VoLTE (1X-RTT)

1X-RTT & Voice over Wi-Fi

Hybrid 1x LTE

(e)1x-CSFB

Inter RAT (C2K-LTE)

E-UTRA RF, RRM, Protocol

E-UTRA Inter-mode, Inter RAT & Inter-band

E-UTRA Carrier Aggregation

VoLTE

Single Radio Voice Call Continuity in alerting phase

E-UTRA MBMS

E-UTRA Network Improvements for MTC

WI's in progress:

Carrier Aggregation with 3DL & 2UL (Rel12)

Dual Connectivity

256-bit QAM

DL MIMO Enhanced with LTE Advanced

Enhanced Voice Services (EVS) Conformance Tests

Plans to implement 3GPP RAN5 WI's:

Rel 13 CA Configurations

Rel-13 LTE DL 4 Rx antenna

Full Dimension MIMO

Licensed-Assisted Access

LTE Direct & Broadcast

TDD/FDD Evolution

LTE-M & NB-IOT

Enhancements for V2X

Rel 15 and Beyond

Cooperation with 3GPP RAN5 and others to focus certification requirements on:

- Unified 5G PHY and MAC Design
- MIMO Spatial Multiplexing
- High Capacity mmWave
- Flexible TDD/FDD subframe
- Non Orthogonal RSMA
- Interconnectivity with HetNets

UE LTE Testing Challenges

- LTE & LTE-Advanced introduces several complexities from a testing perspective:
 - **Multiple Bands:** Including both FDD and TDD bands, multiple sub-carriers and bandwidth, dramatically increases the number of different combinations under test
 - **Different Modulation Schemes:** OFDMA in the DL vs SC-FDMA in the UL
 - **OTA Antenna Performance:** TRP/TIS limits have not been defined causing Operator specific limits to come into place, causing different pass/fail criteria with regards to antenna performance
 - **Inter-RAT:** Co-existence of 3G systems require interoperability testing of different RATs increasing the number of test scenarios
 - **Carrier Aggregation:** Requires emulating multiple cells and multiple bands, while simultaneously analysing Tx and Rx chains over these band and cell combinations. Non-contiguous Inter-Band CA Tests introduce a much higher complexity due to the use of multiple transceivers compared to Intra-Band CA tests
 - **Enhanced MIMO:** Multi-Antenna techniques creates challenges in measuring between multiple Tx signals and dealing with interference in the Rx chain
- All of these increase the # of test cases and time required for certification

LTE-Advanced Support

- LTE Advanced focussed on bringing enhancements to uplink spectral efficiency, higher peak data rates, higher capacity and better cell edge performance:
 - **Carrier Aggregation:** GCF currently has active work items on CA with 3DL and 2UL for both FDD and TDD
 - **MIMO & Spatial Multiplexing:** Work Items supporting 8x8 DL and 4x4 UL going to being developed
 - Additional enhancements via support of **Dual Connectivity** and **Enhanced Voice Service Testing**
- Incorporation of LTE Advanced and Advanced Pro into overall LTE device certification is the key focus for 2017

LTE bands currently within GCF certification

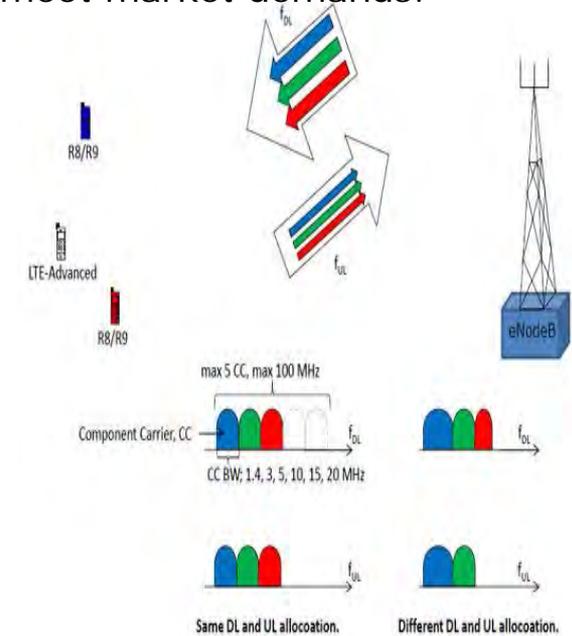
3GPP Band		Activated	1 st Certified Device
1	FDD	Apr 2011	Sep 2011
2	FDD	Apr 2014	Apr 2014
3	FDD	Feb 2012	May 2012
4	FDD	Feb 2012	Sep 2012
5	FDD	Oct 2011	Jan 2013
7	FDD	Apr 2011	Sep 2011
8	FDD	Jan 2013	Oct 2013
11	FDD	Apr 2012	Oct 2012
12	FDD	Jan 2015	May 2015
13	FDD	Dec 2010	Aug 2011
14	FDD	Apr 2014	May 2015
18	FDD	Apr 2012	Oct 2012
19	FDD	Jan 2013	Jul 2014
20	FDD	Dec 2010	Jul 2014
21	FDD	Jan 2013	Aug 2014

3GPP Band		Activated	1 st Certified Device
19	FDD	Jan 2013	Aug 2013
20	FDD	Dec 2010	Mar 2012
21	FDD	Jan 2013	Aug 2013
25	FDD	Jun 2012	Feb 2013
26	FDD	Apr 2013	Feb 2014
27	FDD	Ready for activation	
28	FDD	Jan 2015	May 2016
31	FDD	Ready for activation	
38	TDD	Jul 2011	Sep 2011
39	TDD	Jun 2012	Sep 2014
40	TDD	Oct 2011	Oct 2012
41	TDD	Apr 2012	May 2013
42	TDD	Jan 2016	
66	FDD	Expected Q2 2017	

Carrier Aggregation (CA)

GCF Certification covers a growing range of CA bands in order to meet market demands:

Duplex Type	Configuration	Mode	How many in configurations in GCF certification?	How many in development?
Intraband	contiguous	FDD	1	3
		TDD	4	3
		Intermode	0	0
	non-contiguous	FDD	2	3
		TDD	0	0
		Intermode	0	0
Interband	non-contiguous	FDD	38	16
		TDD	3	1
		Intermode	0	12
		Total configurations	48	38



- Above combinations is reflecting the status at mid 2017 and numbers have grown since
- Constituent bands for CA combinations are based upon spectrum available in different regions of the world.
- GCF currently includes support for 2 DL / 1 UL, 2 DL / 2UL and 3 DL / 1 UL CA configurations (in terms of the number of component carriers in the uplink and downlink).
- CA is covered in 3GPP Release 10 and higher.

Current Challenges for LTE Certification

28

- Evolution in complexity of the 3GPP standards & features are optional:
 - Population of devices in networks becomes more diverse
 - Particular devices towards the lower end of the market may lack support of advanced features, such as Carrier Aggregation
- Test Case Optimisation activities are underway to ensure the total number of executable tests are manageable without compromising quality. Focus on reduction is on GERAN and UTRA test cases as the number of EUTRA tests increase
- Efforts underway to coordinate testing activities between Conformance, Field and Interoperability type testing to ensure duplications and redundancies are eliminated
- Platform certification allows for significant re-use of test results
- VoLTE has specific issues

5G Impact on GCF Certification

- 5G is still being standardised with key elements
 - Enhanced Mobile Broadband
 - Massive IoT
 - Ultra reliable and low latency
- 5G use cases will be driven by industry verticals
 - Certification will need to include requirements from industry verticals
 - Industry Alliances are started to be established for the industry verticals
 - 5G Automotive Alliance is one example
 - GCF will need cooperation agreements and new membership categories
- Evolution in network core
 - Network slicing adding another factor into test considerations

Summary

- Ensuring device – network interoperability is fundamental to the mobile industry and its customers who rely on reliable mobile communication services.
- GCF certification enables device manufacturers to demonstrate their products are interoperable with global networks.
- GCF is open to all operators and manufacturers from the world and to cooperate with all interested parties on interoperability of mobile devices

GCF INFORMATION TOOLS

GCF Public Website

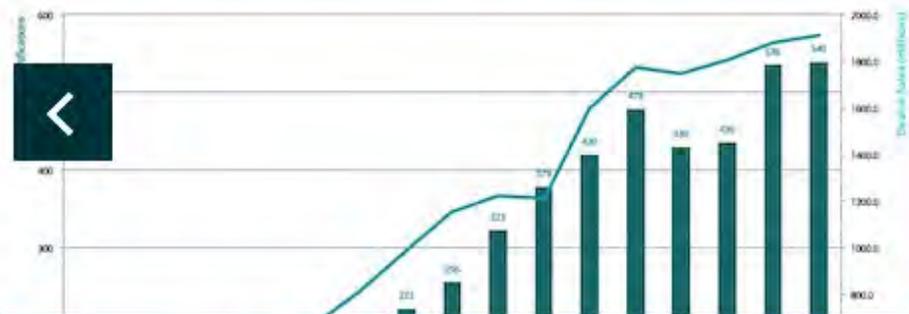


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Mobile Device Trends



Events

Globally-trusted devices for digital life

GCF Certification exists to enable manufacturers to ensure their latests smartphones, handsets and wireless devices will work correctly on the world's mobile networks.

Manufacturer	Device	Date
TCL Communication Ltd	5056X	2016-03-30
TCL Communication	4034M	2016-03-25

GCF Members' Website



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Welcome to the GCF Members' Portal

Whether you are a regular visitor or have recently joined the GCF Certification Scheme, please read the tips below to ensure you maximise the benefits of your membership.

- If you have not already done so, please place your member log in details in a safe place for future reference
- Please make sure the membership details of yourself and your organization are always kept up-to-date
- To ensure you receive all appropriate GCF communications please visit [Mailing List](#) and join the relevant email Reflector lists
- To access the certification criteria for conformance testing click on the [DCC](#) button here or on the navigation bar above.
- To review the latest certified terminals and their certification details, or in the case of Manufacturers, to declare your certification online, please visit [Devices](#)
- To view any GCF documents (and use the search function to help you find what you need quickly) please go to [Documents](#)
- To register for GCF meetings or view documents presented at a specific meeting, go to [Meetings](#)

We regularly update and improve this site and value your comments. If you have any feedback on the GCF Website, or are interested in providing input to the DCC or other GCF related question, please contact secretariat@globalcertificationforum.org.

Device Certification Criteria (DCC) DB



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Home > Latest Changes

Welcome to DCC Version 1.9.1.1

The Global Certification Forum (GCF) Device Certification Criteria (DCC) is a real time tool to enable members to access all the technical Certification Criteria for Conformance Testing in order to assess and certify devices online. DCC represents a significant upgrade from the previous CC database; specifically it is intended to provide much greater functionality and performance.

To make getting started easier we recommend you access the DCC User Guide which can be found from the help button at the top of each DCC page.

DCC includes modules for Certification Criteria, Change Request, Meeting and Explorer:

- The Certification Criteria module provides online and offline GCF-CC versions
- The Change Request module is used to add CRs, manipulate one's own CRs and finally view and challenge public CRs.
- The Meeting module helps to manage meetings and generate new main versions
- The Explorer module shows information on Test Cases, Test Platforms and Work Items

If you experience any problems with DCC please contact dccsupport@globalcertificationforum.org

Useful Links

Link	Description
Latest version of CC	Excel version of most recent main version of CC (Certification Criteria), created immediately after the closure of the last CAG meeting.
Meeting Summary for CAG#40 meeting	A summary of the treatment of all the meeting Change Requests (CRs) showing which CRs were approved and implemented, partially implemented, rejected or revised. CAG#40+CDMA
TC Category changes for CAG#40 meeting	A summary of the Category changes made for each affected TC when the most recent version of CC was created at the end of the last CAG meeting. Download Excel version
List of Test Platforms	A list of all the Test Platforms used by DCC, including details of the Configuration Versions and the related Work Item Status.
List of approved Test Platforms for each Work Item	Overview of the approved and non-approved Test Platforms for each Band within each GCF Work Item (WI). The list uses the Test Platform Approval Criteria (TPAC). For details of how TPAC is handled see the Permanent Reference Document (PRD) called GCF-OP which can be obtained here .
Work Item Summary Report	A report of the current status of all Work Items (WI) showing the TCEC counting and the total number of included test cases per WI. The status after the previous 3 CAG meetings is also shown. Download Excel version
Definitions	Some key definitions from the Permanent Reference Document GCF-AD, relevant to DCC.
Template file for bulk upload	This file is to be used for the bulk upload of completely new test cases (TC) into DCC and is typically used when a new Work Item (WI) has been created. The file contains the template to be used together with guidance on how to use it plus an example. Please ensure that you follow the data formats defined exactly to avoid delay.
Template file for CR import	This Excel file is the template to be used when you wish to submit a Validation Change Request using the Change Request > New > Generate CR with import file menu option. The purpose is to save time during the CR creation process and to generate an Excel Validation Report automatically and full details of how it should be used can be found in the Help guide.
DCC EG Page	Details, documents and reports of the activities of the DCC Experts' Group.
FTAG WIDs	Field Trial Agreement Group (FTAG) Work Item Descriptions (WIDs).
WIASR	Work Item Activation Status Report (WIASR).

below are the latest changes ([full details](#) | [Test Case Comment](#))

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