

Open Development Device Certification Process

This document provides initial information related to the Verizon Wireless Open Development. All information herein is subject to change without notice. The information provided was considered technically accurate at the time the documents were developed, but Verizon Wireless disclaims and makes no guaranty or warranty, express or implied, as to the accuracy or completeness of any information contained or referenced herein. VERIZON WIRELESS DISCLAIMS ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

The developer of any Device, service or product for use on the Verizon Wireless network assumes all risks related to the development of such Device, service or product. Verizon Wireless does not guarantee or warrant the availability of its network or the compatibility of its network with any Device, service or product. Verizon Wireless disclaims liability for any damages or losses of any nature whatsoever whether direct, indirect, special or consequential resulting from the use of or reliance on any information contained or referenced herein.

Document #: SP-OA-ST-08-0003

Contents

REVISION HISTORY.....3

1 OBJECTIVE6

2 GLOSSARY AND DEFINITION OF TERMS7

3 DEVICE COMPLIANCE PROCESS.....9

3.1 Entrance Criteria and Certification Process.....9

 3.1.1 Device Entrance Criteria 9

 3.1.2 Overall Certification Process Flow:..... 9

3.2 Certification Process 10

3.3 Required Agreements/Documents 11

3.4 OD Compliance Testing 11

 3.4.1 Early Testing Process Flow 11

 3.4.2 OD Standard Lab Testing Process Flow 12

 3.4.3 Additional Testing for Verizon Services (If features are supported by the device) 12

 3.4.4 Inactivity 13

4 POST CERTIFICATION DEVICE ID UPLOAD PROCEDURE..... 14

5 OD CERTIFICATION AGREEMENT VIOLATION PROCESS FLOW 16

**6 DEVICE EVOLUTION, MAINTENANCE & REGRESSION TESTING
PROCESS FLOW 17**

6.1 Device Evolution:..... 17

6.2 Device Maintenance & Regression Testing Process..... 17

7 TEST LAB CONTACT INFORMATION 18

| |
|------------------|
| Revision History |
|------------------|

| Re | Revision History | Date |
|------|--|----------------|
| 1.0 | Initial ODIS Testing Document | March 2008 |
| 2.0 | Modifications to add process details, LBS/aGPS and ENAP | June 2009 |
| 3.0 | Modificationss after technical review | |
| 4.0 | Modifications after legal review | June 2009 |
| 5.0 | Adding requirements lock down process | June 2009 |
| 6.0 | Adding language to address export control concerns Section 3.8 | August 2009 |
| 7.0 | Modifications to Device Introduction Process Flow Section | August 2009 |
| 8.0 | Add MMS, Global and Telematics Device support | September 2009 |
| 9.0 | RA process modifications and Vendor meeting agenda details | November 2009 |
| 10.0 | Process updates | January 2010 |
| 11.0 | Add unit requirements, 3 rd party contact name change, edits from review | February 2010 |
| 12.0 | Add ODPT mailbox to Pre-submission process flow and to Device introduction process flow; Modifications to Unit requirements | March 2010 |
| 13.0 | Replace Developer Agreement with Certification Agreement. Updated contact list. | April 2010 |
| 13.1 | Added VzW owns the test reports (Section 3.2.4) | May 2010 |
| 13.2 | Modifications to Device Introduction Process Flow Section (Section 3.4) | May 2010 |
| 13.3 | Removed Authors names | May 2010 |
| 13.4 | Added forecast worksheet to DLD | May 2010 |
| 13.5 | Legal review additions | May 2010 |
| 13.7 | Update DLD Agenda | May 2010 |
| 13.9 | Updated per legal feedback | June 2010 |
| 14.0 | General updates | June 2010 |
| 15.0 | Removed section 3.10. Added VPS – Vertical Solutions Provider. Added ppt 1 pager to pre-submission forms. Added sample Device to DLD agenda and reqs. Changed photo in 3.3. Changed available activations w/ approved module to 20. | |
| 16.0 | Updated SGS Contact Info to Johee from Dawn. Section 3.2.1 – Added Master Showcase to required docs and DLD agenda, added some clarity on how to register a new Device | |

| | | |
|------|---|---------------|
| | Section 3.5 – Mentioned new instructions on OD Portal uploads exist on the site. | |
| 17.0 | Section 3.3.3 - updated the flow and requirement for MMSC Server Test. Replaced CPE with NDET | |
| 18.0 | Section 3.5 – updated the Device Introduction process | |
| 19.0 | Section 3.5 – Updated the Device CSV process | |
| 20.0 | Section 3.5 – Updated the wait window with cut off time Section 3.6 – Added sample Device requirements | |
| 21.0 | Section 3.7 – Updated the Certification Expiration | |
| 22.0 | Section 3.3.1 – Concession Accounts All sections – Changed LBS to LBS/aGPS | |
| 23.0 | Section 3.5 Updated IMEI/ICCID pair instructions | January 2013 |
| 24.0 | Section 3.2 – Updated DLD agenda Section 3.3 – Updated testing process Section 3.4 – Updated time window for ESN upload Section 3.8 (former Section 3.9) – Added new ITL | December 2013 |
| 25.0 | Section 3.1 – Updated export control link Section 3.2 – Added LTE M2M SIM to DLD agenda Section 3.4 – Removed recommendation for EDI Section 3.8 – Updated test lab information | July 2014 |
| 26.0 | Section 3.1 – Added Software Update support for 4G devices | November 2014 |
| 27.0 | Section 3.1 – OTA ID info Section 3.3.2 – Clarification on test results Section 3.2 – Simplified DLD call agenda Section 3.8 – SGS address change and added Wireless Research Center | August 2015 |
| 28 | Removed reference section, updated lab contact | October 2016 |
| 29 | Updated acronyms Added overall flow Added new Required Agreement section Added additional testing sub-sections Updated links Updated Lab contacts Clarified other sections throughout the doc | May 2017 |
| 30 | Removed ECCN link Updated Required Agreements section Clarified FOTA updates Updated EDI upload section, added EID Updated Lab contacts | March 2018 |

| | | |
|----|--|-----------|
| 31 | <p>Section 7. Updated Technical contact for Tech Mahindra</p> <p>Section 7. Updated Test lab name from P3 to Umlaut</p> <p>Section 7. Updated Contact for Nokia</p> | Feb 2020 |
| 32 | <p>Section 3.4.1 Updated conditions for Early Network Access Program devices and Safe For Network devices</p> <p>Section 7. Updated 7Layers into Bureau Veritas</p> <p>Section 7. Added Aricom (CTS-MC)</p> <p>Section 7. Merged Nokia IOT lab and Motive lab</p> <p>Section 7. Updated information for Approved Verizon 3rd party labs</p> | July 2020 |

1 Objective

The purpose of this document is to define and describe the Open Development Device Certification process, Device testing and conformance requirements* that Devices must meet before they are certified for use on the Verizon Wireless Network. “Device(s)” means the product, equipment, parts, and components tested for OD Compliance.

This document describes the methods and procedures used to certify voice Devices, voice/data Devices, and data only Devices. This includes, but is not limited to, PDAs/Handhelds, data cards, M2M/IoT Devices, embedded PCs, and more.

*Available from web ODP under [‘Requirement & Test Plan Documentation’](#) tab (login required).

2 Glossary and Definition of Terms

| | |
|-------|--|
| aGPS | Assisted GPS |
| AM | Account Manager |
| B2B | Business to Business |
| BIS | Bureau of Industry and Security |
| CDMA | Code Division Multiple Access |
| CCATS | Commodity Classification Automated Tracking System |
| CDG | CDMA Development Group |
| CA | Certification agreement |
| CE | <i>Conformité Européenne</i> , "European conformity" |
| COI | Certificate of Insurance |
| CSV | Comma-Separated Values |
| DLD | Device Lock Down |
| DMD | Device Management Database |
| DTO | Device Test Owner |
| EDI | Electronic Data Interchange |
| EID | eUICC ID (Embedded Universal Integrated Circuit Card) ID |
| ENAP | Early Network Access Program |
| ESN | Electronic Serial Number |
| ECCN | Export Control Classification Number |
| ICCID | Integrated Circuit Card Identifier |
| IMEI | International Mobile Equipment Identifier |
| FIT | Field Interoperability Testing |
| FOTA | Firmware Over The Air |
| GCF | Global Certification Forum |
| IOT | Interoperability Testing |
| IoT | Internet of Things |
| ITL | Independent Test Laboratory |
| LBS | Location Based Services |
| M2M | Machine to Machine |
| MEID | Mobile Equipment Identifier |
| MDN | Mobile Directory Number |
| MMS | Multi Media Messaging services |

| | |
|----------|--|
| MMSC | Multimedia Messaging Service Center |
| NDET Lab | Network Device Evaluation Test Laboratory |
| NDRA | National Direct Revenue Assurance |
| NRB | Network Repair Bureau |
| NSRA | National SurePay Revenue Assurance |
| NWRA | National Wholesale Revenue Assurance |
| OEM | Original Equipment Manufacturer |
| OD | Open Development |
| ODP | Open Development Portal |
| ODPT | Open Development Product Team (Including Business Development, Certification Owners and Account management.) |
| ODS | Open Development Specification |
| OTA | Over The Air |
| PDI | Product Development and Integration |
| PM | Product Manager |
| RA | Revenue Assurance |
| RF | Radio Frequency |
| RN | Release Notes |
| SFN | Safe For Network |
| SUPL | Secure User Plane Location |
| TECC | Test Entrance Criteria Checklist (Test Campaign) |
| VSP | Vertical Solutions Provider |
| WS | Wholesale |
| VZW | Verizon Wireless |

3 Device Compliance Process

3.1 Entrance Criteria and Certification Process

All Devices must be type approved and certified by the United States Federal Communications Commission (FCC) and classified by the Department of Commerce's Bureau of Industry and Security (BIS) before Open Development (OD) Conformance testing can commence.

OEMs or OD Device Developers (collectively, "DEVELOPER,") requesting Verizon Wireless' (VZW) certification for LTE capable Devices must receive GCF certification before OD Conformance testing can commence.

All LTE capable Devices must support radio layer Firmware Over The Air (FOTA) updates.

In order for DEVELOPER to access the OD web portal or OD documents, DEVELOPER must execute a Non-Disclosure Agreement (NDA).

Each DEVELOPER will receive a unique VZW-ID after completing NDA. The VZW-ID will be used in conjunction with the submitted Device to form the Device tracking ID. VZW and OD authorized Independent Test Laboratory (ITL) will identify individual Devices prior to Certification using only this Device tracking ID.

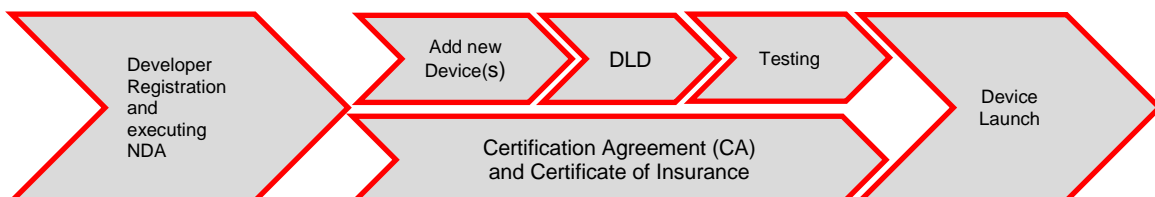
3.1.1 Device Entrance Criteria

The OD Device Tracking ID

- VZW-ID will be assigned for each DEVELOPER submitting a Device for Conformance
 - Example VZW01000001
- FCC-ID Required Prior to Open Development Conformance
 - FCC Grantee ID (First 3 Characters)
 - FCC Product Code (Remaining up to 14 Characters)
 - <https://www.fcc.gov/oet/ea/granteecode#block-menu-block-4>
 - Example "A1C0123456789012"
- BIS ECCN and CCATS Required Prior to Open Development Conformance
 - Example " 5A992, G0823456"

3.1.2 Overall Certification Process Flow:

Obtaining Device certification and launching a Certified Device on the VZW network involves fulfilling technical and the contractual requirements of the CA. The CA is a contract issued by Verizon and jointly signed by the DEVELOPER; review can occur in parallel to device registration and testing.



- Developer Registration and Executing NDA – This allows full access to ODP and detailed documents, such as requirements, test plans, etc.
- Add new Device(s) – This involves a five step process on the ODP
 - New Device Info
 - Marketing Info
 - Forecast
 - Release Notes
 - Attaching all Pre-submission Documents
- DLD - Review and lockdown documents
- Testing - Send device(s) to authorized lab for testing
- FOTA – DEVELOPER to provide FOTA update documentation on a test device.
- Completing Contractual Agreements – Fulfilling CA and COI documents are required prior to device certification.
- Device ID Upload and Launch – Loading Device IDs into Verizon Device Management Database (DMD) system.

3.2 Certification Process

- After the DEVELOPER executes a NDA, accounts will be created to access the ODP at <https://opendevdevelopment.verizonwireless.com/>
- DEVELOPER downloads and reviews the OD certification documentation.
- DEVELOPER adds information regarding the new Device and submits all required information on the ODP and notifies their supporting VZW representative. The registered device name/model number should reflect the marketing name/model number as it appears in any FCC filing or approval.
- A DLD review will be held between DEVELOPER and VZW team. The review will cover the following:
 - Submission Overview
 - Device Certification Agreements
 - Documentation Review
 - Review Test Campaign
 - Review Testing & Schedule
 - Review of Developer's Sample Devices - Besides ITL, DEVELOPER is required to send 2 samples to VZW ODPT.
 - Complete required compliance testing in Verizon authorized ITL
- Pending the successful completion of the DLD requirements, VZW will upload the Test Campaign (TECC) to the ODP and notify the DEVELOPER and selected ITL with Approve To Start test (ATS).
- A host device is certified using an approved module or chipset. A module or chipset is approved through the ODP. For module and chipset approval, refer to Module Guidelines from Requirement & Test Plan Documentation section of the ODP.

3.3 Required Agreements/Documents

All Open Development Agreements must be executed prior to Device Approval.

- **NDA** – Execution required prior to full access to ODP.
- **CA** – Must be executed before device can be fully certified. This will allow use of Verizon mark with a written request per Verizon Branded Guidelines.
- **COI** – Issued by the DEVELOPER and must be provided to Verizon as proof of valid insurance.

(NOTE: As of January 2018, Verizon Wireless and companies with a current Certification Agreement executed prior to then shall no longer execute an addenda for each newly certified device. Certification of devices will be memorialized in the OD Notice of Certification that contains any device specific requirements and will include the Certification Period for the device).

3.4 OD Compliance Testing

The following figure shows a high level view of the OD - required testing process known as OD Compliance Testing:



Any Device (including a test Device) must have a FCC ID before activation on the Verizon Network.

3.4.1 Early Testing Process Flow

DEVELOPER may request early testing if development is required prior to certification. The ODPT will review the request and approve it if there is a need for live network testing during development.

Early Network Access Program (ENAP)

- **If the DEVELOPER is using a VZW certified module, up to 20 activations can be allowed for developmental purposes.** Without a VZW certified module, up to 2 activations can be allowed for developmental purposes. Upon uploading of test Device IMEIs to the ODP, VZW will load the test Device(s) MEID/ESN/IMEI in DMD. The DEVELOPER should then work with their VZW sales representative to subscribe and activate lines to connect the test Device(s) with VZW network. The test MDNs must be disconnected no later than 60 day after testing is completed. In order to obtain approval for more than 20 test device IMEI activations, the OEM must have agreed to the terms of the Certification Agreement, and provided the Certification Manager for the device with a detailed business justification detailing: the need for additional test devices; a list of persons/entities who will be using the additional devices; where the additional devices will be used; for what length of time the additional devices be needed; and the current target date for completing device certification. The Verizon Open Development certification team will consider the requests for the additional test devices over the 20 device limit and will approve or

deny the request, based on the business justification, at its discretion. If the business case is approved, the device OEM will be allowed to update the additional test device IMEIs for approval by their assigned device certification manager.

Safe For Network (SFN) Testing

- **If the DEVELOPER completes SFN testing successfully, up to 500 activations per project can be allowed for further development purposes.** DEVELOPERS must submit the Device information for the ODPT's review and the SFN testing must be conducted at a VZW Authorized ITL.

DEVELOPERS submit Device information on the ODP and send a test Device request with supportive reasons and test ESNs/MEIDs/IMEIs.

- RN, TECC, and Device Solution One Pager are required for SFN.
- ODPT and NDET team review and approve the request.

Upon successful completion of SFN, DEVELOPER can request up to 500 activations of test Devices. All the SFN activated devices must be kept under the device OEM's own mobile account or ECPD (Enterprise Customer Profile Database) ID account and remain in the possession and control of the device OEM. The device OEM must also update the device SW to the final certification version once full certification is complete.

- If the DEVELOPER plans to sell the test devices as commercial products after approval, the DEVELOPER must manage these test devices as commercial products and upload them again (e.g., Note: **Test Devices to be sold as production Devices shall be re-uploaded by DEVELOPER as certified Devices via ODP or EDI**).

3.4.2 OD Standard Lab Testing Process Flow

- DEVELOPER should work with ODPT to obtain a TECC.
- DEVELOPER works directly with IOT labs on schedule, payment and complete IOT testing prior to or in parallel with lab conformance testing.
- DEVELOPER chooses and contacts a Verizon authorized ITL from the VZW approved list (see Section 7).
- DEVELOPER submits required Devices and product documentation to the ITL.
- It is responsibility of the DEVELOPER to provide FOTA update documentation (either their own/proprietary solution, from Module vendor, or from Verizon/Motive solution). This can be submitted while the device is in testing, but required with final results.
- The ITL executes VZW approved test campaign based on the TECC.
- The ITL provides test results to ODPT.
- ODPT reviews the test results, along with FOTA solution documentation and either passes, conditionally passes or fails the device.
- After the Device successfully passes testing, ODPT will certify the Device and issue an official notification.

3.4.3 Additional Testing for Verizon Services (If features are supported by the device)

OD Standard Lab testing completion is a prerequisite to additional testing. Details for additional testing are available in the Requirement and Test Plan Documentation section of the ODP.

3.4.3.1 LBS/aGPS/SUPL Application Testing Process Flow

After OD Standard Lab Test completion, DEVELOPER may start the LBS/aGPS/SUPL process. Refer to “LBS/aGPS Certification Submission Package” for more information.

3.4.3.2 MMS Device Testing Process Flow

The MMS process must be completed before Device certification for Devices that are MMS capable and require the use of the Verizon MMSC server. Refer to the [‘VZW OD MMSC Server Test Process’](#) for more information.

3.4.3.3 Private Network Testing

Applicable to Devices using the Verizon Private Network. Refer to Private Network section on ODP.

3.4.3.4 Device Management Services

Refer to Verizon OMADM 1.2 Reference Client Package or Verizon light weight M2M (LWM2M) OTADM Reference Client Package on ODP.

3.4.4 Inactivity

If the testing status remains inactive for more than 2 months, the certification status will be changed to FAIL. The Device will be subject to re-evaluation or re-submission for certification and may require complying to most recent VZW Requirements.

4 Post Certification Device ID Upload Procedure

After the Device is approved and before the Device goes to market, the Device must be entered into the VZW DMD to allow future activation of a certified Device. This Process is known as the Device identification upload (ESN/MEID for 3G Devices or-IMEI for 4G Devices).

The DEVELOPER can upload the production Device identifications using one of the following approaches:

1. EDI
2. ODP

If one of the above two upload methods is not followed, the VZW' system will prevent activation of the Devices.

4.1 EDI

Electronic Data Interchange (EDI)

- Refer to the “Electronic Data Interchange (EDI) Document” section on the ODP for more information

4.2 OD ODP

- DEVELOPER captures all of the Device identifications (ESNs/MEIDs/IMEIs) in a CSV file or text file as followed:
 - The ESNs/MEIDs/IMEIs will start on the first line of the first column. For Devices with IMEI & ICCID pairings the IMEIs will be placed in column A and ICCIDs will be placed in column B
 - The name of the file should not contain any special characters (e.g. spaces, dashes, quotation marks, etc.) and must contain the make, model, and total number count of ESNs/MEIDs/IMEIs or IMEI/ICCID loaded).
 - Example of the CSV or .txt file:

File Name: CompanyXYZ_ProductABC_5.csv

| | A |
|---|----------------|
| 1 | A00000028BC821 |
| 2 | A00000028BC822 |
| 3 | A00000028BC823 |
| 4 | A00000028BC824 |
| 5 | A00000028BC825 |

ESN/MEID/IMEI:

| | A | B |
|---|-----------------|------------------|
| 1 | A1234567890123 | 1234567890123450 |
| 2 | B1234567890123 | 1234567890123451 |
| 3 | C12345678901234 | 1234567890123452 |

- o IMEI/ICCID pair:
- o IMEI/EID pair (txt or csv):

```

TEST_IMEI_EID_PAIR_UPLOAD.txt - Notepad
File Edit Format View Help
359271090000005 8903302331133000000000227XXXXXX
35927109000000XX 8903302331133000000000227XXXXXX
35927109000000XX 8903302331133000000000227XXXXXX
35927109000000XX 8903302331133000000000227XXXXXX
35927109000000XX 8903302331133000000000227XXXXXX
35927109000000XX 8903302331133000000000227XXXXXX
35927109000000XX 8903302331133000000000227XXXXXX
    
```

| | A | B | C |
|---|-------------|------------|---|
| 1 | 3.59271E+14 | 8.9033E+31 | |
| 2 | 3.59271E+14 | 8.9033E+31 | |
| 3 | 3.59271E+14 | 8.9033E+31 | |
| 4 | 3.59271E+14 | 8.9033E+31 | |
| 5 | 3.59271E+14 | 8.9033E+31 | |
| 6 | 3.59271E+14 | 8.9033E+31 | |

- DEVELOPER logs into ODP, clicks on the “Upload ESN/MEID” link/tab next to the approved Device.
- On the upload screen, select the format of the serial numbers that will be uploaded. The format must be one of the following:
 - o IMEI (15) numeric or alpha
 - o MEID (14) alpha numeric only
 - o ESN HEX (8) alpha numeric only
 - o IMEI/ICCID Pair- IMEI(15) numeric or alpha & ICCID (20) alpha only
 - o IMEI/EID Pair – IMEI(15) numeric or alpha & 32 alphanumeric hexadecimal

- Once the DEVELOPER uploads the CSV or txt file, an email is automatically sent to the DEVELOPER providing notice that an ESN/MEID/IMEI file has been uploaded and automatically approved.
- The Device identification (ESNs/MEIDs/IMEIs or IMEI/ICCID pairs) provided in the CSV approved file will take up to 15 minutes to load into the VZW DMD system and will be ready for activation then.
- **Test Devices to be sold as production Devices shall be re-uploaded by DEVELOPER as certified Devices via ODP or EDI.**

5 OD Certification Agreement Violation Process Flow

Upon knowledge of any Rogue Devices (unapproved Device or approved Device harming the network), Applications or Violations to the CA with VZW the following will take place:

- ODPT notifies DEVELOPER of Device compliance issue (rogue Devices or applications detected, CA violations)
- Developer will ship 2 sample Devices within 48 hours upon receiving the formal request from Verizon for network evaluation.
- VZW retains the right to restrict or deactivate the OD Device if VZW has determined the Device to be harmful to the Network and its end users and de-certify it if necessary.

If a Device fails to comply with the OD Specification, Verizon may de-certify the Device or take any necessary steps to protect the Network and its end-users, including, but not limited to, (a) no provisioning of additional units of the Device on the Network, (b) removal of the Device from the OD website that lists current certified devices, (c) notification to Device end-users of Network issues related to the failure to comply with the OD Specification that impact the Device end-users' service on the Network.

6 Device Evolution, Maintenance & Regression Testing Process Flow

6.1 Device Evolution:

At any time, in case of any updates to the certified software or hardware, DEVELOPER must notify ODPT and provide all submission documentation to the ODPT

- DEVELOPER provides all submission documents with the Device changes in detailed descriptions
- ODPT/NDET determines the level of testing required based on the updated Device.
- DEVELOPER initiates Device Maintenance Release Testing Flow

6.2 Device Maintenance & Regression Testing Process

- DEVELOPER submits updated submission documents to the ODPT/NDET Lab for evaluation, and coordinates with the OD Authorized ITL to execute regression testing (in coordination with VZW NDET Lab).
- After the regression test criteria are completed for the Device, the OD authorized ITL forwards the results to the VZW (ODPT & NDET Lab) to verify that the Device is compliant.
- After the Device successfully passes testing, the ODPT will certify the Device Maintenance Release and issue official notification.

7 Test Lab Contact information

| BUREAU VERITAS | | Capabilities |
|---|--|------------------------------|
| APPROVED TESTING LOCATION 1 - MAIN | | |
| Business Contact: | John (JT) Jose | LTE, VoLTE, eMBMS, VoWIFI |
| Phone: | 1 (949) 716 6512 | |
| Email: | Sales.EAW@us.bureauveritas.com | |
| Technical Contact: | Shubha Gopalakrishna | |
| Phone: | 1 (949) 297 8057 | |
| Email: | Shubha.Gopalakrishna@us.bureauveritas.com | |
| Business Address: | 15 Musick, Irvine, CA, 92618 | |
| APPROVED TESTING LOCATION 2 | | |
| Business Address: | 1293 Anvilwood Ave, Sunnyvale, CA 94089 | OTA |

| AIRCOM (CTS-MC) | | Capabilities |
|---------------------------|--|---|
| Business Contact: | Mark Atwater | LTE, Multi-Mode, VoLTE, eMBMS, VoWIFI |
| Phone: | | |
| Email: | Mark.Atwater@teoco.com | |
| Technical Contact: | Magusood Anwar | |
| Phone: | | |
| Email: | Magusood.Anwar@cts-mcs.com | |
| Business Address: | 411 Dixon Landing Road ,Milpitas CA 95035 | |

| CETECOM | | Capabilities |
|---------------------------|--|---------------------|
| Business Contact: | Nicolas Stamber | OTA, Audio testing |
| Phone: | 1 (408) 586 6234 | |
| Email: | nicolas.stamber@cetecom.com | |
| Technical Contact: | Nicolas Stamber | |
| Phone: | 1 (408) 586 6234 | |
| Email: | nicolas.stamber@cetecom.com | |
| Business Address: | 411 Dixon Landing Road ,Milpitas CA 95035 | |

| Intertek | | Capabilities |
|---|--|---|
| APPROVED TESTING LOCATION - MAIN | | |
| Business Contact: | Robbie Payne | LTE, CDMA, Multi- Mode, VoLTE, CA, OTA, VoiWIFI, FIT |
| Phone: | 859-388-4951 | |
| Email: | robbie.payne@intertek.com | |
| Technical Contact: | Ron Bernot | |
| Phone: | 859-226-1000 | |
| Email: | ron.bernot@intertek.com | |

| | |
|--------------------------|---|
| Business Address: | 731 Enterprise Drive ,Lexington, KY 40510 |
|--------------------------|---|

| PCTEST Engineering Lab. | | Capabilities |
|---|--|--|
| APPROVED TESTING LOCATION 1 - MAIN | | |
| Business Contact: | Steven G. Coston | LTE,VoLTE,CA, OTA, Multi-Mode,CDMA, OTA,FIT, eMBMS, VoWIFI |
| Phone: | 1.410.292.6680 | |
| Email: | steve.coston@pctest.com | |
| Technical Contact: | Andrea Zaworski | |
| Phone: | 1.410.290.6652 | |
| Email: | andrea.zaworski@pctest.com | |
| Business Address: | 7185 Oakland Mills Road, Columbia, MD 20146 | |
| APPROVED TESTING LOCATION 2 | | |
| Business Address: | 6660-B Dobbin Road, Columbia, MD 21045 USA | CDMA,OTA |
| APPROVED TESTING LOCATION 3 | | |
| Business Address: | 382 Piercy Road, San Jose, CA 95138 | OTA |

| SGS | | Capabilities |
|---|--|---|
| APPROVED TESTING LOCATION 1 - MAIN | | |
| Business Contact: | Ben Kuo | LTE, CDMA, Multi-Mode, VoLTE,eMBMS,VoWIFI, OTA,5G FR2 RF, 5G FR2 Protocol |
| Phone: | 1.858.304.9141 | |
| Email: | ben.kuo@sgs.com | |
| Technical Contact: | Gerardo Berrelleza | |
| Phone: | 1.858.592.7100 | |
| Email: | Gerardo.Berrelleza@sgs.com | |
| Business Address: | 15150 Avenue of Science, Suite 300, San Diego, CA 92128 | |
| APPROVED TESTING LOCATION 2 | | |
| Business Address: | 12310 World Trade Dr, Suite 106/107 San Diego, CA, 92128 | OTA, AUDIO |
| APPROVED TESTING LOCATION 3 | | |
| Business Address: | 14 Culnen Dr, Lower Level Branchburg, NJ 08876 | 4G & 5G OTA |

| Tech Mahindra | | Capabilities |
|---|--|-------------------------------------|
| APPROVED TESTING LOCATION 1 - MAIN | | |
| Business Contact: | Arunav Roy | LTE, CDMA, Multi-Mode, VoLTE, eMBMS |
| Phone: | + 1 469 600 7846 | |
| Email: | arunav.roy@techmahindra.com | |
| Technical Contact: | Hiteshkumar Gamdha | |

| | | |
|---|---|---|
| Phone: | 9082395232 | |
| Email: | hg00492321@techmahindra.com | |
| Business Address: | Tech Mahindra (Americas), STE 203, 500 Hills Dr, Bedminster NJ 07921 | |
| <u>APPROVED TESTING LOCATION 2</u> | | |
| Business Address: | 6092 Stewart Ave, Fremont, CA 94538 | 5G FR2 VZW Supplemental RF, 5G FR2 Protocol |

| <u>Wireless Research Center</u> | | Capabilities |
|--|--|---------------------|
| <u>APPROVED TESTING LOCATION - MAIN</u> | | - |
| Business Contact: | Jordan Stearns | LTE/CDMA OTA |
| Phone: | 919-435-1051 x102 | |
| Email: | jordan.stearns@wirelesscenter-nc.org | |
| Technical Contact: | Jordan Stearns | |
| Phone: | 919-435-1051 x102 | |
| Email: | jordan.stearns@wirelesscenter-nc.org | |
| Business Address: | 3331 Heritage Trade Dr. Suite 101, Wake Forest, NC 27587 | |

| <u>UMLAUT</u> | | Capabilities |
|---------------------------|--|-----------------------|
| Business Contact: | Ron Housenick | DFIT (for Field Test) |
| Phone: | Office: 973 984 6050 Cell: 973 867 8395 | |
| Email: | Ron.housenick@umlaut.com | |
| Technical Contact: | Sascha Cigoj | |
| Phone: | +49 241 9437 399 | |
| Email: | Sascha.Cigoj@umlaut.com | |
| Business Address: | 412 Mount Kemble Ave, Morristown NJ 07960 | |

| <u>RC Logixx</u> | | Capabilities |
|---------------------------|--|-----------------------|
| Business Contact: | Ron Cunanan | DFIT (for Field Test) |
| Phone: | 972-922-6289 | |
| Email: | ron@rclogixx.com | |
| Technical Contact: | Ron Cunanan | |
| Phone: | 972-922-6289 | |
| Email: | ron@rclogixx.com | |
| Business Address: | 2727 LBJ Freeway Suite 222, Dallas, TX 75234 | |

| <u>Nokia Lab</u> | | Capabilities |
|-------------------------|--|---------------------|
|-------------------------|--|---------------------|

| | | |
|---------------------------|--|---|
| Business Contact: | Use Alias Email below | Inter-Operability (IOT) Motive-bridge (FOTA) |
| Phone: | | |
| Email: | 1) For new LWM2M OEMs: vzw-lwm2m-onboard@nokia.com 2) For new OMADM OEMs: vzw-omadm-onboard@nokia.com | |
| Technical Contact: | Same as Above | |
| Phone: | | |
| Email: | | |
| Business Address: | 600-700 Mountain Ave, room 6H-424, Murray Hill, NJ 07974 USA | |

| <u>Ericsson</u> | | Capabilities |
|---------------------------|--|-------------------------|
| Business Contact: | Omkar Dalal | Inter-Operability (IOT) |
| Phone: | 972-583-1423 | |
| Email: | omkar.dalal@ericsson.com | |
| Technical Contact: | Omkar Dalal | |
| Phone: | 972-583-1423 | |
| Email: | omkar.dalal@ericsson.com | |
| Business Address: | 6300 Legacy Dr, Plano , TX 75024 | |