

MOP T-Mobile Greenfield Call Testing

Call Testing Method of Procedure

Regulated document Unregulated document

Version, status	1.0, Approved
Date	08.24.2015
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Function	National Technical Project Management
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Doc ID	D522069560
Doc Location	NOLS/IPM Documentation

Change History

Version	Status	Date	Handled by	Comments
0.1	Draft	06-23-2015	Benjamin Espinoza	First Draft
0.2	Draft	06-29-2015	Benjamin Espinoza	Second Draft
0.3	Draft	07-01-2015	Benjamin Espinoza	Third Draft
0.4	Draft	07-16-2015	Vince Williams	Fourth Draft – Add screenshots
0.5	Final Draft	07-20-2015	Benjamin Espinoza	Revise and update
1.0	Approved	08-24-2015	Kenneth Karru-Olsen	First Official Release

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1 Introduction

This supplement was created for Call Testing UMTS and LTE for and on behalf of T-Mobile.

Upon completion of all Commissioning and Integration activities, the site must be thoroughly call tested to ensure the site is ready for Single Site Verification (SSV) to commence. It is assumed at this point that Ready to Transmit (RTT) has been granted.

Note: - If there is any doubt whether RTT was obtained, immediately contact the GDC/GNIC and gain clarification.

Prior to engaging in the activities detailed in this document, applicable training shall be successfully completed. This is not limited to product training; this shall include the handling of equipment/hardware and the correct operation of tools and test equipment.

When planning, preparing and carrying out the work activities identified in this document, applicable Nokia Networks and Manufacturer's documentation shall be identified and used (Check the latest Project Technical Documentation List for updates).

All screenshots and service mode commands used throughout this MOP are from a Samsung Galaxy S6 (model number SM-G920T) running Android 5.0.2 operating system. It is not mandatory to use this handset model for call testing as other handsets are commercial available that fulfill the call testing requirements.

If there are any concerns or changes required to this MOP, these should be raised with the Nokia Networks National Technical Project Manager by e-mail at: tmfeedback@sharenetims.inside.nokiasiemensnetworks.com

This MOP is customer confidential and cannot be shared or distributed outside of T-Mobile without Nokia's prior written consent.

2 Prerequisites

- The Flexi WBTS and eNode B have been fully commissioned and integrated to the RNC and MME
- All required licenses and features are available and activated
- The first two sections (Initial Inspection and Commissioning/Integration)of the Greenfield C&I checklist have been successfully completed
- The on-site engineer has an UMTS and LTE capable handset available to make the test calls
- The SIM card used for the call testing was provided and provisioned by T-Mobile, with the correct quality of service profile and Access Class to make the calls outlined in this document
- The Nokia GDC/GNIC is available to support the on-site engineer, and to lock and unlock carriers and/or sectors as required
- The tests shall be performed with sufficient distance (suggested 150ft away from center bore of the sector) to ensure that the coverage area of the cell under test is not compromised by neighboring cells. Do not stand at the base of the tower or structure nor lock/block any other sectors while performing the test calls. The exception to this rule is in the case of obstructed terrain. The purpose of this is to verify that no feeders were crossed

3 Call Scope

Record all call test results in C&I checklist

3.1 LTE Call Scope

Once per sector on each active LTE technology

Call Scope	Reference
Data Session	4.1.2
VoLTE Mobile Originated	4.1.3
VoLTE Mobile Terminated	4.1.4
CSFB Mobile Originated	4.1.5
CSFB Mobile Terminated	4.1.6
Carrier Aggregation	4.1.7

Table 1: LTE sector by sector call scope

Once per LTE technology (LTE700, LTE1900, LTE2100)

Call Scope	Reference
E911 over VoLTE	4.3.3

Table 2: LTE technology call scope

3.2 UMTS Call Scope

Once per sector for each carrier up to 6 carriers

Call Scope	Reference
Data Session	4.2.2
Voice Call Mobile Originated	4.2.3
Voice Call Mobile Terminated	4.2.4

Table 3: UMTS sector by sector per carrier call scope

Once per UMTS carrier up to 6 carriers

Call Scope	Reference
E911 over WCDMA	4.3.1+4.3.2

Table 4: UMTS site carrier call scope

3.3 Suggested call testing order

Technology	Test
LTE E911	Single Sector E911 over VoLTE Call per LTE technology (LTE700, PCS and AWS)
SECTOR TESTING, complete one sector before moving to next sector	
LTE AWS	Change Band to LTE AWS/2100
	LTE AWS UL/DL Throughput
	LTE AWS VoLTE MO
	LTE AWS VoLTE MT
	Disable VoLTE
	LTE AWS CSFB MO
	LTE AWS CSFB MT
	Verify Carrier Aggregation
LTE 700	Change Band to LTE 700
	LTE 700 UL/DL Throughput
	LTE 700 VoLTE MO
	LTE 700 VoLTE MT
	Diabale VoLTE
	LTE 700 CSFB MO
	LTE 700 CSFB MT
LTE PCS	Change Band to LTE PCS/1900
	LTE PCS UL/DL Throughput
	LTE PCS VoLTE MO
	LTE PCS VoLTE MT
	Disable VoLTE
	LTE PCS CSFB MO
	LTE PCS CSFB MT
UMTS PCS	Change Band to UMTS PCS/1900
	Single Sector E911 Call for each carrier, up to 6 carriers
	UMTS 1900 MO, up to 6 carriers

	UMTS 1900 MT, up to 6 carriers
	UMTS 1900 Data Session, up to 6 carriers
UMTS AWS	Change Band to UMTS AWS/2100
	Single Sector E911 Call for each carrier, up to 6 carriers
	UMTS 2100 MO, up to 6 carriers
	UMTS 2100 MT, up to 6 carriers
	UMTS 2100 Data Session, up to 6 carriers

Table 5: Order of Call Testing

4 Functional Testing Procedure

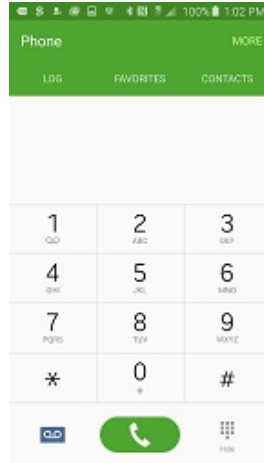
4.1 Call Testing LTE

4.1.1 Required call tests:

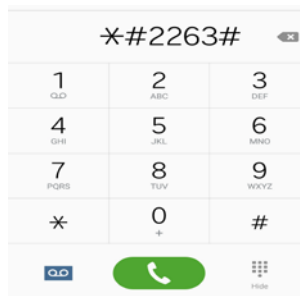
- a. Data
 - I. Ping test
 - II. Download throughput
 - III. Upload throughput
 - IV. HTTP Browsing
- b. VoLTE (mobile originated)
- c. VoLTE (mobile terminated)
- d. CSFB (mobile originated)
- e. CSFB (mobile terminated)
- f. Carrier Aggregation
- g. E911 over VoLTE (once per LTE technology)

4.1.2 Testing LTE Data

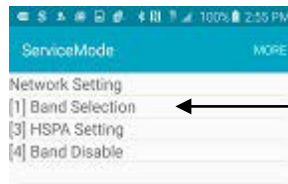
- a. See annex 1 for instructions on installing the Speedtest app
- b. Follow steps below to lock the handset onto the desired technology and band:
 - i. Open the phone app on the Galaxy S6



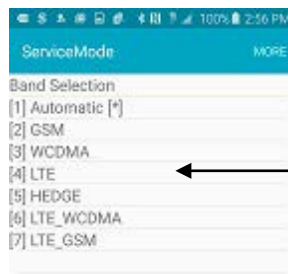
- ii. Enter the code *#2263# to open engineering mode



- iii. Select [1] Band Selection

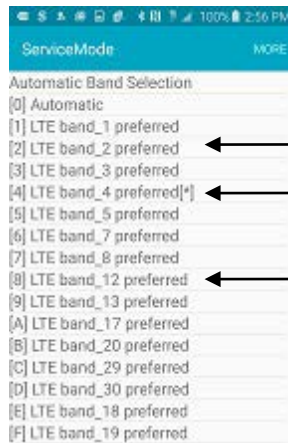


- iv. Select [4] LTE

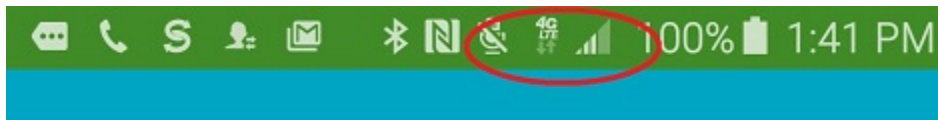


- v. Select the desired band based on the table below

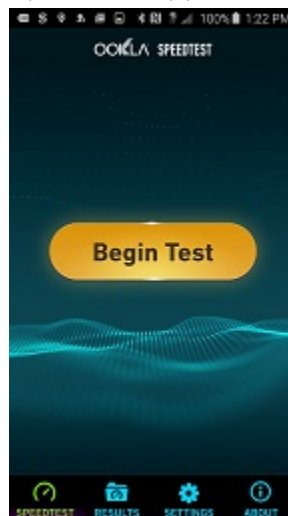
LTE Band	Frequency
B2	LTE 1900 (PCS)
B4	LTE 2100 (AWS)
B12	LTE 700



- vi. Verify 4G LTE icon at the top of the screen



- vii. Open the Speedtest app and begin the speedtest



- viii. Once the app is open and has located a server, select “Begin Test”

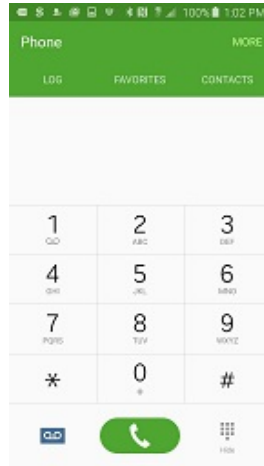
- ix. The app will first test latency using a ping test, then automatically proceed with download and then upload tests. Results will be displayed under the Results tab in the app.



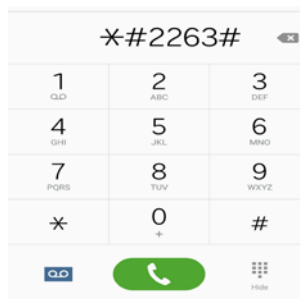
- x. Record download, upload, and latency results in the C&I checklist
- c. Open a browser on the handset, and enter the URL www.nokia.com. Confirm that http browsing works, and record result in C&I checklist

4.1.3 VoLTE Test (Mobile Originated)

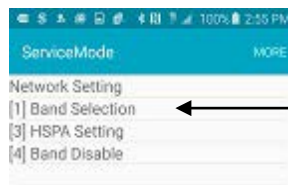
- a. Follow steps below to lock the handset onto the desired technology and band:
 - i. Open the phone app on the Galaxy S6



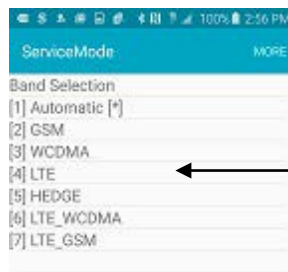
- ii. Enter the code `*#2263#` to open engineering mode



- iii. Select [1] Band Selection

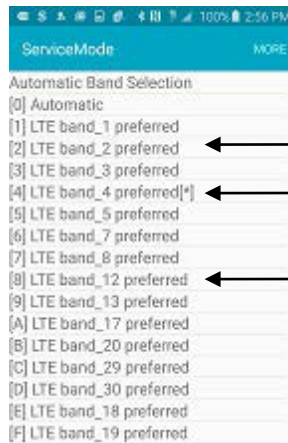


- iv. Select [4] LTE

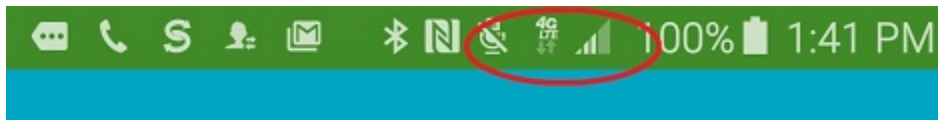


- v. Select the desired band based on the table below

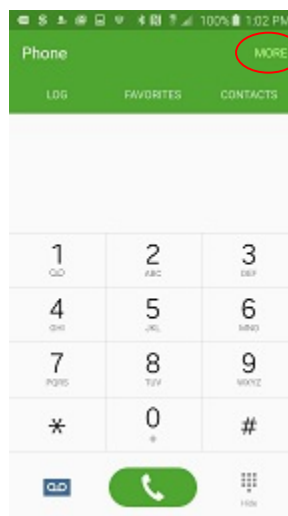
LTE Band	Frequency
B2	LTE 1900 (PCS)
B4	LTE 2100 (AWS)
B12	LTE 700



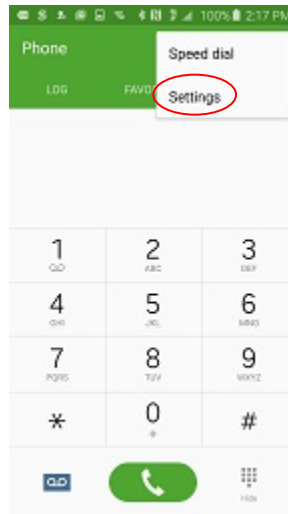
- vi. Verify 4G LTE icon at the top of the screen



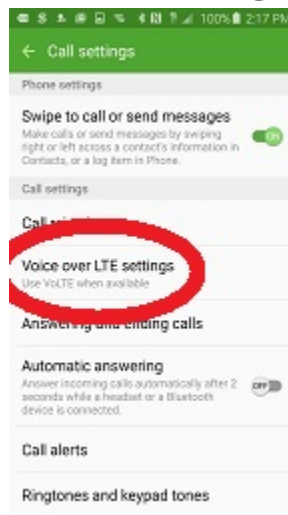
- b. Verify that the VoLTE is enabled on the handset.
 - i. Open the phone app and select MORE from the upper righthand corner



ii. Choose Settings



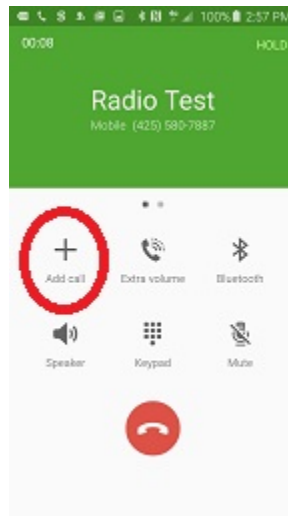
iii. Tap on Voice over LTE settings



- iv. Ensure “Use VoLTE when available” is selected as shown above
- c. Make one mobile originated test call per sector (suggested test call number: (425) 580-7887), per LTE technology (i.e.L2100 + L1900 + L700)



- d. On the phone app, select Add Call



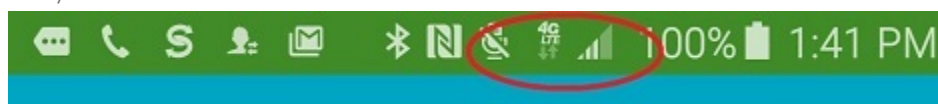
- e. On the keypad, enter *#0011#



- f. This will bring up the ServiceMode menu



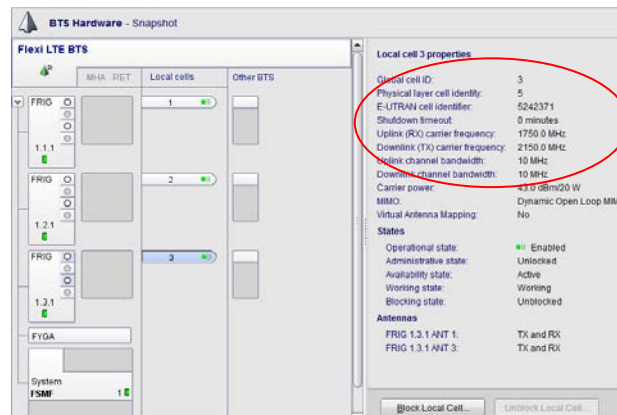
- g. If VoLTE is active, it will be displayed as shown above
- h. Verify "4G LTE" icon at the top of the screen. If the icon changes to "4G" then this may indicate a CSFB call.



- v. Note the band, bandwidth, DL & UL Frequency numbers (EARFCN), and serving cell ID (PCI)



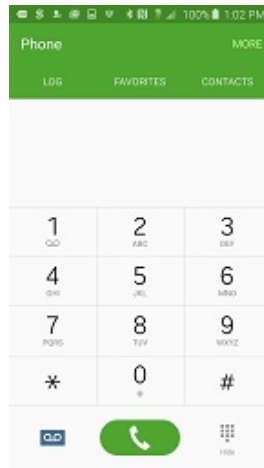
- vi. Confirm the Serving Cell ID (PCI) matches the physical layer cell ID shown in the BTS Manager:



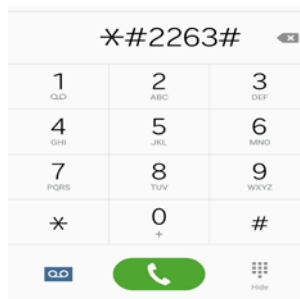
- vii. Note the RSSI and SINR, as these indicate the signal quality
- viii. Record pertinent info in call test checklist
- i. Once mobile originated VoLTE call is successful, end the call and move to the next sector

4.1.4 VoLTE Test (Mobile Terminated)

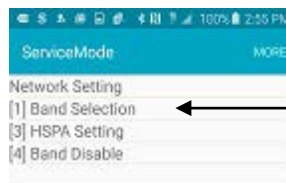
- a. Follow steps below to lock the handset onto the desired technology and band:
 - i. Open the phone app on the Galaxy S6



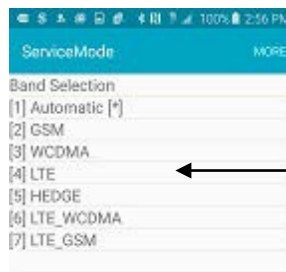
- ii. Enter the code `*#2263#` to open engineering mode



- iii. Select [1] Band Selection

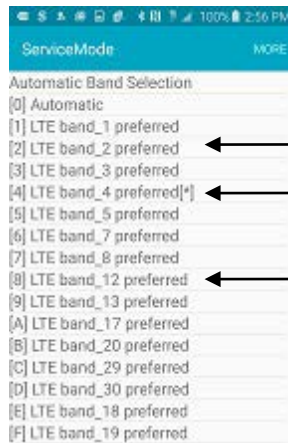


- iv. Select [4] LTE

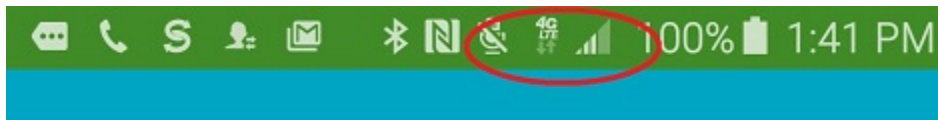


- v. Select the desired band based on the table below

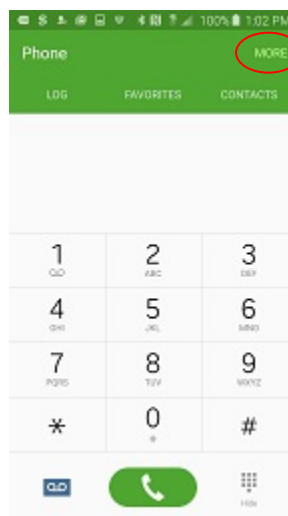
LTE Band	Frequency
B2	LTE 1900 (PCS)
B4	LTE 2100 (AWS)
B12	LTE 700



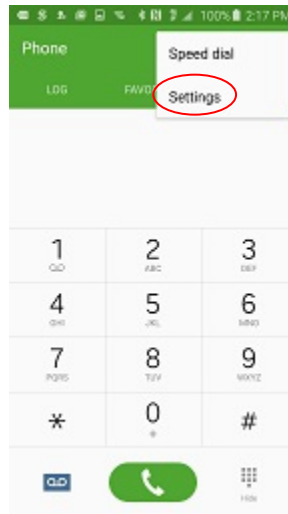
- vi. Verify 4G LTE icon at the top of the screen



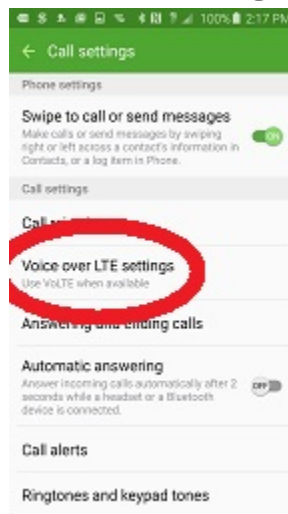
- a. Verify that the VoLTE is enabled on the handset.
 - i. Open the phone app and select MORE from the upper righthand corner



ii. Choose Settings



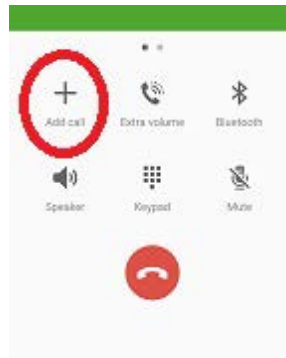
iii. Tap on Voice over LTE settings



iv. Ensure "Use VoLTE when available" is selected as shown above

- b. From a different phone, place a mobile terminated test call to the test handset, once per sector per LTE technology (L700, L1900 and L2100)

- c. While the mobile terminated call is active, open the phone app and select “Add Call”



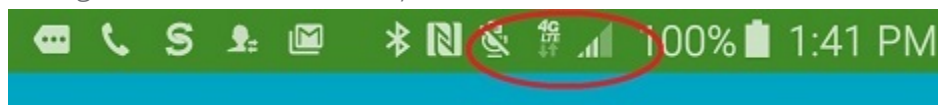
- d. On the keypad, enter *#0011#.



- e. This will bring up the ServiceMode menu



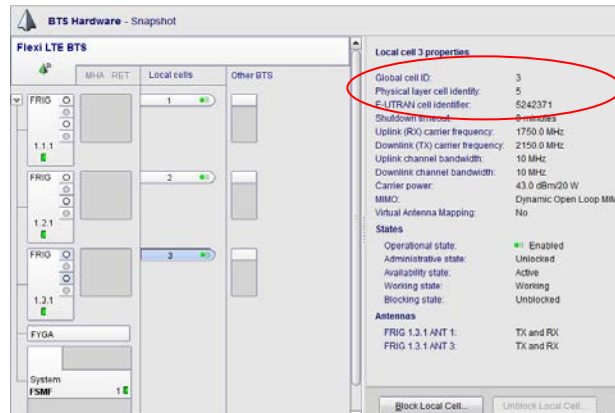
- f. If VoLTE is active, it will be displayed as shown above
- g. Verify “4G LTE” icon at the top of the screen on the test handset. If the icon changes to “4G” then this may indicate CSFB call.



- i. Note the band, bandwidth, EARFCN, and serving cell ID



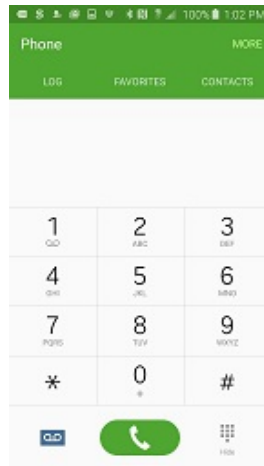
- ii. Confirm the Serving Cell ID (PCI) matches the physical layer cell ID shown in the BTS Manager:



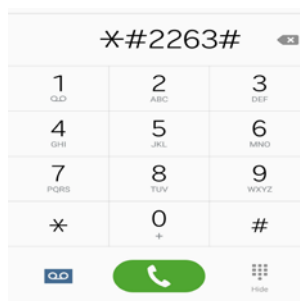
- iii. Note the RSSI and SINR, as these indicate the signal quality
- iv. Record pertinent info in call test checklist
- h. Once mobile terminated VoLTE call is successful, end the call and move to the next sector

4.1.5 CSFB Test (Mobile Originated)

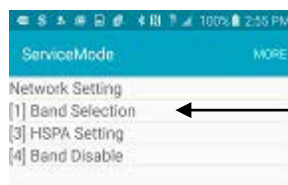
- a. Ensure handset is not locked onto any LTE band
 - i. Open the phone app on the Galaxy S6



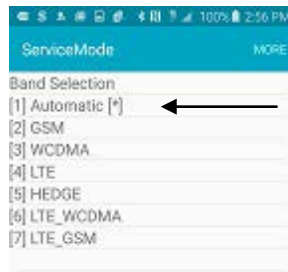
- ii. Enter the code `*#2263#`



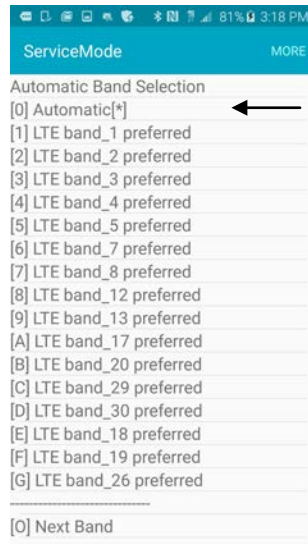
- iii. Select [1] Band Selection



- iv. Select [1] Automatic



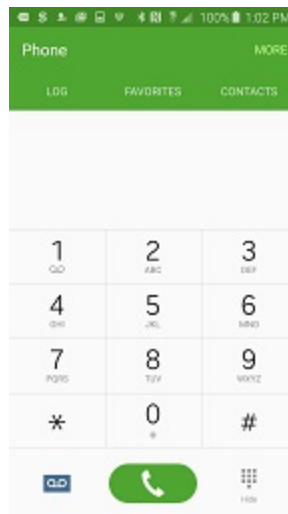
- v. Select [0] Automatic **VERIFY the working ORDER**



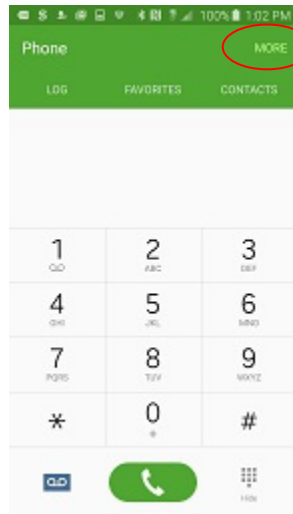
- vi. Tap the back button on the handset to return to the phone app

- b. Disable VoLTE on the handset

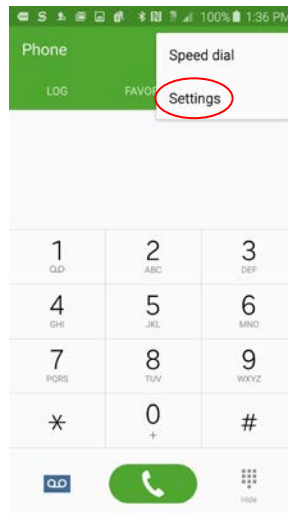
- i. Open the phone app



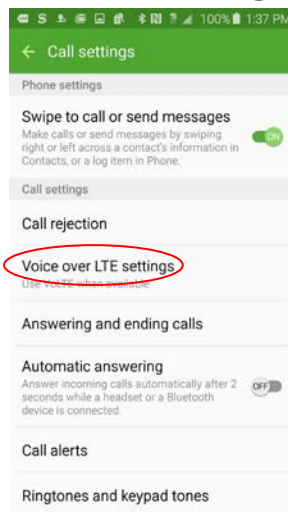
ii. Select More from the upper right-hand corner



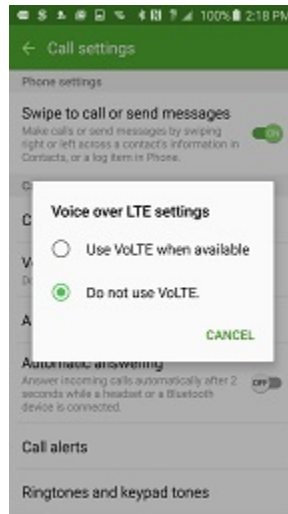
iii. Choose Settings



iv. Tap on Voice over LTE settings.



- v. Ensure “Do not use VoLTE” is selected.



- c. Make one mobile originated CSFB test call suggested test call number: (425) 580-7887) per sector, per LTE technology (i.e. L2100+L1900 + L700)
 - i. Verify “4G LTE” icon at the top of the screen changes to “4G”. This indicates CSFB call.



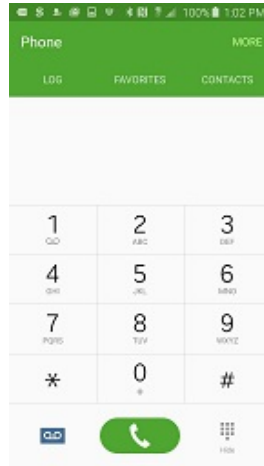
- ii. While the test call is active, select “Add Call”
- iii. On the keypad, dial pattern *#0011# to open the ServiceMode application
- iv. Select [1] Basic Info
- v. Confirm that the active call was dropped to WCDMA



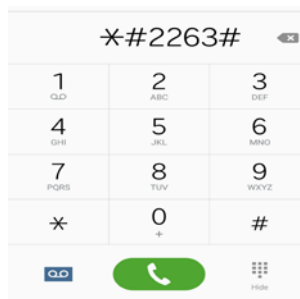
- vi. Note the band, bandwidth, EARFCN, and Primary Scrambling Code (PSC) and record the info in the pertinent sections of the C&I checklist

4.1.6 CSFB Test (Mobile Terminated)

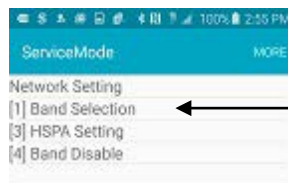
- a. Ensure handset is not locked onto any LTE band
 - i. Open the phone app on the Galaxy S6



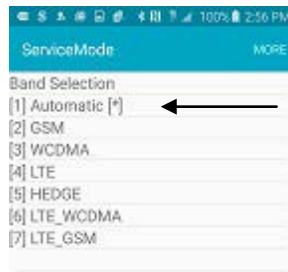
- ii. Enter the code `*#2263#`



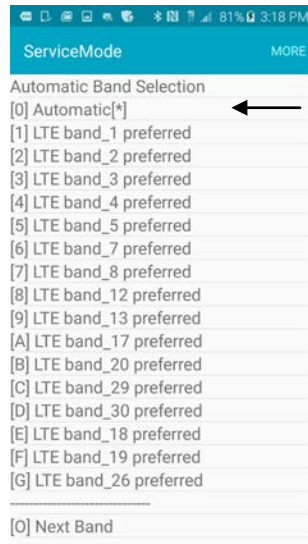
- iii. Select [1] Band Selection



- iv. Select [1] Automatic



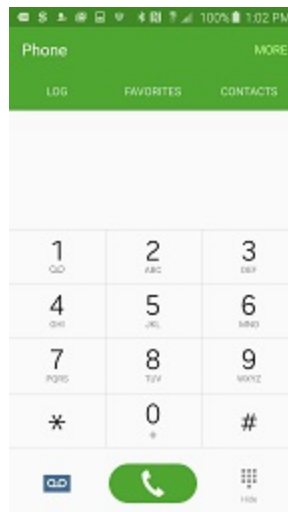
- v. Select [0] Automatic **VERIFY the working ORDER**



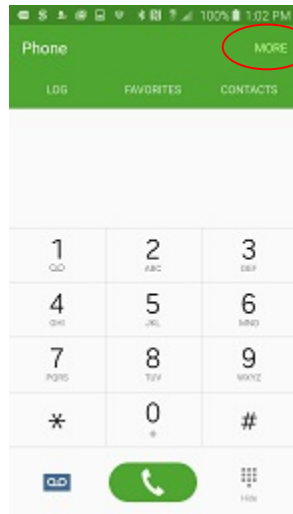
- vi. Tap the back button on the handset to return to the phone app

- b. Disable VoLTE on the handset

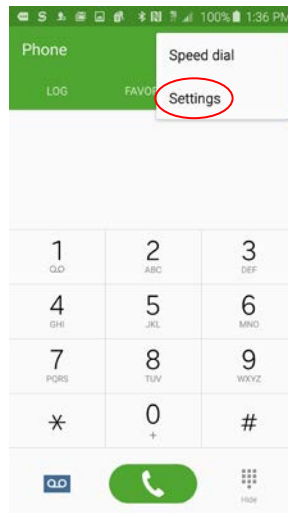
- i. Open the phone app



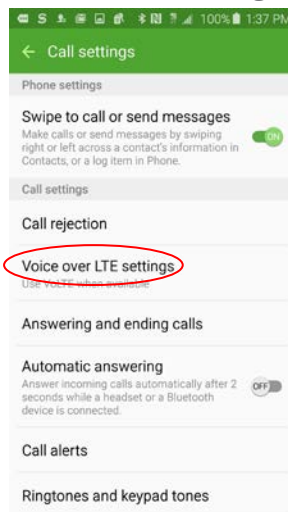
ii. Select More from the upper right-hand corner



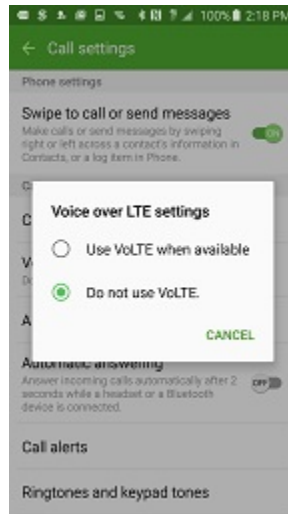
iii. Choose Settings



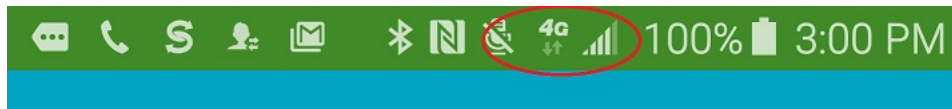
iv. Tap on Voice over LTE settings.



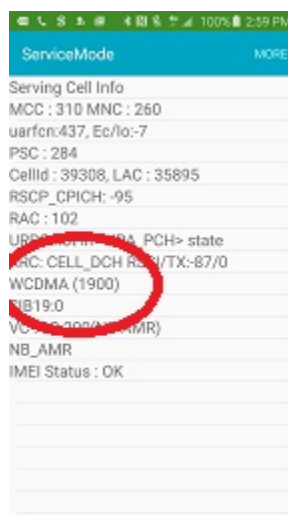
- v. Ensure “Do not use VoLTE” is selected.



- c. From a different cell phone, place a mobile terminated test call to the test handset. Place one mobile terminated test call per sector, per LTE technology (i.e. L2100+L1900 + L700)
- d. Verify “4G LTE” icon at the top of the screen changes to “4G”. This indicates a CSFB call.



- e. While the test call is active, select “Add Call”
 - i. On the keypad, dial pattern *#0011# to open the ServiceMode application
 - ii. Select [1] Basic Info
 - iii. Confirm that the active call was dropped to WCDMA

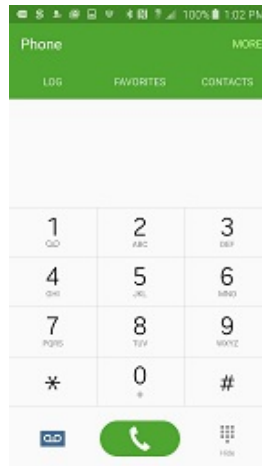


- iv. Note the band, bandwidth, EARFCN, and Primary Scrambling Code (PSC) and record the info in the pertinent sections of the C&I checklist
- v. Once the active call is ended, confirm that the handset reverts back to 4G LTE

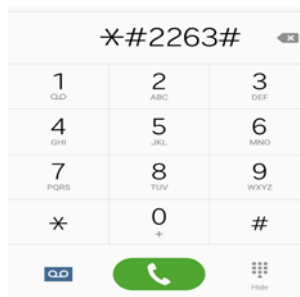
4.1.7 Verify Carrier Aggregation **NEEDS UPDATED WITH CORRECT PROCEDURE**

To verify carrier aggregation, the handset must not be locked onto any band/technology

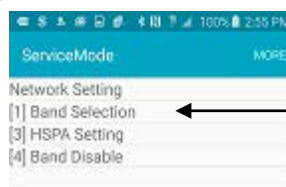
- a. See annex 1 for instructions on installing the Speedtest app
- b. Ensure handset is not locked onto any LTE band
 - i. Open the phone app on the Galaxy S6



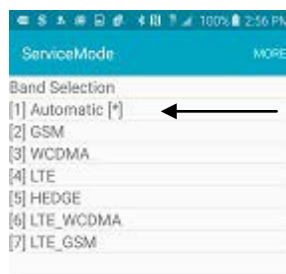
- ii. Enter the code `*#2263#`



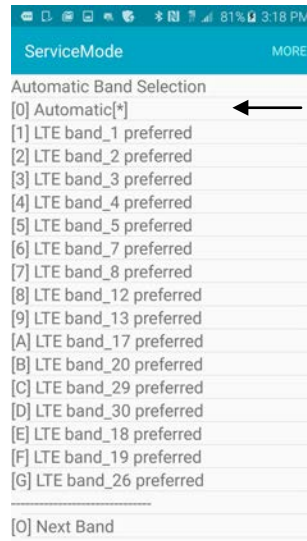
- iii. Select [1] Band Selection



- iv. Select [1] Automatic



- v. Select [0] Automatic **VERIFY the working ORDER**



- vi. Tap the back button on the handset to return to the phone app
- c. Place a test call (suggested test call number: (425) 580-7887)
 - i. While the test call is active, select “Add Call”.
 - ii. On the keypad, dial pattern *#0011# to open the ServiceMode Debug screen
 - iii. Select 1 more Basic Info
 - iv. Note the carrier aggregation status (CA)



- v. The device should display CA:Act and Band Info to indicate that carrier aggregation is active and working (NOTE: Carrier Aggregation inactive in above screen capture)
- d. Record results in the C&I Checklist

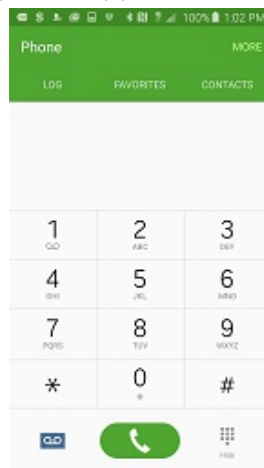
4.2 Call Testing WCDMA

4.2.1 Required call tests:

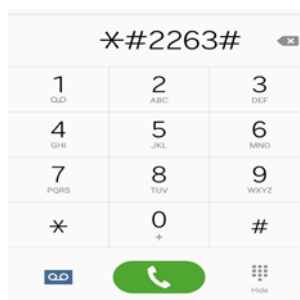
- a. Data
- b. Voice Call (mobile originated)
- c. Voice Call (mobile terminated)
- d. E911 (once per UMTS carrier)

4.2.2 Testing WCDMA Data

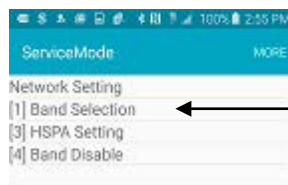
- a. See annex 1 for instructions on installing the Speedtest app
- b. Follow steps below to lock the handset onto the desired technology and band:
 - i. Open the phone app on the Galaxy S6



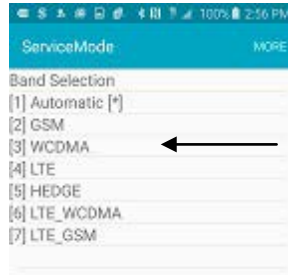
- ii. Enter the code `*#2263#`



- iii. Select [1] Band Selection



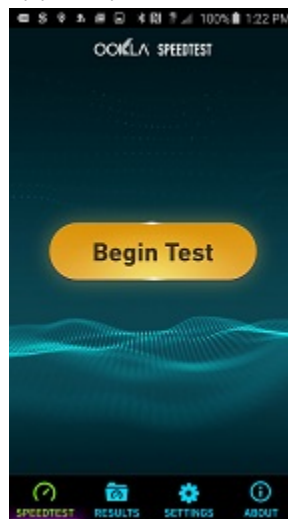
- iv. Select [3] WCDMA



- vi. Select [0] WCDMA_ALL
- vii. Verify 4G icon at the top of the screen (Should not say "4G LTE")



- viii. Open the Speedtest app
- ix. Once the app is open and has located a server, select "Begin Test"



- x. The app will first test latency using a ping test, then automatically proceed with download and then upload tests. Results will be displayed under the Results tab in the app.



- xi. Record download, upload, and latency results in the C&I checklist.
- c. Open a browser on the handset, and enter the URL www.nokia.com. Confirm that http browsing works, and record result in C&I checklist

4.2.3 Testing WCDMA Voice (Mobile Originated)

- 1 Make one mobile originated voice call per sector, per carrier
- 2 Ensure handset remains locked on to the correct WCDMA carrier
 - i. Open the phone app on the Galaxy S6
 - ii. Enter the code `*#2263#`
 - iii. Select [1] Band Selection
 - iv. Select [3] WCDMA
 - v. Select [0] WCDMA_ALL (Or carrier being tested)
 - vi. Verify 4G icon at the top of the screen (Should not say “4G LTE”)
- 3 Place a test call (suggested test call number: (425) 580-7887)
 - Verify “4G” icon at the top of the screen. If the icon shows “4G LTE” then this indicates a VoLTE call. Verify again that VoLTE is disabled, and the phone is locked to the correct WCDMA carrier.
 - While the test call is active, select “Add Call”
 - On the keypad, dial pattern `*#0011#` to open the ServiceMode application
 - Select [1] Basic Info



- Note the Cell ID, UARFCN, and scrambling code (PSC)
 - Note the RSSI and SINR, as these indicate the signal quality
 - Record pertinent info in call test checklist
- 4 Once mobile originated voice call is successful, end the call and move to the next sector

4.2.4 Testing WCDMA Voice (Mobile Terminated)

- 1 Make one mobile terminated voice call per sector, per carrier
- 2 Ensure handset remains locked on to the correct WCDMA carrier
 - vii. Open the phone app on the Galaxy S6
 - viii. Enter the code `*#2263#`
 - ix. Select [1] Band Selection
 - x. Select [3] WCDMA
 - xi. Select [0] WCDMA_ALL (Or carrier being tested)
 - xii. Verify 4G icon at the top of the screen (Should not say “4G LTE”)
- 3 From a different cell phone, place a mobile terminated test call to the test handset
 - Verify “4G” icon at the top of the screen. If the icon shows “4G LTE” then this indicates a VoLTE call. Verify again that VoLTE is disabled, and the phone is locked to the correct WCDMA carrier.
 - While the test call is active, select “Add Call”
 - On the keypad, dial pattern `*#0011#` to open the ServiceMode application
 - Select [1] Basic Info



- Note the Cell ID, UARFCN, and scrambling code
 - Note the RSSI and SINR, as these indicate the signal quality
 - Record pertinent info in call test checklist
- 4 Once mobile originated voice call is successful, end the call and move to the next sector

4.3 Emergency Services

Should only be performed with the T-Mobile WarRoom for documentation and confirmation. GNIC and or GDC do not have access to T-Mobile E-911 systems for proper verification.

4.3.1 E911

Confirm E911 call based on a 3G-originated call once per carrier to verify that the call is routed to the correct PSAP. (To be performed only when requested by T-Mobile as part of the E911 scope.)

- This requires neighboring definitions for 3G to VoLTE Inter System Handover (ISHO).

FACT CHECK

- The Emergency Inter System Handover (EM-ISHO) feature must be enabled (the GDC/GNIC can confirm this).
- T-Mobile will coordinate PSAP co-operation.

4.3.2 E911/MTLR/TDOA/LMU

Confirm Mobile Terminated Location Request (MTLR) works per site. Once camped on the site, call the T-Mobile Regional Location Technology Team. They are responsible for providing and opening the War Room Bridge. Inform them of Site and MSISDN number. War Room will call back confirming that test has Passed or Failed. Site cannot be left until confirmation of pass is obtained. If a failure, troubleshooting of connectivity may be required. Once Call is successful, inform War Room to send confirmation email to GDC

War Room Bridge Number: **888-412-7808**

Table 6: Regional contact phone numbers.

REGION	Conference ID Number
West	650-900-4110 or 650-900-4111
South	9701030#
Central	7842887#

4.3.3 E911 over VoLTE

- **T-Mobile will coordinate PSAP co-operation.**

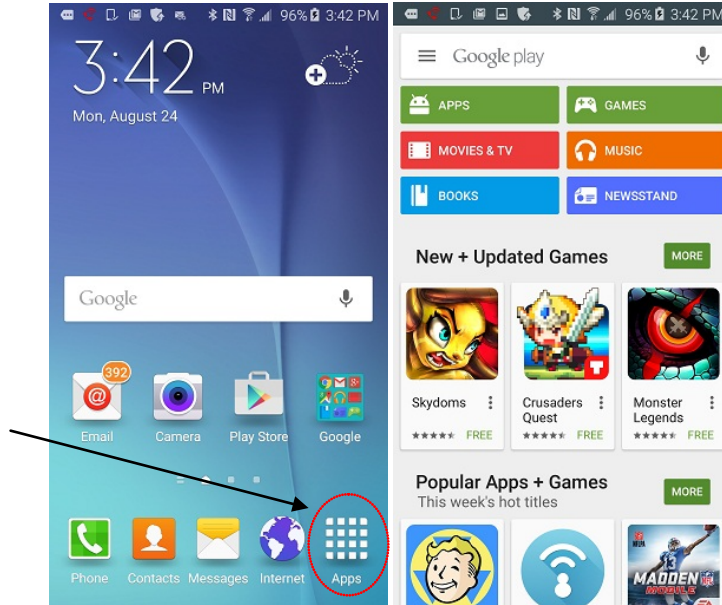
Below is a sample script for the drive testers to use when interacting with the PSAPs.

- *This is _____ with T-Mobile making a non-emergency test call. Do you have time to answer a few questions?*
- *At which PSAP is this call arriving? (E.g. Is this the ___ Sheriff's Office?)*
- *What callback number are you seeing?*
- *What ESRK/pANI/number that looks like a phone number are you seeing?*
- *What ALI/address information are you receiving? (Verify Community, County, and State)*
- *Which carrier are you seeing displayed? (E.g. T-Mobile)*
- *Does the display look correctly formatted for your screen?*

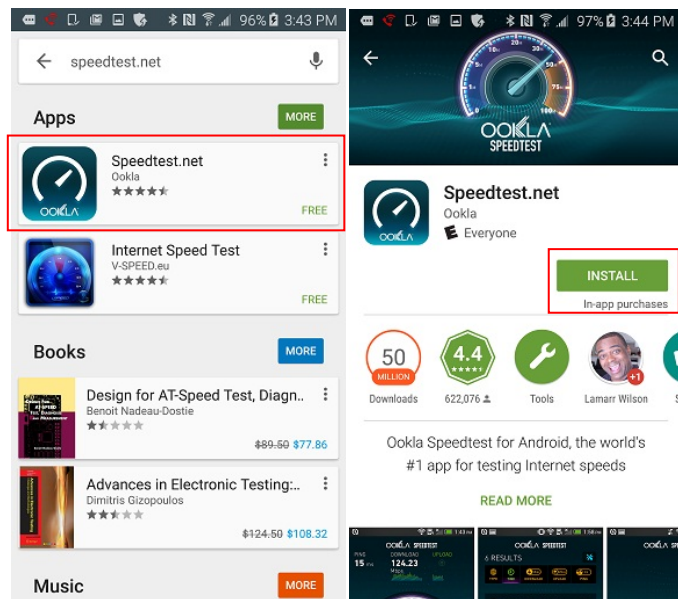
In case that the PSAP does not have the time, mark the test as complete and note PSAP contacted and they were busy.

Annex 1 Install Speedtest Application

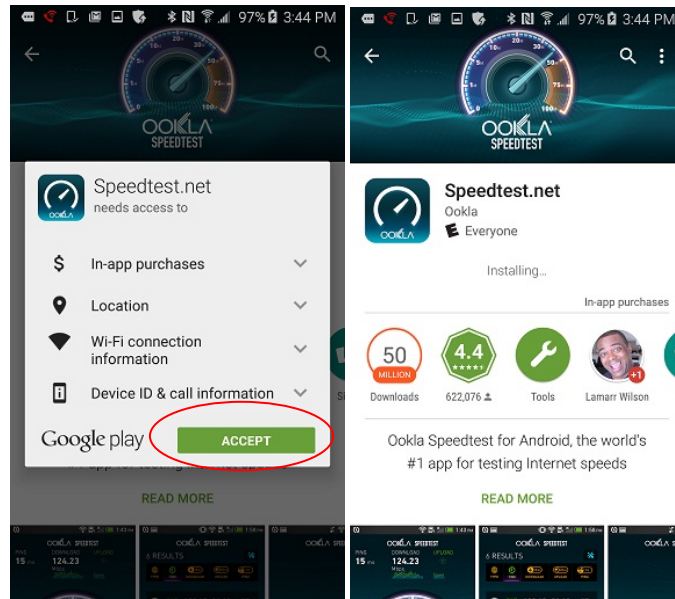
- Locate and tap the icon for the Play Store app



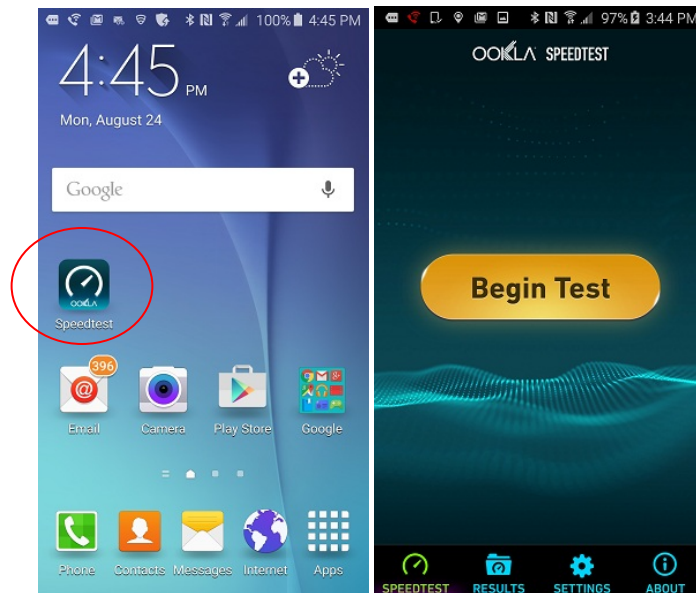
- In the search bar, type Speedtest.net, select the app, and tap Install



- Tap on accept to acknowledge required app permissions and wait for the app complete installation



- Locate the Speedtest.net icon and tap it to open the app



- Select the Start Test button and record the results for each sector.



Figure 1: Perform Speed Test.

- Take a screen shot of the test results by pressing the power button and home button simultaneously. Save a copy of the screen shot for IFM.