

## FCC CFR47 PART 22 SUBPART H FCC CFR47 PART 24 SUBPART E

#### **CERTIFICATION TEST REPORT**

**FOR** 

GSM/WCDMA/LTE PHONE + BLUETOOTH + DTS b/g/n + NFC

MODEL NUMBER: SM-G531F and SM-G531F/DD

FCC ID: A3LSMG531F

REPORT NUMBER: 15I20736-E1, Revision A

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Prepared for

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# **Revision History**

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#### FCC ID: A3LSMG531F

# **TABLE OF CONTENTS**

| 1. |      | ATT    | ESTATION OF TEST RESULTS         | 5  |
|----|------|--------|----------------------------------|----|
| 2. |      | TES    | T METHODOLOGY                    | 6  |
| 3. |      |        | ILITIES AND ACCREDITATION        |    |
| 4. |      | CAL    | IBRATION AND UNCERTAINTY         | 7  |
|    | 4.1. | ME     | EASURING INSTRUMENT CALIBRATION  | 7  |
|    | 4.2. | SA     | MPLE CALCULATION                 | 7  |
|    | 4.3. | ME     | ASUREMENT UNCERTAINTY            | 7  |
| 5. |      | EQU    | IPMENT UNDER TEST                | 8  |
|    | 5.1. | DE     | SCRIPTION OF EUT                 | 8  |
|    | 5.2. | MA     | XXIMUM OUTPUT POWER              | 8  |
|    | 5.3. | MA     | XXIMUM OUTPUT POWER (LTE)        | 9  |
|    | 5.4. | DE     | SCRIPTION OF AVAILABLE ANTENNAS1 | 10 |
|    | 5.5. |        | SCRIPTION OF TEST SETUP1         |    |
| 6. |      |        | T AND MEASUREMENT EQUIPMENT1     |    |
| 7. |      |        | ımary Table1                     |    |
| 8. |      | RF F   | POWER OUTPUT VERIFICATION1       | 6  |
|    | 8.1. | GS     | SM/GPRS/EDGE1                    | 16 |
|    | -    | 1.1.   |                                  |    |
|    | 8.2. | UN     | /ITS REL 991                     | 18 |
|    |      |        | UMTS REL 99 OUTPUT POWER RESULT1 |    |
|    | 8.3. | UN     | ITS HSDPA1                       | 19 |
|    | 8.   | 3.1.   | UMTS HSDPA OUTPUT POWER RESULT2  | _  |
|    | 8.4. | UN     | ITS HSUPA2                       | 21 |
|    | 8.   | 4.1.   | UMTS HSUPA OUTPUT POWER RESULT2  | 22 |
|    | 8.5. | LT     | E OUTPUT VERIFICATION2           | 23 |
|    | 8.   | 5.1.   | LTE OUTPUT RESULT2               | 23 |
| 9. |      | PEA    | K TO AVERAGE RATIO2              | 25 |
|    | 9.1. | CC     | NDUCTED PEAK TO AVERAGE RESULT2  | 25 |
| 10 | ).   | LIMI   | TS AND CONDUCTED RESULTS3        | 30 |
|    | 10.1 | 1. (   | OCCUPIED BANDWIDTH               | 30 |
|    | 10   | 0.1.1. | OCCUPIED BANDWIDTH RESULTS       | 31 |
|    | 10   | 0.1.2. | LTE OCCUPIED BANDWIDTH RESULTS3  | 33 |
|    |      |        |                                  |    |

| 12. SETU   | P PHOTOS                          |                     | .101 |
|------------|-----------------------------------|---------------------|------|
| 11.2.1.    | SPURIOUS RADIATION DATA           |                     | 85   |
| 11.2. Fl   | ELD STRENGTH OF SPURIOUS RADIATIO | ON                  | 84   |
| 11.1.3.    | ERP/EIRP DATA                     |                     | 68   |
| 11.1.2.    | LTE ERP/EIRP Results              |                     | 66   |
| 11.1.1.    | ERP/EIRP Results                  |                     | 64   |
| 11.1. RA   | ADIATED POWER (ERP & EIRP)        |                     | 63   |
| 11. RADIA  | ATED TEST RESULTS                 |                     | 63   |
| 10.4.1.    | FREQUENCY STABILITY RESULTS       |                     | 61   |
| 10.4. FF   | REQUENCY STABILITY                |                     | 60   |
| 10.3.2.    | OUT OF BAND EMISSIONS PLOTS       |                     | 56   |
| 10.3.1.    | OUT OF BAND EMISSIONS RESULT      |                     | 53   |
| 10.3. O    | UT OF BAND EMISSIONS              |                     | 52   |
| 10.2.1.    | BAND EDGE PLOTS                   |                     | 40   |
| 10.2. BA   | AND EDGE EMISSIONS                |                     | 39   |
| 10.1.1.    | OCCUPIED BANDWIDTH PLOTS          |                     | 35   |
| MODEL NUMB | BER: SM-G531F & SM-G531F/DD       | FCC ID: A3LSMG531F  |      |
| REPORT NO: | 15I20736-E1A                      | DATE: JUNE 11, 2015 |      |

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### 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** SAMSUNG ELECTRONICS CO., LTD.

**EUT DESCRIPTION:** GSM/WCDMA/LTE Phone + Bluetooth & WLAN 2.4GHz b/g/n + NFC

MODEL: SM-G531F and SM-G531F/DD

SERIAL NUMBER: R38G40TQMVX (Conducted), R38G40TQM9X (Radiated)

**DATE TESTED:** MAY 8 – 27, 2015

#### **APPLICABLE STANDARDS**

STANDARD TEST RESULTS

FCC PART 22H & 24E PASS

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

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## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with TIA-603-C, FCC CFR 47 Part 22, FCC CFR Part 24, and FCC CFR 47 Part 27.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

| 47173 Benicia Street   | 47266 Benicia Street   |
|------------------------|------------------------|
| Chamber A(IC: 2324B-1) | Chamber D(IC: 2324B-4) |
| Chamber B(IC: 2324B-2) | Chamber E(IC: 2324B-5) |
| Chamber C(IC: 2324B-3) | Chamber F(IC: 2324B-6) |
|                        | Chamber G(IC: 2324B-7) |
|                        | Chamber H(IC: 2324B-8) |

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <a href="http://ts.nist.gov/standards/scopes/2000650.htm">http://ts.nist.gov/standards/scopes/2000650.htm</a>.

### 4. CALIBRATION AND UNCERTAINTY

#### 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

#### 4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

EIRP = PSA reading with EUT worst orientation (dBm) + Path loss (dB) – cable loss(between the SG and substitution antenna) + Substitution Antenna Factor (dBi)

ERP = PSA reading with EUT worst orientation (dBm) + Path loss (dB) – cable loss(between the SG and substitution antenna)

(Path loss = Signal generator output – PSA reading with substitution antenna)

## 4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

| PARAMETER                             | UNCERTAINTY |
|---------------------------------------|-------------|
| Conducted Disturbance, 0.15 to 30 MHz | 3.52 dB     |
| Radiated Disturbance, 30 to 27000 MHz | 4.94 dB     |

Uncertainty figures are valid to a confidence level of 95%.

# 5. EQUIPMENT UNDER TEST

## 5.1. DESCRIPTION OF EUT

The EUT is a GSM/WCDMA/LTE Phone + Bluetooth + WLAN 2.4GHz b/g/n + NFC.

## 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted and radiated ERP / EIRP output powers as follows:

| FCC Part 22/24 |            |            |      |          |       |         |  |  |
|----------------|------------|------------|------|----------|-------|---------|--|--|
| Band           | Frequency  | Modulation | Cond | Radiated |       |         |  |  |
|                | Range(MHz) | Peak       | Avg  | mW       | Avg   | mW      |  |  |
|                | 824~849    | GMSK       | 32.7 | 1862.09  |       |         |  |  |
| GSM850         | 824~849    | GPRS       | 32.7 | 1862.09  | 29.74 | 941.89  |  |  |
|                | 824~849    | EGPRS      | 27.4 | 549.54   | 24.76 | 299.23  |  |  |
|                | 1850~1910  | GMSK       | 30.1 | 1023.29  |       |         |  |  |
| GSM1900        | 1850~1910  | GPRS       | 30.1 | 1023.29  | 31.24 | 1330.45 |  |  |
|                | 1850~1910  | EGPRS      | 27.1 | 512.86   | 27.22 | 527.23  |  |  |
|                | 824~849    | REL99      | 23.0 | 199.53   | 20.66 | 116.41  |  |  |
| Band 5         | 824~849    | HSDPA      | 23.0 | 199.53   | 20.56 | 113.76  |  |  |
|                | 824~849    | HSUPA      | 23.0 | 199.53   |       |         |  |  |
|                | 1850~1910  | REL99      | 23.6 | 229.09   | 24.17 | 261.22  |  |  |
| Band 2         | 1850~1910  | HSDPA      | 23.0 | 199.53   | 24.04 | 253.51  |  |  |
|                | 1850~1910  | HSUPA      | 23.0 | 199.53   |       |         |  |  |

# 5.3. MAXIMUM OUTPUT POWER (LTE)

The transmitter has a maximum peak conducted and radiated ERP/EIRP output powers as follows:

| FCC Part 22 |            |       |       |                    |         |          |         |  |
|-------------|------------|-------|-------|--------------------|---------|----------|---------|--|
| Band        | Frequency  |       |       | dulation Conducted |         | Radiated |         |  |
|             | Range(MHz) | (MHz) |       | AVG(dBm)           | AVG(mW) | AVG(dBm) | AVG(mW) |  |
| LTE5        | 824~849    | 10MHz | QPSK  | 24.1               | 257.04  | 20.97    | 125.03  |  |
|             | 824~849    | 10MHz | 16QAM | 23.5               | 223.87  | 20.09    | 102.09  |  |

| FCC Part 22 |            |       |          |         |           |         |          |  |
|-------------|------------|-------|----------|---------|-----------|---------|----------|--|
| Band        | Frequency  | · · · |          | Cond    | Conducted |         | Radiated |  |
|             | Range(MHz) | (MHz) | AVG(dBm) | AVG(mW) | AVG(dBm)  | AVG(mW) |          |  |
| LTE5        | 824~849    | 5MHz  | QPSK     | 24.2    | 263.03    | 20.88   | 122.46   |  |
|             | 824~849    | 5MHz  | 16QAM    | 23.5    | 223.87    | 20.0    | 100.00   |  |

|      | FCC Part 22         |      |          |         |          |          |        |  |  |
|------|---------------------|------|----------|---------|----------|----------|--------|--|--|
| Band | Trequency Banaviati |      |          |         | ucted    | Radiated |        |  |  |
|      | Range(MHz) (MHz)    |      | AVG(dBm) | AVG(mW) | AVG(dBm) | AVG(mW)  |        |  |  |
| LTE5 | 824~849             | 3MHz | QPSK     | 24.2    | 263.03   | 20.75    | 118.85 |  |  |
|      | 824~849             | 3MHz | 16QAM    | 23.5    | 223.87   | 19.94    | 98.63  |  |  |

|      | FCC Part 22 |        |       |                  |         |          |         |  |  |
|------|-------------|--------|-------|------------------|---------|----------|---------|--|--|
| Band | Frequency   |        |       | Modulation Condu |         | Radiated |         |  |  |
|      | Range(MHz)  | (MHz)  |       | AVG(dBm)         | AVG(mW) | AVG(dBm) | AVG(mW) |  |  |
| LTE5 | 824~849     | 1.4MHz | QPSK  | 24.2             | 263.03  | 20.28    | 106.66  |  |  |
|      | 824~849     | 1.4MHz | 16QAM | 23.5             | 223.87  | 19.61    | 91.41   |  |  |

FORM NO: CCSUP4701I

## 5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PIFA antenna for the bands list below with a maximum peak gain as follow:

| Frequency (MHz)      | Peak Gain (dBi) |
|----------------------|-----------------|
| Band 5, 824~849MHz   | -1.2            |
| Band 2, 1850~1910MHz | 1.4             |

## 5.5. DESCRIPTION OF TEST SETUP

#### **SUPPORT EQUIPMENT**

| Support Equipment List                              |         |     |     |     |  |  |  |  |
|---|---------|-----|-----|-----|--|--|--|--|
| Description Manufacturer Model Serial Number FCC ID |         |     |     |     |  |  |  |  |
| AC Adapter  | SAMSUNG | N/A | N/A | N/A |  |  |  |  |
| Earphone  | SAMSUNG | N/A | N/A | N/A |  |  |  |  |

### I/O CABLES (CONDUCTED SETUP)

|             | I/O Cable List |   |                        |            |                     |         |  |  |  |  |  |
|-------------|----------------|---|------------------------|------------|---------------------|---------|--|--|--|--|--|
| Cable<br>No |                |   | Connector Type         | Cable Type | Cable<br>Length (m) | Remarks |  |  |  |  |  |
| 1           | RF Out         | 1 | Spectrum Analyzer      | Shielded   | None                | NA      |  |  |  |  |  |
| 2           | Antenna Port   | 1 | EUT                    | Shielded   | 0.1m                | NA      |  |  |  |  |  |
| 3           | RF In/Out      | 1 | Communication Test Set | Shielded   | 1m                  | NA      |  |  |  |  |  |

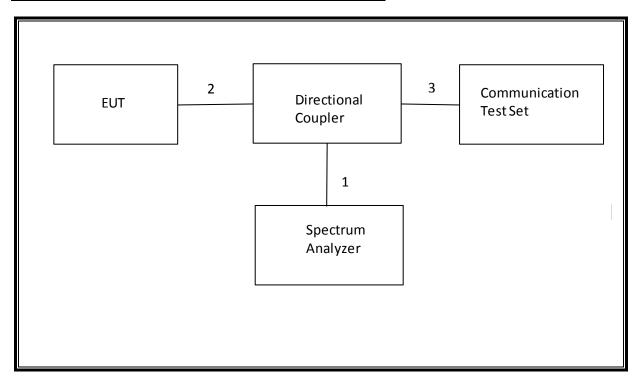
#### I/O CABLES (RADIATED SETUP)

|              | I/O CABLE LIST |                      |                        |               |                 |         |  |  |  |  |
|--------------|----------------|----------------------|------------------------|---------------|-----------------|---------|--|--|--|--|
| Cable<br>No. | Port           | # of Identical Ports | Connector<br>Type      | Cable<br>Type | Cable<br>Length | Remarks |  |  |  |  |
| 1            | USB            | 1                    | AC Adapter             | Un-shielded   | 1.2m            | No      |  |  |  |  |
| 2            | Jack           | 1                    | Headset                | Shielded      | 1m              | No      |  |  |  |  |
| 3            | RF In/out      | 1                    | Communication Test Set | Un-shielded   | 2m              | Yes     |  |  |  |  |

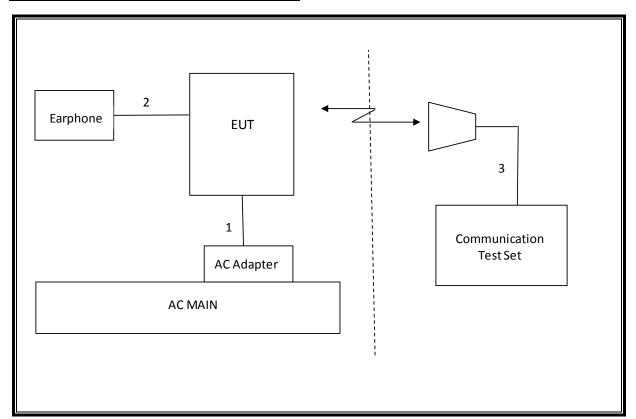
### **TEST SETUP**

The EUT is continuously communicated to the call box during the tests.

# SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



### **SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)**



# **6. TEST AND MEASUREMENT EQUIPMENT**

The following test and measurement equipment was utilized for the tests documented in this report:

| TEST EQUIPMENT LIST                |                |              |          |           |  |  |  |  |
|------------------------------------|----------------|--------------|----------|-----------|--|--|--|--|
| Description                        | Manufacturer   | Model        | Asset    | Cal Due   |  |  |  |  |
| Spectrum Analyzer, 44 GHz          | Agilent / HP   | E4446A       | C01179   | 05/01/16  |  |  |  |  |
| Antenna, Bilog, 2 GHz              | Sunol Sciences | JB1          | C01011   | 04/22/16  |  |  |  |  |
| Antenna, Horn, 18 GHz              | EMCO           | 3115         | C00783   | 10/25/15  |  |  |  |  |
| Antenna, Horn, 18 GHz              | EMCO           | 3115         | C00784   | 10/25/15  |  |  |  |  |
| Highpass Filter, 2.7 GHz           | Micro-Tronics  | HPM13194     | N02687   | CNR       |  |  |  |  |
| Highpass Filter, 1.5 GHz           | Micro-Tronics  | HPM13193     | N02688   | CNR       |  |  |  |  |
| Temperature / Humidity Chamber     | Thermotron     | SE 600-10-10 | C00930   | 05/11/16  |  |  |  |  |
| Communications Test Set            | R&S            | CMW500       | T159     | 07/02/16  |  |  |  |  |
| DC power supply, 8 V @ 3 A or 15 V | Agilent / HP   | E3610A       | None     | CNR       |  |  |  |  |
| Vector signal generator, 6 GHz     | Agilent / HP   | E4438C       | None     | 06/18/15  |  |  |  |  |
| Antenna, Tuned Dipole 400~1000     | ETS            | 3121C DB4    | C00993   | 02/11/16  |  |  |  |  |
| Directional Coupler                | RF-Lambda      | RFDC5M06G15  | None     | CNR       |  |  |  |  |
| Antenna, Horn, 26.5 GHz            | ARA            | MWH-1826/B   | C00589   | 12/17/15  |  |  |  |  |
| Multimeter                         | Fluke          | 26111        | 74320701 | 4/15/2016 |  |  |  |  |

| Test Software List    |              |        |                          |  |  |  |  |  |
|-----------------------|--------------|--------|--------------------------|--|--|--|--|--|
| Description           | Manufacturer | Model  | Version                  |  |  |  |  |  |
| Radiated Software     | UL           | UL EMC | Version 9.5, 07/22/14    |  |  |  |  |  |
| Conducted Software    | UL           | UL EMC | Version 9.5, 05/17/14    |  |  |  |  |  |
| CLT Software          | UL           | UL RF  | Version 1.0, 02/02/15    |  |  |  |  |  |
| Antenna Port Software | UL           | UL RF  | Version 2.1.1.1, 1/20/15 |  |  |  |  |  |

# 7. Summary Table

| FCC Part<br>Section    | RSS Section(s)                   | Test Description                           | Test Limit | Test<br>Condition | Test<br>Result | Worst Case |
|------------------------|----------------------------------|--|------------|-------------------|----------------|------------|
| 2.1049                 | N/A                              | Occupied Band width (99%)                  | N/A        |                   | Pass           | 9.028 MHz  |
| 22.917(a)<br>24.238(a) | RSS-132(4.5.1)<br>RSS-133(6.5.1) | Band Edge / Conducted<br>Spurious Emission | -13dBm     | Conducted         | Pass           | -13.441dBm |
| 2.1046                 | N/A                              | Conducted output power                     | N/A        | Conducted         | Pass           | 32.7 dBm   |
| 22.355<br>24.235       | RSS-132(4.3)<br>RSS-133(6.3)     | Frequency Stability                        | 2.5PPM     |                   | Pass           | 0.040 PPM  |
| 22.913(a)(2)           | RSS-132(4.4)                     | Effective Radiated Power                   | 38 dBm     |                   | Pass           | 29.74dBm   |
| 24.232(c )             | RSS-133(6.4)                     | Equivalent Isotropic Radiated Power        | 33dBm      | Radiated          | Pass           | 31.24 dBm  |
| 22.917(a)<br>24.238(a) | RSS-132(4.5.1)<br>RSS-133(6.5.1) | Radiated Spurious Emission                 | -13dBm     |                   | Pass           | -37.5dBm   |

## 8. RF POWER OUTPUT VERIFICATION

#### 8.1. GSM/GPRS/EDGE

Function: Menu select > GSM Mobile Station > GSM 850/900/1800/1900

Press Connection control to choose the different menus

Press RESET > choose all to reset all settings

Connection Press Signal Off to turn off the signal and change settings

Network Support > GSM+GPRS or GSM+EGPRS

Main Service > Packet Data

Service selection > Test Mode A - Auto Slot Config. off

MS Signal Press Slot Config bottom on the right twice to select and change the number of time slots and

power setting

> Slot configuration > Uplink/Gamma

> 33 dBm for GPRS 850/900 > 30 dBm for GPRS1800/1900

BS Signal Enter the same channel number for TCH channel (test channel) and BCCH channel

Frequency Offset > + 0 Hz Mode > BCCH and TCH

BCCH Level > -85 dBm (May need to adjust if link is not stable)

BCCH Channel > choose desire test channel [Enter the same channel number for TCH channel (test channel) and

BCCH channel]

Channel Type > Off

P0> 4 dB

Slot Config > Unchanged (if already set under MS Signal)

TCH > choose desired test channel

Hopping > Off Main Timeslot > 3 (Default)

Network Coding Scheme > CS4 (GPRS) and MCS5 ~ MCS9 (EGPRS)

Bit Stream > 2E9-1PSR Bit Pattern

AF/RF Enter appropriate offsets for Ext. Att. Output and Ext. Att. Input

Connection Press Signal On to turn on the signal and change settings

## 8.1.1. GSM OUTPUT POWER RESULT

| Band    | Mode  | Ch. | f(MHz) | 1 time slot | 2 time slot | 3 time slot | 4 time slot |
|---------|-------|-----|--------|-------------|-------------|-------------|-------------|
| 20112   |       |     | .(2)   | Peak (dBm)  | Peak (dBm)  | Peak (dBm)  | Peak (dBm)  |
|         |       | 128 | 824.2  | 32.7        |             |             |             |
|         | GMSK  | 190 | 836.6  | 32.7        |             |             |             |
|         |       | 251 | 848.8  | 32.7        |             |             |             |
|         |       | 128 | 824.2  | 32.7        | 31.3        | 29.0        | 27.0        |
| GSM850  | GPRS  | 190 | 836.6  | 32.7        | 31.4        | 29.0        | 27.0        |
|         |       | 251 | 848.8  | 32.7        | 31.4        | 29.0        | 27.0        |
|         |       | 128 | 824.2  | 27.2        | 25.8        | 23.6        | 21.5        |
|         | EGPRS | 190 | 836.6  | 27.0        | 25.6        | 23.4        | 21.2        |
|         |       | 251 | 848.8  | 27.4        | 25.9        | 23.8        | 21.6        |
|         |       | 512 | 1850.2 | 29.9        |             |             |             |
|         | GMSK  | 661 | 1880   | 30.1        |             |             |             |
|         |       | 810 | 1909.8 | 29.9        |             |             |             |
|         |       | 512 | 1850.2 | 29.9        | 28.5        | 26.5        | 24.3        |
| GSM1900 | GPRS  | 661 | 1880   | 30.1        | 28.5        | 26.5        | 24.4        |
|         |       | 810 | 1909.8 | 29.9        | 28.3        | 26.2        | 23.9        |
|         |       | 512 | 1850.2 | 26.3        | 24.8        | 22.6        | 20.2        |
|         | EGPRS | 661 | 1880   | 27.1        | 25.4        | 23.0        | 21.0        |
|         |       | 810 | 1909.8 | 26.2        | 24.6        | 22.3        | 20.0        |

## 8.2. UMTS REL 99

### **TEST PROCEDURE**

The following summary of these settings are illustrated below:

|               | Mode                    | Rel99          |  |
|---------------|-------------------------|----------------|--|
|               | Subtest                 | -              |  |
|               | Loopback Mode           | Test Mode 1    |  |
|               | Rel99 RMC               | 12.2kbps RMC   |  |
|               | HSDPA FRC               | Not Applicable |  |
|               | HSUPA Test              | Not Applicable |  |
| WCDMA General | Power Control Algorithm | Algorithm2     |  |
| Settings      | βc                      | Not Applicable |  |
| Settings      | βd                      | Not Applicable |  |
|               | βес                     | Not Applicable |  |
|               | βc/βd                   | 8/15           |  |
|               | βhs                     | Not Applicable |  |
|               | βed                     | Not Applicable |  |

### 8.2.1. UMTS REL 99 OUTPUT POWER RESULT

| Band   | Mode  | Ch.  | f(MHz) | Conducted<br>Power (dBm)<br>Avg (dBm) |
|--------|-------|------|--------|---------------------------------------|
|        |       | 4132 | 826.4  | 23.0                                  |
| Band 5 | REL99 | 4183 | 836.6  | 23.0                                  |
|        |       | 4233 | 846.6  | 23.0                                  |
|        |       | 9262 | 1852.4 | 23.0                                  |
| Band 2 | REL99 | 9400 | 1880   | 23.6                                  |
|        |       | 9538 | 1907.6 | 22.9                                  |

## 8.3. UMTS HSDPA

The following 4 Sub-tests were completed according to Release 5 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

|                   | Mode                         | Rel5 HSDPA   |       |       |       |  |  |
|-------------------|------------------------------|--------------|-------|-------|-------|--|--|
|                   | Subtest                      | 1            | 2     | 3     | 4     |  |  |
|                   | Loopback Mode                | Test Mode 1  |       |       |       |  |  |
| MCDAAA            | Rel99 RMC                    | 12.2kbps RMC |       |       |       |  |  |
|                   | HSDPA FRC                    | H-Set1       |       |       |       |  |  |
|                   | Power Control Algorithm      | Algorithm 2  |       |       |       |  |  |
| WCDMA<br>General  | βс                           | 2/15         | 12/15 | 15/15 | 15/15 |  |  |
| Settings          | βd                           | 15/15        | 15/15 | 8/15  | 4/15  |  |  |
| Settings          | Bd (SF)                      | 64           |       |       |       |  |  |
|                   | βc/βd                        | 2/15         | 12/15 | 15/8  | 15/4  |  |  |
|                   | βhs                          | 4/15         | 24/15 | 30/15 | 30/15 |  |  |
|                   | MPR (dB)                     | 0            | 0     | 0.5   | 0.5   |  |  |
|                   | D <sub>ACK</sub>             | 8            |       |       |       |  |  |
|                   | D <sub>NAK</sub>             | 8            |       |       |       |  |  |
| LICDDA            | DCQI                         | 8            | 8     |       |       |  |  |
| HSDPA<br>Specific | Ack-Nack repetition factor   | 3            |       |       |       |  |  |
| Settings          | CQI Feedback (Table 5.2B.4)  | 4ms          |       |       |       |  |  |
| Jettings          | CQI Repetition Factor (Table |              |       |       |       |  |  |
|                   | 5.2B.4)                      | 2            |       |       |       |  |  |
|                   | Ahs =βhs/βc                  | 30/15        |       |       | •     |  |  |

## 8.3.1. UMTS HSDPA OUTPUT POWER RESULT

| Band   | Mode  | Subset | Ch.  | f(MHz) | Conducted<br>Power (dBm)<br>Avg (dBm) |
|--------|-------|--------|------|--------|---------------------------------------|
|        |       | 1      | 4132 | 826.4  | 23.0                                  |
|        |       |        | 4183 | 836.6  | 23.0                                  |
|        |       |        | 4233 | 846.6  | 23.0                                  |
|        |       |        | 4132 | 826.4  | 22.6                                  |
|        |       | 2      | 4183 | 836.6  | 22.7                                  |
| Band 5 | HSDPA |        | 4233 | 846.6  | 22.7                                  |
|        |       |        | 4132 | 826.4  | 22.1                                  |
|        |       | 3      | 4183 | 836.6  | 22.3                                  |
|        |       |        | 4233 | 846.6  | 22.3                                  |
|        |       | 4      | 4132 | 826.4  | 22.1                                  |
|        |       |        | 4183 | 836.6  | 22.3                                  |
|        |       |        | 4233 | 846.6  | 22.3                                  |
|        |       |        | 9262 | 1852.4 | 23.0                                  |
|        |       | 1      | 9400 | 1880   | 22.8                                  |
|        |       |        | 9538 | 1907.6 | 22.9                                  |
|        |       |        | 9262 | 1852.4 | 22.8                                  |
|        |       | 2      | 9400 | 1880   | 22.8                                  |
| Band 2 | HSDPA |        | 9538 | 1907.6 | 22.3                                  |
|        |       |        | 9262 | 1852.4 | 22.5                                  |
|        |       | 3      | 9400 | 1880   | 22.4                                  |
|        |       |        | 9538 | 1907.6 | 21.9                                  |
|        |       |        | 9262 | 1852.4 | 22.5                                  |
|        |       | 4      | 9400 | 1880   | 22.4                                  |
|        |       |        | 9538 | 1907.6 | 21.9                                  |

## 8.4. UMTS HSUPA

### **TEST PROCEDURE**

The following summary of these settings are illustrated below: (ETSI TS 134.121-1 Table C.11.1)

|          | Mode                                 | Rel6 HSUPA               | Rel6 HSUPA | Rel6 HSUPA   | Rel6 HSUPA               | Rel6 HSUPA |  |  |  |  |
|----------|--------------------------------------|--------------------------|------------|--------------|--------------------------|------------|--|--|--|--|
|          | Subtest                              | 1                        | 2          | 3            | 4                        | 5          |  |  |  |  |
|          | Loopback Mode                        | Test Mode 1              |            |              |                          |            |  |  |  |  |
|          | P-CPICH (dB)                         | -10                      |            |              |                          |            |  |  |  |  |
|          | P-CCPCH (dB)                         | -12                      |            |              |                          |            |  |  |  |  |
|          | SCH (dB)                             | -12                      |            |              |                          |            |  |  |  |  |
|          | PICH(dB)                             | -15                      |            |              |                          |            |  |  |  |  |
|          | DPCH (dB)                            | -9                       |            |              |                          |            |  |  |  |  |
|          | HS-SCCH_1 (dB)                       | -8                       |            |              |                          |            |  |  |  |  |
|          | HS-PDSCH (dB)                        | -3                       |            |              |                          |            |  |  |  |  |
| WCDMA    | Rel99 RMC                            | 12.2kbps RMC             |            |              |                          |            |  |  |  |  |
| General  | HSDPA FRC                            | H-Set1                   |            |              |                          |            |  |  |  |  |
| Settings | HSUPA Test                           | HSUPA Loopba             | ck         |              |                          |            |  |  |  |  |
| Settings | Power Control Algorithm              | Algorithm2               |            | •            |                          |            |  |  |  |  |
|          | Вс                                   | 11/15                    | 6/15       | 15/15        | 2/15                     | 15/15      |  |  |  |  |
|          | Bd                                   | 15/15                    | 15/15      | 9/15         | 15/15                    | 15/15      |  |  |  |  |
|          | Bec                                  | 209/225                  | 12/15      | 30/15        | 2/15                     | 5/15       |  |  |  |  |
|          | βc/βd                                | 11/15                    | 6/15       | 15/9         | 2/15                     | 15/15      |  |  |  |  |
|          | Bhs                                  | 22/15                    | 12/15      | 30/15        | 4/15                     | 30/15      |  |  |  |  |
|          |                                      |                          |            | 47/15        |                          |            |  |  |  |  |
|          | βed (note1)                          | 1309/225                 | 94/75      | 47/15        | 56/75                    | 134/15     |  |  |  |  |
|          | MPR                                  | 0                        | 2          | 1            | 2                        | 0          |  |  |  |  |
|          | DACK 8                               |                          |            |              |                          |            |  |  |  |  |
|          | DNAK                                 | 8                        |            |              |                          |            |  |  |  |  |
| HSDPA    | DCQI                                 | 8                        |            |              |                          |            |  |  |  |  |
| Specific | Ack-Nack repetition factor           | 3                        |            |              |                          |            |  |  |  |  |
| Settings | CQI Feedback (Table 5.2B.4)          | 4ms                      |            |              |                          |            |  |  |  |  |
|          | CQI Repetition Factor (Table 5.2B.4) | 2                        |            |              |                          |            |  |  |  |  |
|          | Ahs = βhs/βc                         | 30/15                    | Т -        | T =          | T_                       | T_         |  |  |  |  |
|          | D E-DPCCH                            | 6                        | 8          | 8            | 5                        | 7          |  |  |  |  |
|          | DHARQ                                | 0                        | 0          | 0            | 0                        | 0          |  |  |  |  |
|          | AG Index                             | 20                       | 12         | 15           | 17                       | 21         |  |  |  |  |
|          | Reference E-TFCIs                    | 5                        | 5          | 2            | 5                        | 5          |  |  |  |  |
|          | ETFCI (from 34.121 Table C.11.1.3)   | 75                       | 67         | 92           | 71                       | 81         |  |  |  |  |
|          | Associated Max UL Data Rate kbps     | 242.1                    | 174.9      | 482.8        | 205.8                    | 308.9      |  |  |  |  |
| HSUPA    |                                      | E-TFCI 11<br>E-TFCI PO 4 |            |              | E-TFCI 11                |            |  |  |  |  |
| Specific |                                      | E-TFCI PO 4              |            |              | E-TFCI PO 4<br>E-TFCI 67 |            |  |  |  |  |
| Settings |                                      | E-TFCI PO 18             |            |              | E-TFCI PO 18             |            |  |  |  |  |
|          |                                      | E-TFCI 70 18             |            |              | E-TFCI 70 18             |            |  |  |  |  |
|          | Reference E_TFCIs                    | E-TFCI PO 23             |            |              | E-TFCI PO 23             |            |  |  |  |  |
|          |                                      | E-TFCI 75                |            | E-TFCI 11    | E-TFCI 75                |            |  |  |  |  |
|          |                                      | E-TFCI PO 26             |            | E-TFCI PO 4  | E-TFCI PO 26             |            |  |  |  |  |
|          |                                      | E-TFCI 81                |            | E-TFCI 92    | E-TFCI 81                |            |  |  |  |  |
|          |                                      | E-TFCI PO 27             |            | E-TFCI PO 18 | E-TFCI PO 27             |            |  |  |  |  |

Note1: βed cannot be set directly, it is set by Absolute Grant Value.

## 8.4.1. UMTS HSUPA OUTPUT POWER RESULT

| Band   | Mode  | Subset Ch. | Ch.  | f(MHz) | Conducted<br>Power (dBm) |
|--------|-------|------------|------|--------|--------------------------|
|        |       |            |      | ,      | Avg (dBm)                |
|        |       |            | 4132 | 826.4  | 22.9                     |
|        |       | 1          | 4183 | 836.6  | 22.7                     |
|        |       |            | 4233 | 846.6  | 22.8                     |
|        |       |            | 4132 | 826.4  | 21.7                     |
|        |       | 2          | 4183 | 836.6  | 21.5                     |
|        |       |            | 4233 | 846.6  | 21.6                     |
|        |       |            | 4132 | 826.4  | 22.3                     |
| Band 5 | HSUPA | 3          | 4183 | 836.6  | 22.0                     |
|        |       |            | 4233 | 846.6  | 22.1                     |
|        |       |            | 4132 | 826.4  | 21.7                     |
|        |       | 4          | 4183 | 836.6  | 21.5                     |
|        |       |            | 4233 | 846.6  | 21.6                     |
|        |       | 5          | 4132 | 826.4  | 23.0                     |
|        |       |            | 4183 | 836.6  | 23.0                     |
|        |       |            | 4233 | 846.6  | 23.0                     |
|        |       | 1          | 9262 | 1852.4 | 23.1                     |
|        |       |            | 9400 | 1880   | 23.1                     |
|        |       |            | 9538 | 1907.6 | 22.8                     |
|        |       |            | 9262 | 1852.4 | 21.9                     |
|        |       | 2          | 9400 | 1880   | 22.0                     |
|        |       |            | 9538 | 1907.6 | 21.8                     |
|        |       |            | 9262 | 1852.4 | 22.4                     |
| Band 2 | HSUPA | 3          | 9400 | 1880   | 22.5                     |
|        |       |            | 9538 | 1907.6 | 22.2                     |
|        |       |            | 9262 | 1852.4 | 21.9                     |
|        |       | 4          | 9400 | 1880   | 22.0                     |
|        |       |            | 9538 | 1907.6 | 21.8                     |
|        |       |            | 9262 | 1852.4 | 23.0                     |
|        |       | 5          | 9400 | 1880   | 23.0                     |
|        |       |            | 9538 | 1907.6 | 23.0                     |

# 8.5. LTE OUTPUT VERIFICATION

# 8.5.1. LTE OUTPUT RESULT

|        |             | Mode  | DB.              |              |               |               | Avg Pwr (dBm)  |                        |  |
|--------|-------------|-------|------------------|--------------|---------------|---------------|--|------------------------|--|
| Band   | BW<br>(MHz) |       | RB<br>Allocation | RB<br>offset | Target<br>MPR | 20450         | 20525  | 20600                  |  |
|        | (*** 12)    |       |                  |              |               | 829 MHz       | 836.5 MHz  | 844 MHz                |  |
|        |             |       | 1                | 0            | 0             | 24.1          | 24.1   | 24.0                   |  |
|        |             |       | 1                | 25           | 0             | 24.1          | 24.0   | 24.0                   |  |
|        |             |       | 1                | 49           | 0             | 24.1          | 20450         20525         20600           829 MHz         836.5 MHz         844 MHz           24.1         24.0         24.0           24.1         24.0         23.9           23.2         23.1         23.0           23.2         23.1         23.0           23.2         23.1         23.0           23.2         23.1         23.0           23.5         23.5         23.4           23.4         23.5         23.4           23.4         23.5         23.3           22.5         22.4         22.4           22.5         22.4         22.4           22.4         22.4         22.4           22.4         22.3         22.3           Avg Pwr (dBm)           20425         20525         20625 |                        |  |
|        |             | QPSK  | 25               | 0            | 1             | 23.2          |  |                        |  |
|        |             |       | 25               | 12           | 1             | 23.2          | 23.1   | 23.0                   |  |
|        |             |       | 25               | 25           | 1             | 23.2          | 23.1   | 23.0                   |  |
| LTE    | 10          |       | 50               | 0            | 1             | 23.2          | 23.1   | 23.0                   |  |
| Band 5 | 10          |       | 1                | 0            | 1             | 23.5          | 23.5   | 23.4                   |  |
|        |             |       | 1                | 25           | 1             | 23.5          | 23.5   | 23.4                   |  |
|        |             |       | 1                | 49           | 1             | 23.4          | 23.5   | 23.3                   |  |
|        |             | 16QAM | 25               | 0            | 2             | 22.5          | 22.4   | 22.4                   |  |
|        |             |       | 25               | 12           | 2             | 22.5          | 22.4   | 22.4 22.4<br>22.4 22.4 |  |
|        |             |       | 25               | 25           | 2             | 22.5          | 22.4   | 22.4                   |  |
|        |             |       | 50               | 0            | 2             | 22.4          | 22.3   | 22.3                   |  |
|        |             |       |                  |              | _             | Avg Pwr (dBm) |  |                        |  |
| Band   | BW<br>(MHz) | Mode  | RB<br>Allocation | RB<br>offset | Target<br>MPR | 20425         | 20525  | 20625                  |  |
|        | , , ,       |       |                  |              |               | 826.5 MHz     | 836.5 MHz  | 846.5 MHz              |  |
|        |             |       | 1                | 0            | 0             | 24.1          | 24.2   | 24.1                   |  |
|        |             |       | 1                | 12           | 0             | 24.1          | 24.2   | 24.1                   |  |
|        |             |       | 1                | 24           | 0             | 24.2          | 24.1   | 24.0                   |  |
|        |             | QPSK  | 12               | 0            | 1             | 23.2          | 23.2   | 23.1                   |  |
|        |             |       | 12               | 7            | 1             | 23.2          | 23.2   | 23.1                   |  |
|        |             |       | 12               | 13           | 1             | 23.2          | 23.1   | 23.1                   |  |
| LTE    | 5           |       | 25               | 0            | 1             | 23.2          | 20525         20600           836.5 MHz         844 MHz           24.1         24.0           24.0         23.9           23.1         23.0           23.1         23.0           23.1         23.0           23.5         23.4           23.5         23.4           23.5         23.3           22.4         22.4           22.4         22.4           22.3         22.3           Avg Pwr (dBm)         20525           836.5 MHz         846.5 MHz           24.2         24.1           24.1         24.0           23.2         23.1           23.1         23.1           23.1         23.1           23.1         23.1           23.5         23.5  | 23.0                   |  |
| Band 5 | 3           |       | 1                | 0            | 1             | 23.5          | 23.5   | 23.5                   |  |
|        |             |       | 1                | 12           | 1             | 23.5          | 23.5   | 23.5                   |  |
|        |             |       | 1                | 24           | 1             | 23.5          | 23.5   | 23.5                   |  |
|        |             | 16QAM | 12               | 0            | 2             | 22.5          | 24.0 24.0 24.0 23.9 23.1 23.0 23.1 23.0 23.1 23.0 23.1 23.0 23.1 23.0 23.5 23.4 23.5 23.4 23.5 23.3 22.4 22.4 22.4 22.4 22.4 22.4 22.3 22.3  Avg Pwr (dBm)  20525 20625 836.5 MHz 846.5 MHz 24.2 24.1 24.1 24.0 23.2 23.1 23.1 23.1 23.1 23.1 23.1 23.1 23.1 23.1 23.1 23.1 23.1 23.5 23.5 23.5 23.5 23.5 23.5 23.5 23.5 22.4 22.5 22.4  |                        |  |
|        |             |       | 12               | 7            | 2             | 22.5          | 22.5   | 22.4                   |  |
|        |             |       | 12               | 13           | 2             | 22.5          | 22.5   | 22.4                   |  |
|        |             |       | 25               | 0            | 2             | 22.5          | 22.4   | 22.3                   |  |

MODEL NUMBER: SM-G531F & SM-G531F/DD

|        |             | Mode         |                                   |                                   |  | Avg Pwr (dBm)  |  |  |
|--------|-------------|--------------|-----------------------------------|-----------------------------------|--|--|--|--|
| Band   | BW          |              | RB                                | RB                                | Target<br>MPR                                  | 20415  | 20525  | 20635  |
|        | (MHz)       |              | Allocation                        | offset                            |  | 825.5 MHz  | 836.5 MHz  | 847.5 MHz  |
|        |             |              | 1                                 | 0                                 | 0  | 24.1   | 24.1   | 24.0   |
|        |             |              | 1                                 | 8                                 | 0  | 24.2   | 24.1   | 23.9   |
|        |             |              | 1                                 | 14                                | 0  | 24.2   | 24.0   | 23.9   |
|        |             | QPSK         | 8                                 | 0                                 | 1  | 23.3   | 23.3   | 23.2   |
|        |             |              | 8                                 | 4                                 | 1  | 23.3   | 23.3   | 23.1   |
|        |             |              | 8                                 | 7                                 | 1  | 23.3   | 23.3   | 23.2   |
| LTE    | 3           |              | 15                                | 0                                 | 1  | 23.2   | 23.1   |  |
| Band 5 | 3           |              | 1                                 | 0                                 | 1  | 23.4   | 23.5   | 23.4   |
|        |             |              | 1                                 | 8                                 | 1  | 23.5   | 23.5   | 23.3   |
|        |             |              | 1                                 | 14                                | 1  | 23.5   | 23.5   | 23.3   |
|        |             | 16QAM        | 8                                 | 0                                 | 2  | 22.5   | 22.4   | 22.5   |
|        |             |              | 8                                 | 4                                 | 2  | 22.5   | 22.4   | 22.5   |
|        |             |              | 8                                 | 7                                 | 2  | 22.5   | 22.4   | 22.5   |
|        |             |              | 15                                | 0                                 | 2  | 22.5   | 22.5   | 22.3   |
|        |             |              |                                   |                                   |  |  |  |  |
|        |             |              |                                   |                                   |  |  | Avg Pwr (dBm)  | <u> </u>   |
| Band   | BW<br>(MHz) | Mode         | RB<br>Allocation                  | RB<br>offset                      | Target<br>MPR                                  | 20407  | Avg Pwr (dBm)<br>20525   | 20643  |
| Band   |             | Mode         |                                   |                                   |  | 20407<br>824.7 MHz   |  | 20643<br>848.3 MHz   |
| Band   |             | Mode         |                                   |                                   |  |  | 20525  |  |
| Band   |             | Mode         | Allocation                        | offset                            | MPR  | 824.7 MHz  | 20525<br>836.5 MHz   | 848.3 MHz  |
| Band   |             | Mode         | Allocation<br>1                   | offset<br>0                       | MPR<br>0                                       | 824.7 MHz<br>24.1  | 20525<br>836.5 MHz<br>24.0   | 848.3 MHz<br>24.0  |
| Band   |             | Mode<br>QPSK | Allocation  1 1                   | offset  0  3                      | 0<br>0   | 824.7 MHz<br>24.1<br>24.1  | 20525<br>836.5 MHz<br>24.0<br>24.0   | 848.3 MHz<br>24.0<br>24.0  |
| Band   |             |              | Allocation  1 1 1                 | offset  0  3  5                   | 0<br>0<br>0                                    | 824.7 MHz<br>24.1<br>24.1<br>24.1                                | 20525<br>836.5 MHz<br>24.0<br>24.0<br>24.0   | 848.3 MHz<br>24.0<br>24.0<br>23.9  |
| Band   |             |              | Allocation  1 1 1 3               | 0<br>3<br>5<br>0                  | 0<br>0<br>0<br>0                               | 824.7 MHz 24.1 24.1 24.1 24.1 24.2                               | 20525<br>836.5 MHz<br>24.0<br>24.0<br>24.0<br>24.2   | 24.0<br>24.0<br>23.9<br>24.1   |
| LTE    | (MHz)       |              | Allocation  1 1 1 3 3             | 0<br>3<br>5<br>0                  | 0<br>0<br>0<br>0<br>0                          | 824.7 MHz 24.1 24.1 24.1 24.1 24.2 24.2                          | 20525<br>836.5 MHz<br>24.0<br>24.0<br>24.0<br>24.2<br>24.2                                 | 23.5 23.4 23.5 23.3 23.5 23.3 22.4 22.5 22.4 22.5 22.4 22.5 22.5 22.3  AVG PWr (dBm)  20525 20643  836.5 MHz 848.3 MHz 24.0 24.0 24.0 24.0 24.0 23.9 24.2 24.1 24.2 24.1 |
|        |             |              | Allocation  1 1 1 3 3 3           | 0 3 5 0 1 3 3                     | 0<br>0<br>0<br>0<br>0<br>0                     | 824.7 MHz 24.1 24.1 24.1 24.2 24.2 24.2                          | 20525<br>836.5 MHz<br>24.0<br>24.0<br>24.0<br>24.2<br>24.2<br>24.2<br>24.2<br>23.3         | 24.0<br>24.0<br>23.9<br>24.1<br>24.1<br>24.1<br>23.1   |
| LTE    | (MHz)       |              | 1 1 1 3 3 3 3 6                   | 0 3 5 0 1 3 0                     | 0<br>0<br>0<br>0<br>0<br>0<br>0                | 824.7 MHz 24.1 24.1 24.2 24.2 24.2 23.3                          | 20525<br>836.5 MHz<br>24.0<br>24.0<br>24.0<br>24.2<br>24.2<br>24.2<br>23.3<br>23.5         | 24.0<br>24.0<br>23.9<br>24.1<br>24.1<br>24.1<br>23.1<br>23.4   |
| LTE    | (MHz)       |              | 1 1 1 3 3 3 6 1 1                 | 0 3 5 0 1 3 0 0                   | 0<br>0<br>0<br>0<br>0<br>0<br>0                | 824.7 MHz 24.1 24.1 24.1 24.2 24.2 24.2 23.3 23.5                | 20525<br>836.5 MHz<br>24.0<br>24.0<br>24.2<br>24.2<br>24.2<br>24.2<br>23.3<br>23.5<br>23.5 | 24.0<br>24.0<br>23.9<br>24.1<br>24.1<br>24.1<br>23.1<br>23.4<br>23.3   |
| LTE    | (MHz)       |              | 1 1 1 3 3 3 6 1 1 1               | 0 3 5 0 1 3 0 0 3                 | 0<br>0<br>0<br>0<br>0<br>0<br>0<br>1<br>1      | 824.7 MHz 24.1 24.1 24.1 24.2 24.2 24.2 23.3 23.5 23.5           | 20525<br>836.5 MHz<br>24.0<br>24.0<br>24.2<br>24.2<br>24.2<br>24.2<br>23.3<br>23.5<br>23.5 | 24.0<br>24.0<br>23.9<br>24.1<br>24.1<br>24.1<br>23.1<br>23.4<br>23.3   |
| LTE    | (MHz)       | QPSK         | 1 1 1 3 3 3 6 1 1 1 1 1 1         | 0 3 5 0 1 3 0 0 3 5 5             | 0<br>0<br>0<br>0<br>0<br>0<br>0<br>1<br>1<br>1 | 824.7 MHz 24.1 24.1 24.2 24.2 24.2 23.3 23.5 23.5 23.5           | 20525<br>836.5 MHz<br>24.0<br>24.0<br>24.2<br>24.2<br>24.2<br>23.3<br>23.5<br>23.5<br>23.5 | 24.0<br>24.0<br>23.9<br>24.1<br>24.1<br>23.1<br>23.4<br>23.3<br>23.3   |
| LTE    | (MHz)       | QPSK         | Allocation  1 1 1 3 3 3 6 1 1 1 3 | 0 3 5 0 1 3 0 0 3 5 0 0 0 3 5 0 0 | MPR  0 0 0 0 0 1 1 1 1                         | 824.7 MHz 24.1 24.1 24.1 24.2 24.2 24.2 23.3 23.5 23.5 23.5 23.4 | 20525 836.5 MHz 24.0 24.0 24.0 24.2 24.2 24.2 23.3 23.5 23.5 23.5 23.4                     | 24.0<br>24.0<br>23.9<br>24.1<br>24.1<br>24.1<br>23.1<br>23.4<br>23.3<br>23.3<br>23.4   |

## 9. PEAK TO AVERAGE RATIO

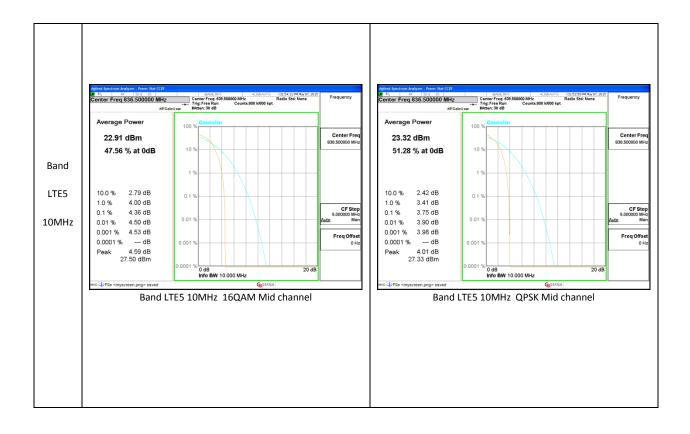
#### **Test Procedure**

Per KDB 971168 D01 Power Meas License Digital Systems v02r02

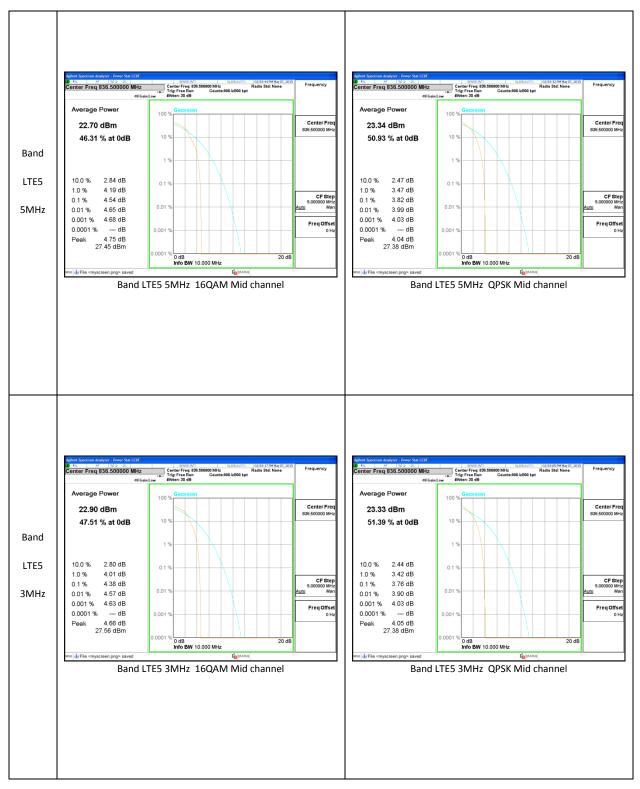
#### **Test Spec**

In addition, when the transmitter power is measured in terms of average value, the peak-to-average ratio of the power shall not exceed 13 dB.

### 9.1. CONDUCTED PEAK TO AVERAGE RESULT



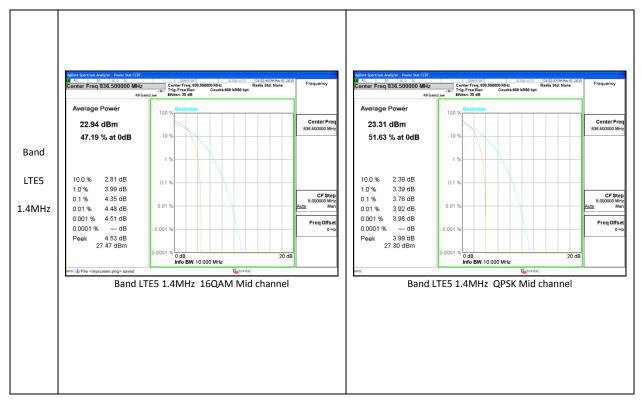
FCC ID: A3LSMG531F



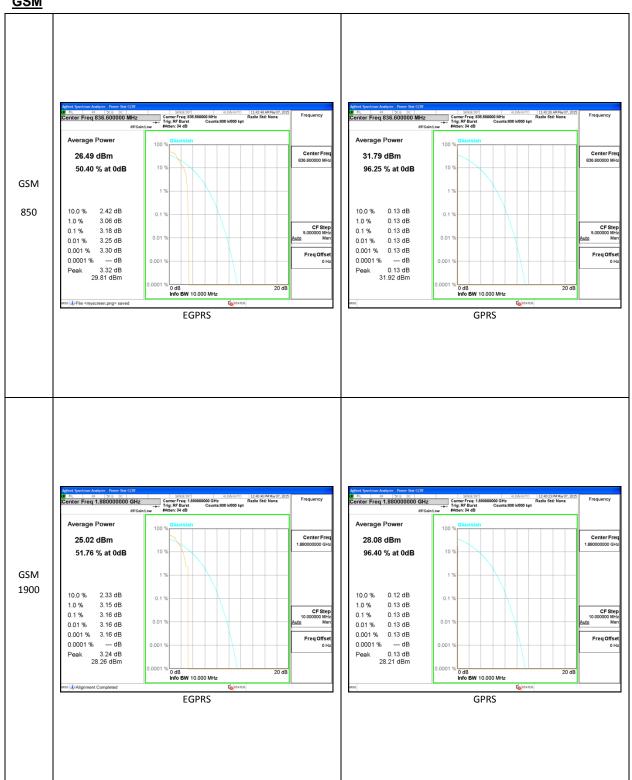
REPORT NO: 15I20736-E1A

MODEL NUMBER: SM-G531F & SM-G531F/DD

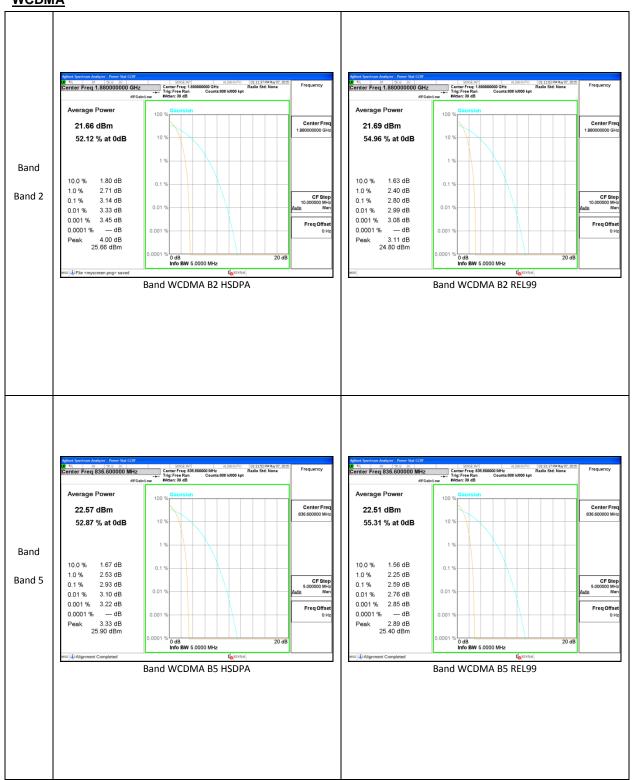
DATE: JUNE 11, 2015 FCC ID: A3LSMG531F



## **GSM**



## **WCDMA**



## 10. LIMITS AND CONDUCTED RESULTS

## 10.1. OCCUPIED BANDWIDTH

## **RULE PART(S)**

FCC: §2.1049

IC: RSS-132, 4.5; RSS-133, 6.5

#### **LIMITS**

For reporting purposes only

#### **TEST PROCEDURE**

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at the low, middle and high channel in each band. The -26dB bandwidth was also measured and recorded.

(KDB 971168 D01 Power Meas License Digital Systems v02r02)

#### **MODES TESTED**

GSM 850, GSM 1900, WCDMA Band 2, WCDMA Band 5

TEL: (510) 771-1000

FORM NO: CCSUP4701I

## 10.1.1. OCCUPIED BANDWIDTH RESULTS

| Band    | Mode  | Channel | f (MHz) | 99% BW (KHz) | -26dB BW (KHz) |
|---------|-------|---------|---------|--------------|----------------|
|         |       | 128     | 824.2   |              |                |
|         | GMSK  | 190     | 836.6   |              |                |
|         |       | 251     | 848.8   |              |                |
|         |       | 128     | 824.2   | 244.2        | 318.1          |
| GSM850  | GPRS  | 190     | 836.6   | 245.1        | 326.4          |
|         |       | 251     | 848.8   | 244.2        | 320.4          |
|         | EGPRS | 128     | 824.2   | 248.5        | 315.6          |
|         |       | 190     | 836.6   | 245.3        | 308.5          |
|         |       | 251     | 848.8   | 239.7        | 290.9          |
|         | GMSK  | 512     | 1850.2  |              |                |
|         |       | 661     | 1880    |              |                |
|         |       | 810     | 1909.8  |              |                |
|         |       | 512     | 1850.2  | 246.5        | 321.2          |
| GSM1900 | GPRS  | 661     | 1880    | 245.9        | 317.7          |
|         |       | 810     | 1909.8  | 243.4        | 322.9          |
|         |       | 512     | 1850.2  | 245.7        | 319.6          |
|         | EGPRS | 661     | 1880    | 240.6        | 315.9          |
|         |       | 810     | 1909.8  | 242.8        | 301.8          |

REPORT NO: 15I20736-E1A DATE: JUNE 11, 2015 FCC ID: A3LSMG531F

MODEL NUMBER: SM-G531F & SM-G531F/DD

| Band   | Mode  | Channel | f (MHz) | 99% BW (MHz) | -26dB BW (MHz) |
|--------|-------|---------|---------|--------------|----------------|
|        |       | 4132    | 826.4   | 4.118        | 4.686          |
|        | REL99 | 4183    | 836.6   | 4.142        | 4.745          |
|        |       | 4233    | 846.6   | 4.138        | 4.686          |
|        |       | 4132    | 826.4   | 4.129        | 4.688          |
| Band 5 | HSDPA | 4183    | 836.6   | 4.143        | 4.685          |
|        |       | 4233    | 846.6   | 4.126        | 4.67           |
|        |       | 4132    | 826.4   |              |                |
|        | HSUPA | 4183    | 836.6   |              |                |
|        |       | 4233    | 846.6   |              |                |
|        | REL99 | 9262    | 1852.4  | 4.139        | 4.728          |
|        |       | 9400    | 1880    | 4.127        | 4.704          |
|        |       | 9538    | 1907.6  | 4.138        | 4.708          |
|        |       | 9262    | 1852.4  | 4.118        | 4.702          |
| Band 2 | HSDPA | 9400    | 1880    | 4.118        | 4.702          |
|        |       | 9538    | 1907.6  | 4.136        | 4.67           |
|        |       | 9262    | 1852.4  |              |                |
|        | HSUPA | 9400    | 1880    |              |                |
|        |       | 9538    | 1907.6  |              |                |

## 10.1.2. LTE OCCUPIED BANDWIDTH RESULTS

| Band | BW(MHz) | Mode  | RB/RB Size | f (MHz) | 99% BW (MHz) | -26dB BW<br>(MHz) |
|------|---------|-------|------------|---------|--------------|-------------------|
|      |         |       | 50/0       | 829     | 9.004        | 10.392            |
|      |         | QPSK  | 50/0       | 836.5   | 8.997        | 10.345            |
| LTE5 | LTE5 10 |       | 50/0       | 844     | 9.021        | 10.394            |
|      |         |       | 50/0       | 829     | 8.971        | 10.57             |
|      |         | 16QAM | 50/0       | 836.5   | 9.025        | 10.44             |
|      |         |       | 50/0       | 844     | 9.028        | 10.566            |

| Band | BW(MHz) | Mode  | RB/RB Size | f (MHz) | 99% BW (MHz) | -26dB BW |
|------|---------|-------|------------|---------|--------------|----------|
|      |         |       |            |         |              | (MHz)    |
|      |         |       | 25/0       | 826.5   | 4.515        | 5.256    |
|      |         | QPSK  | 25/0       | 836.5   | 4.498        | 5.276    |
| LTE5 | 5       |       | 25/0       | 846.5   | 4.52         | 5.232    |
|      |         |       | 25/0       | 826.5   | 4.51         | 5.249    |
|      |         | 16QAM | 25/0       | 836.5   | 4.504        | 5.217    |
|      |         |       | 25/0       | 846.5   | 4.525        | 5.43     |

| Band | BW(MHz) | Mode  | RB/RB Size | f (MHz) | 99% BW (MHz) | -26dB BW |
|------|---------|-------|------------|---------|--------------|----------|
|      |         |       |            |         |              | (MHz)    |
|      |         |       | 15/0       | 825.5   | 2.716        | 3.417    |
|      |         | QPSK  | 15/0       | 836.5   | 2.724        | 3.355    |
| LTE5 | 3       |       | 15/0       | 847.5   | 2.715        | 3.325    |
|      |         |       | 15/0       | 825.5   | 2.723        | 3.476    |
|      |         | 16QAM | 15/0       | 836.5   | 2.72         | 3.539    |
|      |         |       | 15/0       | 847.5   | 2.715        | 3.491    |

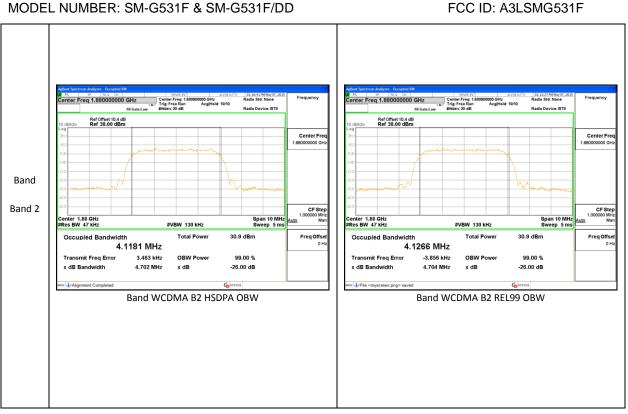
| Band | BW(MHz)  | Mode  | RB/RB Size | f (MHz) | 99% BW (MHz) | -26dB BW |
|------|----------|-------|------------|---------|--------------|----------|
|      |          |       |            |         |              | (MHz)    |
|      |          | 6/0   | 824.7      | 1.106   | 1.553        |          |
|      |          | QPSK  | 6/0        | 836.5   | 1.096        | 1.507    |
| LTE5 | LTE5 1.4 |       | 6/0        | 848.3   | 1.104        | 1.522    |
|      |          |       | 6/0        | 824.7   | 1.1          | 1.545    |
|      |          | 16QAM | 6/0        | 836.5   | 1.105        | 1.581    |
|      |          |       | 6/0        | 848.3   | 1.112        | 1.595    |

## 10.1.1. OCCUPIED BANDWIDTH PLOTS





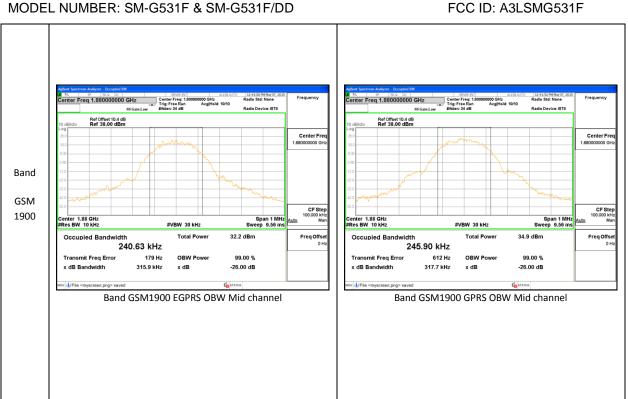






TEL: (510) 771-1000

DATE: JUNE 11, 2015





DATE: JUNE 11, 2015

#### 10.2. BAND EDGE EMISSIONS

## **RULE PART(S)**

FCC: §22.359, §24.238, §27.53

#### **LIMITS**

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log (P) dB$ .

#### **TEST PROCEDURE**

Per KDB 971168 D01 Power Meas License Digital Systems v02r02

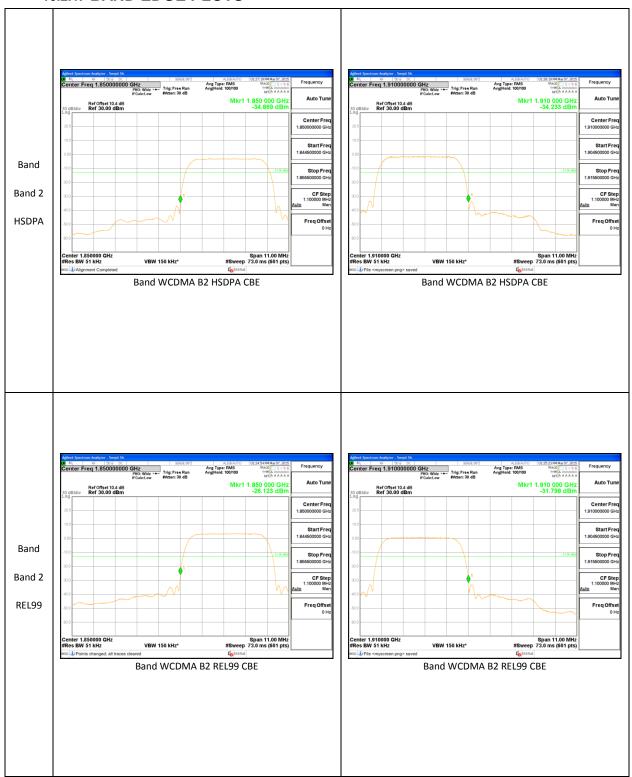
The transmitter output was connected to an Agilent 8960 or a CMW500 Test Set and configured to operate at maximum power. The band edge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.

#### **MODES TESTED**

GSM 850, GSM 1900, WCDMA Band 2, WCDMA Band 5

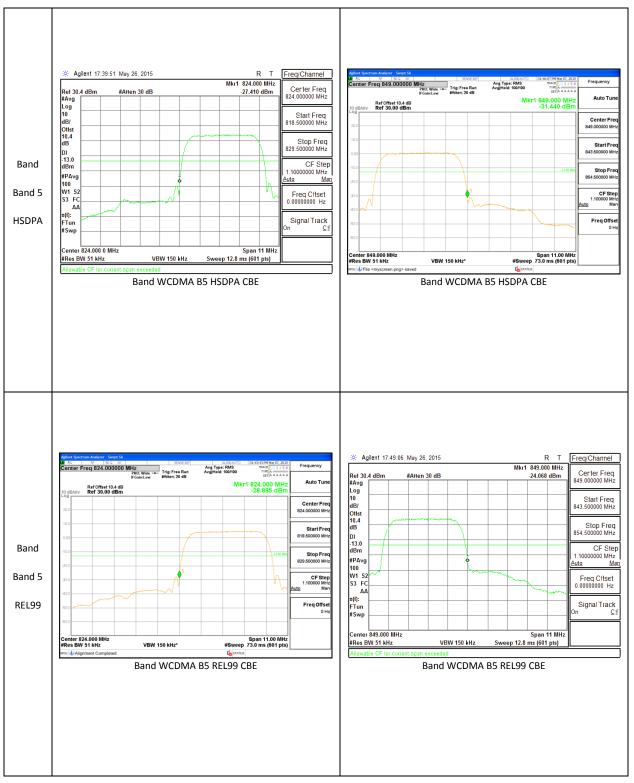
#### **RESULTS**

## 10.2.1. BAND EDGE PLOTS



DATE: JUNE 11, 2015

MODEL NUMBER: SM-G531F & SM-G531F/DD FCC ID: A3LSMG531F



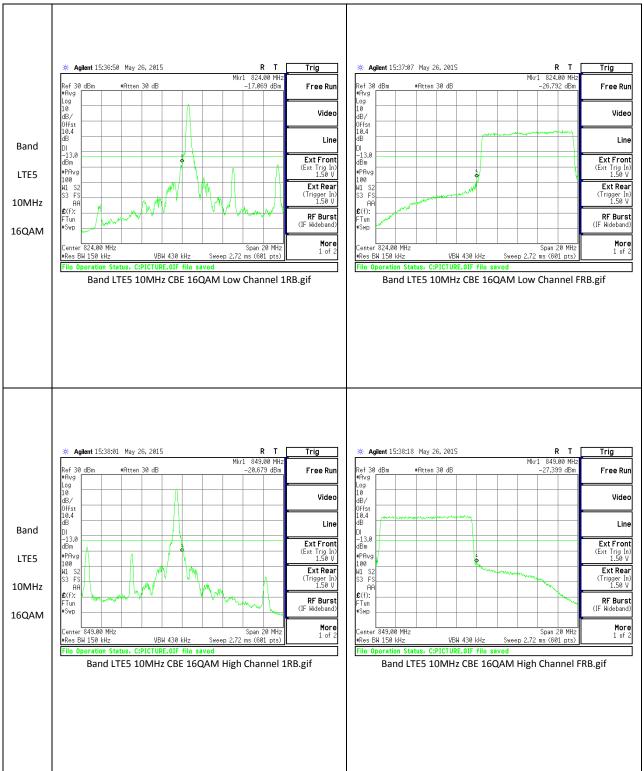
Avg Type: RMS AvgiHold: 100/100 Avg Type: RMS AvgiHold: 100/100 Mkr2 1.849 967 GH -26.987 dBr Ref Offset 19.4 dB Ref 39.00 dBm Center Fr Center Fr Band GSM 1900 Freq Offse Freq Offse **EGPRS** Span 1.000 MHz #Sweep 1.00 s (200 pts) Band GSM1900 EGPRS CBE Low channel Band GSM1900 EGPRS CBE High channel Mkr2 1.849 982 GH -19.374 dBr Center Fr Center Fr Start Fre Band Stop Fre GSM 1900 Freq Offse Freq Offse **GPRS** VBW 27 kHz\* Band GSM1900 GPRS CBE Low channel Band GSM1900 GPRS CBE High channel

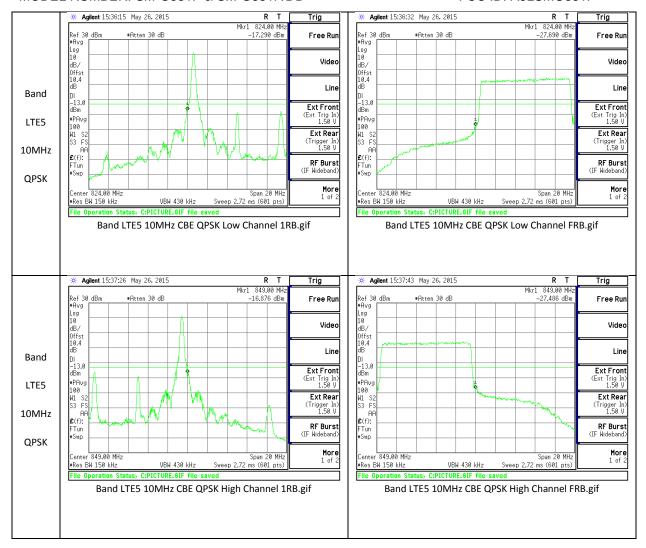
DATE: JUNE 11, 2015

FCC ID: A3LSMG531F

FCC ID: A3LSMG531F Avg Type: RMS AvgiHold: 100/100 Ref Offset 19.4 dB Ref 39.00 dBm Center Fr Center Fr Band GSM 850 Freq Offse Freq Offse **EGPRS** Band GSM850 EGPRS CBE Low channel Band GSM850 EGPRS CBE High channel Center Fr Center Fr Band Stop Fre GSM 850 Freq Offse Freq Offse **GPRS** Band GSM850 GPRS CBE Low channel Band GSM850 GPRS CBE High channel

DATE: JUNE 11, 2015

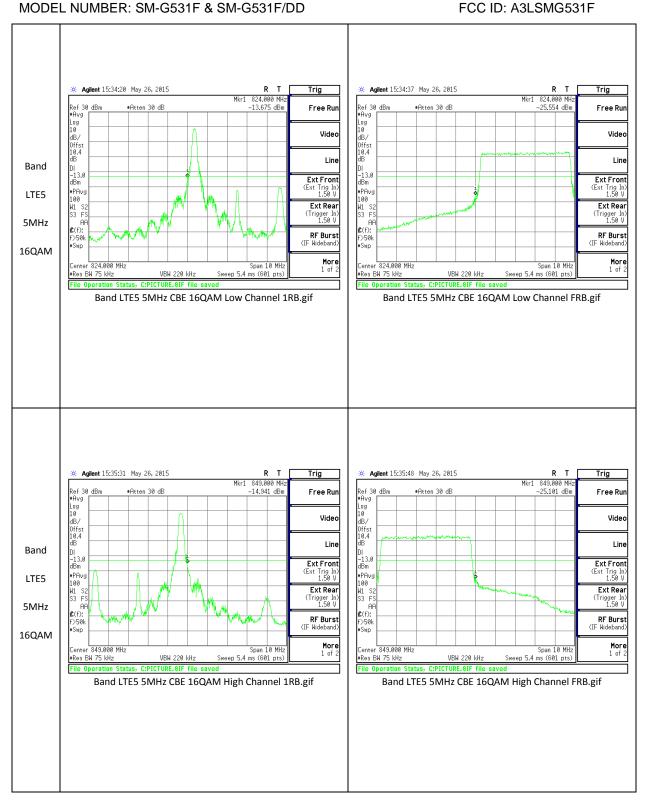


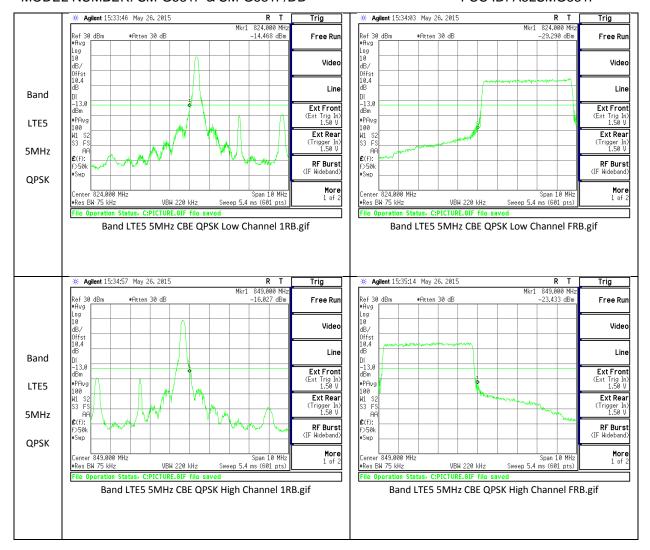


FORM NO: CCSUP4701I

REPORT NO: 15120736-E1A

DATE: JUNE 11, 2015

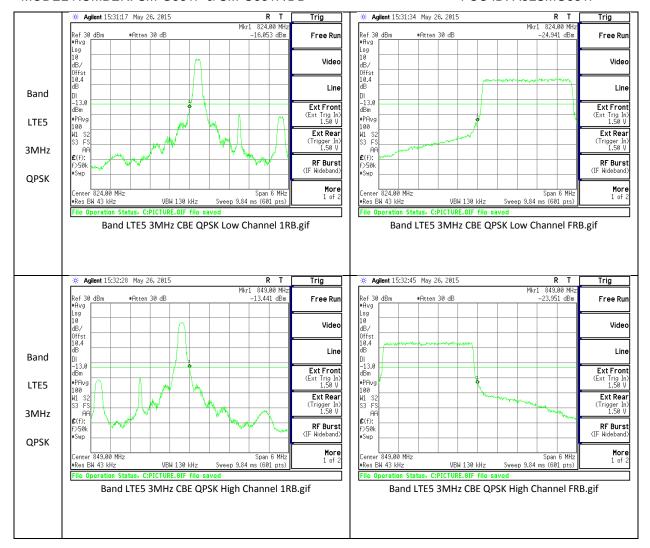




**Agilent** 15:31:51 May 26, 2015 **Agilent** 15:32:08 May 26, 2015 Mkr1 824.00 MH Mkr1 824.00 MH; Ref 30 dBm #Avg •Atten 30 dB -16.048 dBm Free Rur •Atten 30 dB Free Run Log Video Video dB/ Offst 10.4 dB Offst 10.4 Line Line Band Ext Front Ext Front \*PAv: Trig In 1.50 V \*PAvs Trig In 1.50 V LTE5 Ext Rear (Trigger In) 1.50 V Ext Rear (Trigger In) 1.50 V 3MHz £(f): f>50k #Swp £(f): f>50k #Swp RF Burst RF Burst (IF Wideband) 16QAM 824.00 MH; Center 824.00 MH; •Res BW 43 kHz VBW 130 kHz File Operation Status, C:PICTURE.GIF file saved File Operation Status, C:PICTURE.GIF file saved Band LTE5 3MHz CBE 16QAM Low Channel 1RB.gif Band LTE5 3MHz CBE 16QAM Low Channel FRB.gif \* Agilent 15:33:02 May 26, 2015 Trig Agilent 15:33:19 May 26, 2015 Trig Mkr1 849.00 MH Mkr1 849.00 MH -24.575 dBm Free Ru Free Rur Log Video Video dB/ Line Line Band Ext Front (Ext Trig In) 1.50 V Ext Front (Ext Trig In) 1.50 V LTE5 Ext Rear (Trigger In) 1.50 V Ext Rear (Trigger In) 1.50 V 3MHz £(f): f>50k #Swp £(f): f>50k RF Burst RF Burst (IF Wideband) Swp 16QAM Span 6 MHz Sweep 9.84 ms (601 pts) Center 849.00 MHz •Res BW 43 kHz Center 849.00 MHz •Res BW 43 kHz Span 6 MH: Sweep 9.84 ms (601 pts) VBW 130 kHz VBW 130 kHz File Operation Status, C:PICTURE.GIF file saved File Operation Status, C:PICTURE.GIF file saved Band LTE5 3MHz CBE 16QAM High Channel 1RB.gif Band LTE5 3MHz CBE 16QAM High Channel FRB.gif

DATE: JUNE 11, 2015

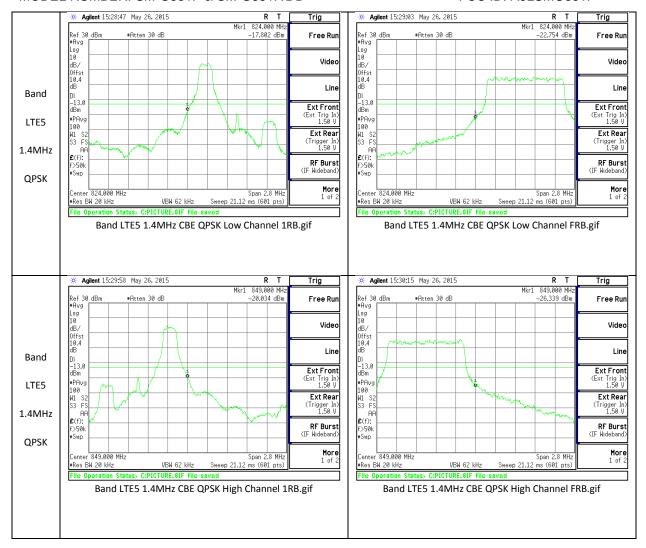
FCC ID: A3LSMG531F



FCC ID: A3LSMG531F Agilent 15:29:21 May 26, 2015 **Agilent** 15:29:38 May 26, 2015 824.000 MH Mkr1 824,000 MH Ref 30 dBm #Avg •Atten 30 dB Free Rur •Atten 30 dB Free Run Log Video Video dB/ Offst 10.4 dB Offst 10.4 Line Line Band Ext Front Ext Front \*PAv: Trig In 1.50 V \*PAvs Trig In 1.50 V LTE5 Ext Rear (Trigger In) 1.50 V Ext Rear (Trigger In) 1.50 V 1.4MHz £(f): f>50k #Swp £(f): f>50k #Swp RF Burst RF Burst (IF Wideband) 16QAM Center 824.000 MHz •Res BW 20 kHz File Operation Status, C:PICTURE.GIF file save File Operation Status, C:PICTURE.GIF file saved Band LTE5 1.4MHz CBE 16QAM Low Channel 1RB.gif Band LTE5 1.4MHz CBE 16QAM Low Channel FRB.gif \* Agilent 15:30:32 May 26, 2015 Trig \* Agilent 15:30:49 May 26, 2015 Trig 849.000 MH 849.000 MH Free Ru Free Rur Log Video Video dB/ Line Line Band Ext Front (Ext Trig In) 1.50 V Ext Front (Ext Trig In) 1.50 V LTE5 Ext Rear (Trigger In) 1.50 V Ext Rear (Trigger In) 1.50 V 1.4MHz £(f): f>50k #Swp £(f): f>50k #Swp RF Burst RF Burst (IF Wideband) 16QAM Center 849.000 MHz •Res BW 20 kHz Center 849.000 MHz •Res BW 20 kHz Span 2.8 MHz Sweep 21.12 ms (601 pts) Span 2.8 MH: Sweep 21.12 ms (601 pts) VBW 62 kHz VBW 62 kHz File Operation Status, C:PICTURE.GIF file saved File Operation Status, C:PICTURE.GIF file saved Band LTE5 1.4MHz CBE 16QAM High Channel 1RB.gif Band LTE5 1.4MHz CBE 16QAM High Channel FRB.gif

TEL: (510) 771-1000

DATE: JUNE 11, 2015



## 10.3. OUT OF BAND EMISSIONS

#### **RULE PART(S)**

FCC: §2.1051, §22.901, §22.917, §24.238

#### **LIMITS**

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log (P) dB$ .

#### **TEST PROCEDURE**

Per KDB 971168 D01 Power Meas License Digital Systems v02r02

The RF output of the transmitter was connected to a spectrum analyzer through a calibrated coaxial cable. Sufficient scans were taken to show the out-of-band Emissions, if any, up to 10th harmonic. Multiple sweeps were recorded in maximum hold mode using a peak detector to ensure that the worst-case emissions were caught.

#### **MODES TESTED**

GSM 850, GSM 1900, WCDMA Band 2, WCDMA Band 5

#### **RESULTS**

# 10.3.1. OUT OF BAND EMISSIONS RESULT

| Band | BW (MHz) | Mode  | f (MHz) | Spur (dBm) | Spec (dBm) | Delta (dB) |
|------|----------|-------|---------|------------|------------|------------|
|      |          |       | 829     | -28.49     | -13        | -15.49     |
|      |          | QPSK  | 836.5   | -28.20     | -13        | -15.2      |
| LTE5 | 10       |       | 844     | -28.33     | -13        | -15.33     |
|      |          |       | 829     | -27.88     | -13        | -14.88     |
|      |          | 16QAM | 836.5   | -27.87     | -13        | -14.87     |
|      |          |       | 844     | -28.10     | -13        | -15.1      |

| Band | BW (MHz) | Mode  | f (MHz) | Spur (dBm) | Spec (dBm) | Delta (dB) |
|------|----------|-------|---------|------------|------------|------------|
|      |          |       | 826.5   | -34.92     | -13        | -21.92     |
|      |          | QPSK  | 836.5   | -28.19     | -13        | -15.19     |
| LTE5 | 5        |       | 846.5   | -27.91     | -13        | -14.91     |
|      | 2.125    |       | 826.5   | -35.37     | -13        | -22.37     |
|      |          | 16QAM | 836.5   | -28.21     | -13        | -15.21     |
|      |          |       | 846.5   | -28.21     | -13        | -15.21     |

| Band | BW (MHz) | Mode  | f (MHz) | Spur (dBm) | Spec (dBm) | Delta (dB) |
|------|----------|-------|---------|------------|------------|------------|
|      |          |       | 825.5   | -34.50     | -13        | -21.5      |
|      |          | QPSK  | 836.5   | -27.64     | -13        | -14.64     |
| LTE5 | 3        |       | 847.5   | -27.13     | -13        | -14.13     |
|      | 2.125    | 16QAM | 825.5   | -35.43     | -13        | -22.43     |
|      |          |       | 836.5   | -27.45     | -13        | -14.45     |
|      |          |       | 847.5   | -28.24     | -13        | -15.24     |

FORM NO: CCSUP4701I

| Band | BW (MHz) | Mode  | f (MHz) | Spur (dBm) | Spec (dBm) | Delta (dB) |
|------|----------|-------|---------|------------|------------|------------|
|      |          |       | 824.7   | -34.40     | -13        | -21.4      |
|      |          | QPSK  | 836.5   | -27.68     | -13        | -14.68     |
| LTE5 | 1.4      |       | 848.3   | -34.98     | -13        | -21.98     |
|      |          | 16QAM | 824.7   | -34.75     | -13        | -21.75     |
|      |          |       | 836.5   | -27.60     | -13        | -14.6      |
|      |          |       | 848.3   | -35.17     | -13        | -22.17     |

| Band       | Mode  | f (MHz) | Spur (dBm) | Spec (dBm) | Delta (dB) |
|------------|-------|---------|------------|------------|------------|
|            |       | 824.2   | -24.486    | -13        | -11.486    |
|            | GPRS  | 836.6   | -24.544    | -13        | -11.544    |
| GSM 850    |       | 848.8   | -25.308    | -13        | -12.308    |
| G3IVI 630  |       | 824.2   | -24.376    | -13        | -11.376    |
|            | EGPRS | 836.6   | -24.603    | -13        | -11.603    |
|            |       | 848.8   | -25.227    | -13        | -12.227    |
|            | GPRS  | 1850.2  | -24.568    | -13        | -11.568    |
|            |       | 1880    | -24.628    | -13        | -11.628    |
| GSM 1900   |       | 1909.8  | -24.871    | -13        | -11.871    |
| G3IVI 1900 |       | 1850.2  | -24.93     | -13        | -11.93     |
|            | EGPRS | 1880    | -24.744    | -13        | -11.744    |
|            |       | 1909.8  | -24.753    | -13        | -11.753    |

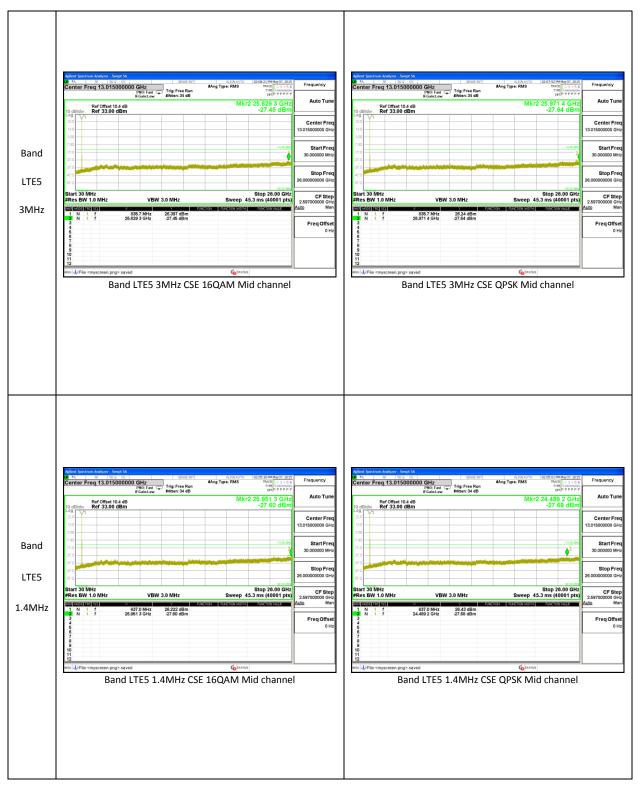
| Band    | Mode  | f (MHz) | Spur (dBm) | Spec (dBm) | Delta (dB) |
|---------|-------|---------|------------|------------|------------|
|         |       | 826.4   | -34.274    | -13        | -21.274    |
|         | REL99 | 836.6   | -35.109    | -13        | -22.109    |
| Band 5  |       | 846.6   | -33.773    | -13        | -20.773    |
| Dallu 3 |       | 826.4   | -34.174    | -13        | -21.174    |
|         | HSDPA | 836.6   | -34.752    | -13        | -21.752    |
|         |       | 846.6   | -34.322    | -13        | -21.322    |
|         |       | 1852.4  | -35.034    | -13        | -22.034    |
|         | REL99 | 1880    | -34.996    | -13        | -21.996    |
| Band 2  |       | 1907.6  | -34.558    | -13        | -21.558    |
| Dailu Z |       | 1852.4  | -33.927    | -13        | -20.927    |
|         | HSDPA | 1880    | -35.332    | -13        | -22.332    |
|         | _     | 1907.6  | -34.041    | -13        | -21.041    |

## 10.3.2. OUT OF BAND EMISSIONS PLOTS



DATE: JUNE 11, 2015

FCC ID: A3LSMG531F

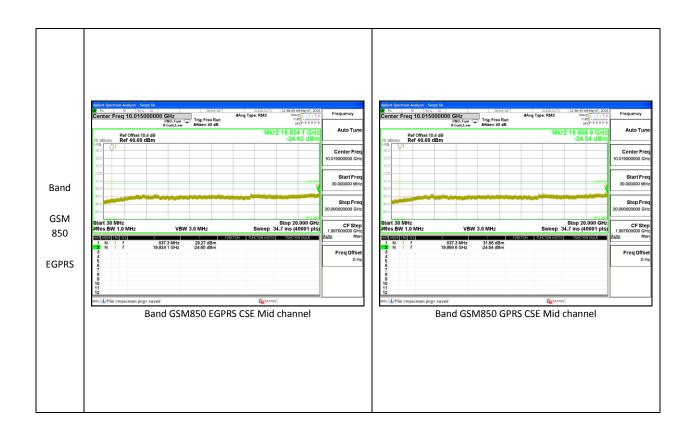


FCC ID: A3LSMG531F Ref Offset 10.4 dB Ref 30.00 dBm Ref Offset 10.4 dB Ref 30.00 dBm Center Fr Center F Band Stop Fr art 30 MHz Res BW 1.0 MHz Band 2 VBW 3.0 MHz VBW 3.0 MHz 21.96 dBm -35.33 dBm HSDPA Freq Offse Freq Offse Band WCDMA B2 HSDPA CSE Band WCDMA B2 REL99 CSE



DATE: JUNE 11, 2015

FCC ID: A3LSMG531F Ref Offset 10.4 dB Ref 40.00 dBm Ref Offset 10.4 dB Ref 40.00 dBm Center F Center F Band Stop Fr GSM VBW 3.0 MHz VBW 3.0 MHz 1900 25.01 dBm -24.74 dBm Freq Offse Freq Offse **EGPRS** Band GSM1900 GPRS CSE Mid channel Band GSM1900 EGPRS CSE Mid channel



DATE: JUNE 11, 2015

REPORT NO: 15I20736-E1A DATE: JUNE 11, 2015

MODEL NUMBER: SM-G531F & SM-G531F/DD FCC ID: A3LSMG531F

## 10.4. FREQUENCY STABILITY

## **RULE PART(S)**

FCC: §2.1055, §22.355, §24.235

#### **LIMITS**

 $\S22.355$  - The carrier frequency shall not depart from the reference frequency in excess of  $\pm 2.5$  ppm for mobile stations.

§24.235 - The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

§27.54 - The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

#### **TEST PROCEDURE**

Per KDB 971168 D01 Power Meas License Digital Systems v02r02

#### **MODES TESTED**

GSM 850, GSM 1900, LTE Band 41

#### **RESULTS**

See the following pages.

## 10.4.1. FREQUENCY STABILITY RESULTS

# GPRS 850, Channel 190 Freq: 836.6MHz- MID CHANNEL

| Re           | Reference Frequency: Cell Mid Channel |                   |                      | MHz @ 20°C     |
|--------------|---------------------------------------|-------------------|----------------------|----------------|
|              | Limit: to                             | stay +- 2.5 ppm = | 2091.500             | Hz             |
| Power Supply | Environment                           | Frequency Dev     | viation Measureed wi | th Time Elapse |
| (Vdc)        | Temperature (°C)                      | (MHz)             | Delta (ppm)          | Limit (ppm)    |
| 3.80         | 50                                    | 836.599991        | 0.032                | 2.5            |
| 3.80         | 40                                    | 836.599985        | 0.040                | 2.5            |
| 3.80         | 30                                    | 836.599992        | 0.031                | 2.5            |
| 3.80         | 20                                    | 836.600018        | 0                    | 2.5            |
| 3.80         | 10                                    | 836.600006        | 0.014                | 2.5            |
| 3.80         | 0                                     | 836.599989        | 0.035                | 2.5            |
| 3.80         | -10                                   | 836.600004        | 0.017                | 2.5            |
| 3.80         | -20                                   | 836.600018        | 0.001                | 2.5            |
| 3.80         | -30                                   | 836.600008        | 0.012                | 2.5            |

| Re                | ference Frequency: | 836.6                | MHz @ 20°C     |             |
|-------------------|--------------------|----------------------|----------------|-------------|
|                   | Limit: to          | 2091.500             | Hz             |             |
| Power Supply      | Environment        | viation Measureed wi | th Time Elapse |             |
| (Vdc)             | Temperature (°C)   | (MHz)                | Delta (ppm)    | Limit (ppm) |
| 3.80              | 20                 | 836.600018           | 0              | 2.5         |
| 4.37              | 20                 | 836.6000069          | 0.013          | 2.5         |
| 3.23(End of volt) | 20                 | 836.6000113          | 0.008          | 2.5         |

TEL: (510) 771-1000

FAX: (510) 661-0888

REPORT NO: 15I20736-E1A DATE: JUNE 11, 2015

FCC ID: A3LSMG531F

MODEL NUMBER: SM-G531F & SM-G531F/DD

GPRS 1900, Channel 661 Freq: 1880MHz- MID CHANNEL

| Re           | Reference Frequency: PCS Mid Channel |                   |                                   | MHz @ 20°C  |  |
|--------------|--------------------------------------|-------------------|-----------------------------------|-------------|--|
|              | Limit: to                            | stay +- 2.5 ppm = | 4700.000                          | Hz          |  |
| Power Supply | Environment                          | Frequency Dev     | iation Measureed with Time Elapse |             |  |
| (Vdc)        | Temperature (°C)                     | (MHz)             | Delta (ppm)                       | Limit (ppm) |  |
| 3.80         | 50                                   | 1879.999988       | 0.000                             | 2.5         |  |
| 3.80         | 40                                   | 1879.999990       | -0.001                            | 2.5         |  |
| 3.80         | 30                                   | 1879.999985       | 0.002                             | 2.5         |  |
| 3.80         | 20                                   | 1879.999988       | 0                                 | 2.5         |  |
| 3.80         | 10                                   | 1879.999984       | 0.002                             | 2.5         |  |
| 3.80         | 0                                    | 1879.999984       | 0.002                             | 2.5         |  |
| 3.80         | -10                                  | 1879.999983       | 0.003                             | 2.5         |  |
| 3.80         | -20                                  | 1879.999988       | 0.000                             | 2.5         |  |
| 3.80         | -30                                  | 1879.999989       | 0.000                             | 2.5         |  |

| Re                | ference Frequency: | 1880          | MHz @ 20°C           |                |
|-------------------|--------------------|---------------|----------------------|----------------|
|                   | Limit: to          | 4700.000      | Hz                   |                |
| Power Supply      | Environment        | Frequency Dev | riation Measureed wi | th Time Elapse |
| (Vdc)             | Temperature (°C)   | (MHz)         | Delta (ppm)          | Limit (ppm)    |
| 3.80              | 20                 | 1879.999988   | 0                    | 2.5            |
| 4.37              | 20                 | 1879.999988   | 0.000                | 2.5            |
| 3.23(End of volt) | 20                 | 1879.999983   | 0.003                | 2.5            |

REPORT NO: 15I20736-E1A DATE: JUNE 11, 2015

MODEL NUMBER: SM-G531F & SM-G531F/DD FCC ID: A3LSMG531F

## 11. RADIATED TEST RESULTS

# 11.1. RADIATED POWER (ERP & EIRP)

## **RULE PART(S)**

FCC: §2.1046, §22.913, §24.232.

#### **LIMITS**

22.913(a) - The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

24.232(c) - Mobile/portable stations are limited to 2 watts e.i.r.p. peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.

In addition, when the transmitter power is measured in terms of average value, the peak-to-average ratio of the power shall not exceed 13dB.

#### **TEST PROCEDURE**

ANSI / TIA / EIA 603C Clause 2.2.17; PSA setting reference to 971168 D01 v02r02

For peak power measurement with a PSA:

a) Set the RBW  $\geq$  OBW; b) Set VBW  $\geq$  3 × RBW; c) Set span  $\geq$  2 x RBW; d) Sweep time = auto couple; e) Detector = peak; f) Ensure that the number of measurement points  $\geq$  span/RBW; g) Trace mode = max hold;

For average power measurement with a PSA:

a) Set span to at least 1.5 times the OBW; b) Set RBW = 1-5% of the OBW, not to exceed 1 MHz; c) Set VBW  $\geq$  3 x RBW; d) Set number of points in sweep  $\geq$  2 × span / RBW; e) Sweep time = auto-couple; f) Detector = RMS (power averaging); g) Use free run trigger If burst duty cycle  $\geq$  98; h) Use trigger to capture bursts If burst duty cycle < 98; i) Trace average at least 100 traces in power averaging (*i.e.*, RMS) mode. j) Compute the power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function.

#### **MODES TESTED**

GSM 850, GSM 1900, WCDMA Band 2, WCDMA Band 5, LTE Band 41

#### **TEST RESULTS**

FORM NO: CCSUP4701I

# 11.1.1. ERP/EIRP Results

| Band   | Mode  | Channel | f(MHz) | ERP / EIRP |        |
|--------|-------|---------|--------|------------|--------|
|        |       |         |        | dBm        | mW     |
|        |       | 9262    | 1852.4 | 23.86      | 243.22 |
|        | REL99 | 9400    | 1880   | 23.99      | 250.61 |
|        |       | 9538    | 1907.6 | 24.17      | 261.22 |
|        |       | 9262    | 1852.4 | 23.70      | 234.42 |
| Band 2 | HSDPA | 9400    | 1880   | 23.90      | 245.47 |
|        |       | 9538    | 1907.6 | 24.04      | 253.51 |
|        |       | 9262    | 1852.4 |            |        |
|        | HSUPA | 9400    | 1880   |            |        |
|        |       | 9538    | 1907.6 |            |        |

| Band   | Mode  | Channel | f(MHz) | ERP / EIRP |        |
|--------|-------|---------|--------|------------|--------|
|        |       |         |        | dBm        | mW     |
|        |       | 4132    | 826.4  | 20.41      | 109.90 |
|        | REL99 | 4183    | 836.6  | 20.66      | 116.41 |
|        |       | 4233    | 846.6  | 20.33      | 107.89 |
|        |       | 4132    | 826.4  | 20.37      | 108.89 |
| Band 5 | HSDPA | 4183    | 836.6  | 20.56      | 113.76 |
|        |       | 4233    | 846.6  | 20.19      | 104.47 |
|        |       | 4132    | 826.4  |            |        |
|        | HSUPA | 4183    | 836.6  |            |        |
|        |       | 4233    | 846.6  |            |        |

| Band    | Mode  | Channel | f(MHz) | ERP / | ' EIRP  |
|---------|-------|---------|--------|-------|---------|
|         |       |         |        | dBm   | mW      |
|         |       | 512     | 1850.2 |       |         |
|         | GMSK  | 661     | 1880   |       |         |
|         |       | 810     | 1909.8 |       |         |
|         |       | 512     | 1850.2 | 31.24 | 1330.45 |
| GSM1900 | GPRS  | 661     | 1880   | 30.14 | 1032.76 |
|         |       | 810     | 1909.8 | 31.0  | 1258.93 |
|         |       | 512     | 1850.2 | 27.21 | 526.02  |
|         | EGPRS | 661     | 1880   | 26.84 | 483.06  |
|         |       | 810     | 1909.8 | 27.22 | 527.23  |

| Band   | Mode  | Channel | f(MHz) | ERP / | ' EIRP |
|--------|-------|---------|--------|-------|--------|
|        |       |         |        | dBm   | mW     |
|        |       | 128     | 824.2  |       |        |
|        | GMSK  | 190     | 836.6  |       |        |
|        |       | 251     | 848.8  |       |        |
|        | GPRS  | 128     | 824.2  | 29.74 | 941.89 |
| GSM850 |       | 190     | 836.6  | 29.20 | 831.76 |
|        |       | 251     | 848.8  | 29.33 | 857.04 |
|        |       | 128     | 824.2  | 24.76 | 299.23 |
|        | EGPRS | 190     | 836.6  | 24.66 | 292.42 |
|        |       | 251     | 848.8  | 24.58 | 287.08 |

# 11.1.2. LTE ERP/EIRP Results

| Band | BW (MHz) Mode RB/RB Size f (MHz) |       | f (MHz) | ERP / EIRP |       |        |
|------|----------------------------------|-------|---------|------------|-------|--------|
|      | , ,                              |       | ,       | , ,        | dBm   | mW     |
|      |                                  |       | 1/0     | 829        | 20.97 | 125.03 |
|      |                                  | QPSK  | 1/0     | 836.5      | 20.88 | 122.46 |
| LTE5 | 10                               |       | 1/0     | 844        | 20.65 | 116.14 |
|      |                                  |       | 1/0     | 829        | 20.07 | 101.62 |
|      |                                  | 16QAM | 1/0     | 836.5      | 20.09 | 102.09 |
|      |                                  |       | 1/0     | 844        | 19.78 | 95.06  |

| Band | BW (MHz) | Mode  | RB/RB Size | f (MHz) | ERP / EIRP |        |  |
|------|----------|-------|------------|---------|------------|--------|--|
|      |          |       |            |         | dBm        | mW     |  |
|      |          |       | 1/0        | 826.5   | 20.88      | 122.46 |  |
|      |          | QPSK  | 1/0        | 836.5   | 20.68      | 116.95 |  |
| LTE5 | 5        |       | 1/0        | 846.5   | 20.51      | 112.46 |  |
|      |          |       | 1/0        | 826.5   | 19.98      | 99.54  |  |
|      |          | 16QAM | 1/0        | 836.5   | 20.0       | 100.00 |  |
|      |          |       | 1/0        | 846.5   | 19.74      | 94.19  |  |

| Band | BW (MHz) | Mode  | RB/RB Size | f (MHz) | ERP / EIRP |        |
|------|----------|-------|------------|---------|------------|--------|
|      |          |       |            |         | dBm        | mW     |
|      |          |       | 1/0        | 825.5   | 20.59      | 114.55 |
|      |          | QPSK  | 1/0        | 836.5   | 20.75      | 118.85 |
| LTE5 | 3        |       | 1/0        | 847.5   | 20.17      | 103.99 |
|      |          |       | 1/0        | 825.5   | 19.94      | 98.63  |
|      |          | 16QAM | 1/0        | 836.5   | 19.88      | 97.27  |
|      |          |       | 1/0        | 847.5   | 19.31      | 85.31  |

| Band | BW (MHz) | Mode  | RB/RB Size | f (MHz) | ERP / EIRP |        |  |
|------|----------|-------|------------|---------|------------|--------|--|
|      | , ,      |       |            |         | dBm        | mW     |  |
|      |          |       | 1/0        | 824.7   | 20.22      | 105.20 |  |
|      |          | QPSK  | 1/0        | 836.5   | 20.28      | 106.66 |  |
| LTE5 | 1.4      |       | 1/0        | 848.3   | 19.84      | 96.38  |  |
|      |          |       | 1/0        | 824.7   | 19.61      | 91.41  |  |
|      |          | 16QAM | 1/0        | 836.5   | 19.57      | 90.57  |  |
|      |          |       | 1/0        | 848.3   | 19.17      | 82.60  |  |

REPORT NO: 15I20736-E1A DATE: JUNE 11, 2015

FCC ID: A3LSMG531F

MODEL NUMBER: SM-G531F & SM-G531F/DD

## 11.1.3. ERP/EIRP DATA

## LTE Band 41

High Frequency Substitution Measurement UL Verification Services, Inc.

 Company:
 Samsung

 Project #:
 15/20736

 Date:
 5/16/2015

 Test Engineer:
 Charles Vergonio

 Configuration:
 EUT only

 Location:
 Chamber B

Mode: LTE 16QAM Band 5 Fundamentals, 10MHz Bandwidth

Band Test Equpment:

Receiving: Hybrid T243, and Chamber B SMA Cables

LTE5
Substitution: Dipole T446, Xft SMA Cable (SN # SEDIA

Substitution: Dipole T416, Xft SMA Cable (SN # SERIALNUMBER) Warehouse

10MHz

16QAM

| f       | SG reading | Ant. Pol. | Cable Loss | Antenna Gain | ERP   | Limit | Delta | Notes |
|---------|------------|-----------|------------|--------------|-------|-------|-------|-------|
| MHz     | (dBm)      | (H/V)     | (dB)       | (dBd)        | (dBm) | (dBm) | (dB)  |       |
| Low Ch  |            |           |            |              |       |       |       |       |
| 829.00  | 20.97      | V         | 0.9        | 0.0          | 20.07 | 38.5  | -18.4 |       |
| 829.00  | 3.46       | Н         | 0.9        | 0.0          | 2.56  | 38.5  | -35.9 |       |
| Mid Ch  |            |           |            |              |       |       |       |       |
| 836.50  | 20.99      | V         | 0.9        | 0.0          | 20.09 | 38.5  | -18.4 |       |
| 836.50  | 3.54       | Н         | 0.9        | 0.0          | 2.64  | 38.5  | -35.9 |       |
| High Ch |            |           |            |              |       |       |       |       |
| 844.00  | 20.68      | V         | 0.9        | 0.0          | 19.78 | 38.5  | -18.7 |       |
| 844.00  | 2.94       | Н         | 0.9        | 0.0          | 2.04  | 38.5  | -36.5 |       |

High Frequency Substitution Measurement UL Verification Services, Inc.

 Company:
 Samsung

 Project #:
 15!20736

 Date:
 5/16/2015

 Test Engineer:
 Charles Vergonio

 Configuration:
 EUT only

 Location:
 Chamber B

Mode: LTE\_QPSK Band 5 Fundamentals, 10MHz Bandwidth

Band LTE5

Test Equpment:

Receiving: Hybrid T243, and Chamber B SMA Cables

Substitution: Dipole T416, Xft SMA Cable (SN # SERIALNUMBER) Warehouse

10MHz

QPSK

| f       | SG reading | Ant. Pol. | Cable Loss | Antenna Gain | ERP   | Limit | Delta | Notes |
|---------|------------|-----------|------------|--------------|-------|-------|-------|-------|
| MHz     | (dBm)      | (H/V)     | (dB)       | (dBd)        | (dBm) | (dBm) | (dB)  |       |
| Low Ch  |            |           |            |              |       |       |       |       |
| 829.00  | 21.87      | V         | 0.9        | 0.0          | 20.97 | 38.5  | -17.5 |       |
| 829.00  | 4.54       | Н         | 0.9        | 0.0          | 3.64  | 38.5  | -34.9 |       |
| Mid Ch  |            |           |            |              |       |       |       |       |
| 836.50  | 21.78      | V         | 0.9        | 0.0          | 20.88 | 38.5  | -17.6 |       |
| 836.50  | 4.58       | Н         | 0.9        | 0.0          | 3.68  | 38.5  | -34.8 |       |
| High Ch |            |           |            |              |       |       |       |       |
| 844.00  | 21.55      | V         | 0.9        | 0.0          | 20.65 | 38.5  | -17.9 |       |
| 844.00  | 4.04       | Н         | 0.9        | 0.0          | 3.14  | 38.5  | -35.4 |       |

High Frequency Substitution Measurement UL Verification Services, Inc.

 Company:
 Samsung

 Project #:
 15!20736

 Date:
 5/16/2015

 Test Engineer:
 Charles Vergonio

 Configuration:
 EUT only

 Location:
 Chamber B

Mode: LTE\_16QAM Band 5 Fundamentals, 5MHz Bandwidth

Band LTE5

Test Equpment:

Receiving: Hybrid T243, and Chamber B SMA Cables

Substitution: Dipole T416, Xft SMA Cable (SN # SERIALNUMBER) Warehouse

5MHz

16QAM

| f       | SG reading | Ant. Pol. | Cable Loss | Antenna Gain | ERP   | Limit | Delta | Notes |
|---------|------------|-----------|------------|--------------|-------|-------|-------|-------|
| MHz     | (dBm)      | (H/V)     | (dB)       | (dBd)        | (dBm) | (dBm) | (dB)  |       |
| Low Ch  |            |           |            |              |       |       |       |       |
| 826.50  | 20.88      | V         | 0.9        | 0.0          | 19.98 | 38.5  | -18.5 |       |
| 826.50  | 3.16       | Н         | 0.9        | 0.0          | 2.26  | 38.5  | -36.2 |       |
| Mid Ch  |            |           |            |              |       |       |       |       |
| 836.50  | 20.90      | V         | 0.9        | 0.0          | 20.00 | 38.5  | -18.5 |       |
| 836.50  | 3.59       | Н         | 0.9        | 0.0          | 2.69  | 38.5  | -35.8 |       |
| High Ch |            |           |            |              |       |       |       |       |
| 846.50  | 20.64      | V         | 0.9        | 0.0          | 19.74 | 38.5  | -18.8 |       |
| 846.50  | 2.62       | Н         | 0.9        | 0.0          | 1.72  | 38.5  | -36.8 |       |

High Frequency Substitution Measurement UL Verification Services, Inc.

 Company:
 Samsung

 Project #:
 15!20736

 Date:
 5/16/2015

 Test Engineer:
 Charles Vergonio

 Configuration:
 EUT only

 Location:
 Chamber B

Mode: LTE\_QPSK Band 5 Fundamentals, 5MHz Bandwidth

Band LTE5

Test Equpment:

Receiving: Hybrid T243, and Chamber B SMA Cables

Substitution: Dipole T416, Xft SMA Cable (SN # SERIALNUMBER) Warehouse

5MHz

QPSK

| f       | SG reading | Ant. Pol. | Cable Loss | Antenna Gain | ERP   | Limit | Delta | Notes |
|---------|------------|-----------|------------|--------------|-------|-------|-------|-------|
| MHz     | (dBm)      | (H/V)     | (dB)       | (dBd)        | (dBm) | (dBm) | (dB)  |       |
| Low Ch  |            |           |            |              |       |       |       |       |
| 826.50  | 21.78      | V         | 0.9        | 0.0          | 20.88 | 38.5  | -17.6 |       |
| 826.50  | 4.24       | Н         | 0.9        | 0.0          | 3.34  | 38.5  | -35.2 |       |
| Mid Ch  |            |           |            |              |       |       |       |       |
| 836.50  | 21.58      | V         | 0.9        | 0.0          | 20.68 | 38.5  | -17.8 |       |
| 836.50  | 4.36       | Н         | 0.9        | 0.0          | 3.46  | 38.5  | -35.0 |       |
| High Ch |            |           |            |              |       |       |       |       |
| 846.50  | 21.41      | V         | 0.9        | 0.0          | 20.51 | 38.5  | -18.0 |       |
| 846.50  | 3.83       | Н         | 0.9        | 0.0          | 2.93  | 38.5  | -35.6 |       |

High Frequency Substitution Measurement UL Verification Services, Inc.

 Company:
 Samsung

 Project #:
 15!20736

 Date:
 05/16/15

 Test Engineer:
 Charles Vergonio

 Configuration:
 EUT only

 Location:
 Chamber B

Mode: LTE\_16QAM Band 5 Fundamentals, 3MHz Bandwidth

Band LTE5

Test Equpment:

Receiving: Hybrid T243, and Chamber B SMA Cables Substitution: Dipole T273, 3ft SMA Cable Warehouse

3MHz

16QAM

| f       | SG reading | Ant. Pol. | Cable Loss | Antenna Gain | ERP   | Limit | Delta | Notes |
|---------|------------|-----------|------------|--------------|-------|-------|-------|-------|
| MHz     | (dBm)      | (H/V)     | (dB)       | (dBd)        | (dBm) | (dBm) | (dB)  |       |
| Low Ch  |            |           |            |              |       |       |       |       |
| 825.50  | 20.84      | V         | 0.9        | 0.0          | 19.94 | 38.5  | -18.6 |       |
| 825.50  | 3.12       | Н         | 0.9        | 0.0          | 2.22  | 38.5  | -36.3 |       |
| Mid Ch  |            |           |            |              |       |       |       |       |
| 836.50  | 20.78      | V         | 0.9        | 0.0          | 19.88 | 38.5  | -18.6 |       |
| 836.50  | 3.44       | Н         | 0.9        | 0.0          | 2.54  | 38.5  | -36.0 |       |
| High Ch |            |           |            |              |       |       |       |       |
| 847.50  | 20.21      | V         | 0.9        | 0.0          | 19.31 | 38.5  | -19.2 |       |
| 847.50  | 2.59       | Н         | 0.9        | 0.0          | 1.69  | 38.5  | -36.8 |       |
| 011100  |            |           |            |              |       |       |       | .i    |
|         |            |           |            |              |       |       |       |       |

High Frequency Substitution Measurement UL Verification Services, Inc.

 Company:
 Samsung

 Project #:
 15!20736

 Date:
 05/16/15

 Test Engineer:
 Charles Vergonio

 Configuration:
 EUT only

 Location:
 Chamber B

Mode: LTE\_QPSK Band 5 Fundamentals, 3MHz Bandwidth

Band LTE5

Test Equpment:

Receiving: Hybrid T243, and Chamber B SMA Cables Substitution: Dipole T273, 3ft SMA Cable Warehouse

3MHz

QPSK

| f       | SG reading | Ant. Pol. | Cable Loss | Antenna Gain | ERP   | Limit | Delta | Notes |
|---------|------------|-----------|------------|--------------|-------|-------|-------|-------|
| MHz     | (dBm)      | (H/V)     | (dB)       | (dBd)        | (dBm) | (dBm) | (dB)  |       |
| Low Ch  |            |           |            |              |       |       |       |       |
| 825.50  | 21.49      | V         | 0.9        | 0.0          | 20.59 | 38.5  | -17.9 |       |
| 825.50  | 4.25       | Н         | 0.9        | 0.0          | 3.35  | 38.5  | -35.2 |       |
| Mid Ch  |            |           |            |              |       |       |       |       |
| 836.50  | 21.65      | V         | 0.9        | 0.0          | 20.75 | 38.5  | -17.8 |       |
| 836.50  | 4.35       | Н         | 0.9        | 0.0          | 3.45  | 38.5  | -35.1 |       |
| High Ch |            |           |            |              |       |       |       |       |
| 847.50  | 21.07      | V         | 0.9        | 0.0          | 20.17 | 38.5  | -18.3 |       |
| 847.50  | 3.61       | Н         | 0.9        | 0.0          | 2.71  | 38.5  | -35.8 |       |

High Frequency Substitution Measurement UL Verification Services, Inc.

 Company:
 Samsung

 Project #:
 15!20736

 Date:
 5/16/2015

 Test Engineer:
 Charles Vergonio

 Configuration:
 EUT Only

 Location:
 Chamber B

Mode: LTE5 1.4MHz 16QAM FUND

Band LTE5

Test Equpment:

Receiving: Hybrid T899, and Chamber G SMA Cables Substitution: Dipole T273, 6ft SMA Cable Warehouse

1.4MHz

16QAM

| f       | SG reading | Ant. Pol. | Cable Loss | Antenna Gain | ERP   | Limit | Delta | Notes |
|---------|------------|-----------|------------|--------------|-------|-------|-------|-------|
| MHz     | (dBm)      | (H/V)     | (dB)       | (dBd)        | (dBm) | (dBm) | (dB)  |       |
| Low Ch  |            |           |            |              |       |       |       |       |
| 824.70  | 20.51      | V         | 0.9        | 0.0          | 19.61 | 38.5  | -18.9 |       |
| 824.70  | 2.69       | Н         | 0.9        | 0.0          | 1.79  | 38.5  | -36.7 |       |
| Mid Ch  |            |           |            |              |       |       |       |       |
| 836.50  | 20.47      | V         | 0.9        | 0.0          | 19.57 | 38.5  | -18.9 |       |
| 836.50  | 2.85       | Н         | 0.9        | 0.0          | 1.95  | 38.5  | -36.6 |       |
| High Ch |            |           |            |              |       |       |       |       |
| 848.30  | 20.07      | V         | 0.9        | 0.0          | 19.17 | 38.5  | -19.3 |       |
| 848.30  | 2.18       | Н         | 0.9        | 0.0          | 1.28  | 38.5  | -37.2 |       |

High Frequency Substitution Measurement UL Verification Services, Inc.

 Company:
 Samsung

 Project #:
 15!20736

 Date:
 5/16/2015

 Test Engineer:
 Charles Vergonio

 Configuration:
 EUT Only

 Location:
 Chamber B

Mode: LTE5 1.4MHz QPSK FUND

Band LTE5

Test Equpment:

Receiving: Hybrid T899, and Chamber G SMA Cables Substitution: Dipole T273, 6ft SMA Cable Warehouse

1.4MHz

QPSK

| f       | SG reading | Ant. Pol. | Cable Loss | Antenna Gain | ERP   | Limit | Delta | Notes |
|---------|------------|-----------|------------|--------------|-------|-------|-------|-------|
| MHz     | (dBm)      | (H/V)     | (dB)       | (dBd)        | (dBm) | (dBm) | (dB)  |       |
| Low Ch  |            |           |            |              |       |       |       |       |
| 824.70  | 21.12      | V         | 0.9        | 0.0          | 20.22 | 38.5  | -18.3 |       |
| 824.70  | 3.70       | Н         | 0.9        | 0.0          | 2.80  | 38.5  | -35.7 |       |
| Mid Ch  |            |           |            |              |       |       |       |       |
| 836.50  | 21.18      | V         | 0.9        | 0.0          | 20.28 | 38.5  | -18.2 |       |
| 836.50  | 3.92       | Н         | 0.9        | 0.0          | 3.02  | 38.5  | -35.5 |       |
| High Ch |            |           |            |              |       |       |       |       |
| 848.30  | 20.74      | V         | 0.9        | 0.0          | 19.84 | 38.5  | -18.7 |       |
| 848.30  | 3.21       | Н         | 0.9        | 0.0          | 2.31  | 38.5  | -36.2 |       |

# **WCDMA**

## High Frequency Substitution Measurement UL Verification Services, Inc.

 Company:
 Samsung

 Project #:
 15/20736

 Date:
 5/11/2015

 Test Engineer:
 D. Mun

 Configuration:
 X-Pos EUT Only

 Location:
 Chamber B

 Mode:
 HSDPA B2

Band

Receiving: Horn T345, and Chamber B SMA Cables

Substitution: Horn T59 Substitution, 4ft SMA Cable Warehouse

Band 2

HSDPA

| f       | SG reading | Ant. Pol. | Cable Loss | Antenna Gain | EIRP  | Limit | Margin | Notes |
|---------|------------|-----------|------------|--------------|-------|-------|--------|-------|
| MHz     | (dBm)      | (H/V)     | (dB)       | (dBi)        | (dBm) | (dBm) | (dB)   |       |
| Low Ch  |            |           |            |              |       |       |        |       |
| 1852.40 | 2.12       | V         | 0.9        | 8.0          | 9.23  | 33.0  | -23.8  |       |
| 1852.40 | 16.59      | Н         | 0.9        | 8.0          | 23.70 | 33.0  | -9.3   |       |
| Mid Ch  |            |           |            |              |       |       |        |       |
| 1880.00 | 3.36       | V         | 0.9        | 8.0          | 10.47 | 33.0  | -22.5  |       |
| 1880.00 | 16.79      | Н         | 0.9        | 8.0          | 23.90 | 33.0  | -9.1   |       |
| High Ch |            |           |            |              |       |       |        |       |
| 1907.60 | 6.45       | V         | 0.9        | 8.0          | 13.56 | 33.0  | -19.4  |       |
| 1907.60 | 16.93      | Н         | 0.9        | 8.0          | 24.04 | 33.0  | -9.0   |       |

Rev. 3.17.11

Test Equipment:

Note: For Band 4 EIRP limit is 30dBm

# High Frequency Substitution Measurement UL Verification Services, Inc.

 Company:
 Samsung

 Project #:
 15/20736

 Date:
 5/11/2015

 Test Engineer:
 D. Mun

 Configuration:
 X-pos EUT Only

 Location:
 Chamber B

 Mode:
 Rel99 B2

Band

Receiving: Horn T345, and Chamber C SMA Cables

Substitution: Horn T59 Substitution, 4ft SMA Cable Warehouse

Band 2

REL99

| f       | SG reading | Ant. Pol. | Cable Loss | Antenna Gain | EIRP  | Limit | Margin | Notes |
|---------|------------|-----------|------------|--------------|-------|-------|--------|-------|
| MHz     | (dBm)      | (H/V)     | (dB)       | (dBi)        | (dBm) | (dBm) | (dB)   |       |
| Low Ch  |            |           |            |              |       |       |        | _     |
| 1852.40 | 1.30       | V         | 0.9        | 8.0          | 8.41  | 33.0  | -24.6  |       |
| 1852.40 | 16.75      | Н         | 0.9        | 8.0          | 23.86 | 33.0  | -9.1   |       |
| Mid Ch  |            | i         |            |              |       |       |        |       |
| 1880.00 | 2.60       | V         | 0.9        | 8.0          | 9.71  | 33.0  | -23.3  |       |
| 1880.00 | 16.88      | Н         | 0.9        | 8.0          | 23.99 | 33.0  | -9.0   |       |
| High Ch |            |           |            |              |       |       |        |       |
| 1907.60 | 4.41       | V         | 0.9        | 8.0          | 11.52 | 33.0  | -21.5  |       |
| 1907.60 | 17.06      | Н         | 0.9        | 8.0          | 24.17 | 33.0  | -8.8   |       |

Rev. 3.17.11

Test Equipment:

Note: For Band 4 EIRP limit is 30dBm

High Frequency Substitution Measurement UL Verification Services, Inc. Chamber B

 Company:
 LG

 Project #:
 15!20736

 Date:
 05/11/15

 Test Engineer:
 D. Mun

 Configuration:
 Z-pos EUT

Mode: WCDMA Band 5 HSDPA

Band Receiving: Sunol

Receiving: Sunol T243, and 3m Chamber B N-type Cable Substitution: Dipole T416, 6ft SMA Cable Warehouse

Band 5

**HSDPA** 

| f       | SG reading | Ant. Pol. | Cable Loss | Antenna Gain | ERP   | Limit | Margin | Notes |
|---------|------------|-----------|------------|--------------|-------|-------|--------|-------|
| MHz     | (dBm)      | (H/V)     | (dB)       | (dBd)        | (dBm) | (dBm) | (dB)   |       |
| Low Ch  |            |           |            |              |       |       |        |       |
| 826.40  | 21.27      | V         | 0.9        | 0.0          | 20.37 | 38.5  | -18.1  |       |
| 826.40  | 4.49       | Н         | 0.9        | 0.0          | 3.59  | 38.5  | -34.9  |       |
| Mid Ch  |            |           |            |              |       |       |        |       |
| 836.60  | 21.46      | V         | 0.9        | 0.0          | 20.56 | 38.5  | -17.9  |       |
| 836.60  | 4.34       | Н         | 0.9        | 0.0          | 3.44  | 38.5  | -35.0  |       |
| High Ch |            |           |            |              |       |       |        |       |
| 846.60  | 21.09      | V         | 0.9        | 0.0          | 20.19 | 38.5  | -18.3  |       |
| 846.60  | 3.91       | Н         | 0.9        | 0.0          | 3.01  | 38.5  | -35.4  |       |

Rev. 3.17.11

Note: For Band 13/17 ERP limit is 34.77dBm; For Band 26 limit is 50dBm

High Frequency Substitution Measurement UL Verification Services, Inc. Chamber B

 Company:
 LG

 Project #:
 15!20736

 Date:
 05/11/15

 Test Engineer:
 D. Mun

 Configuration:
 Z-pos EUT

 Mode:
 REL99 B5 FUND

Band Receiving: Sunol

Receiving: Sunol T243, and 3m Chamber B N-type Cable Substitution: Dipole T416, 6ft SMA Cable Warehouse

Band 5

| REL99 |  |
|-------|--|

| f       | SG reading | Ant. Pol. | Cable Loss | Antenna Gain | ERP   | Limit | Margin | Notes |
|---------|------------|-----------|------------|--------------|-------|-------|--------|-------|
| MHz     | (dBm)      | (H/V)     | (dB)       | (dBd)        | (dBm) | (dBm) | (dB)   |       |
| Low Ch  |            |           |            |              |       |       |        |       |
| 826.40  | 21.31      | V         | 0.9        | 0.0          | 20.41 | 38.5  | -18.0  |       |
| 826.40  | 4.56       | Н         | 0.9        | 0.0          | 3.66  | 38.5  | -34.8  |       |
| Mid Ch  |            |           |            |              |       |       |        |       |
| 836.60  | 21.56      | V         | 0.9        | 0.0          | 20.66 | 38.5  | -17.8  |       |
| 836.60  | 4.49       | Н         | 0.9        | 0.0          | 3.59  | 38.5  | -34.9  |       |
| High Ch |            |           |            |              |       |       |        |       |
| 846.60  | 21.23      | V         | 0.9        | 0.0          | 20.33 | 38.5  | -18.1  |       |
| 846.60  | 4.11       | Н         | 0.9        | 0.0          | 3.21  | 38.5  | -35.2  |       |

Rev. 3.17.11

Note: For Band 13/17 ERP limit is 34.77dBm; For Band 26 limit is 50dBm

# **GSM**

# High Frequency Substitution Measurement UL Verification Services, Inc.

Company: Samsung
Project #: 15120736
Date: 5/11/2015
Test Engineer: D. Mun
Configuration: EUT X-pos only
Mode: EGPRS 1900

Band

<u>Test Equipment:</u> Receiving: Horn T345, and Chamber B SMA Cables

Substitution: Horn T59 Substitution, 4ft SMA Cable Warehouse

GSM 1900

**EGPRS** 

| f       | SG reading | Ant. Pol. | Cable Loss | Antenna Gain | EIRP  | Limit | Margin | Notes |
|---------|------------|-----------|------------|--------------|-------|-------|--------|-------|
| MHz     | (dBm)      | (H/V)     | (dB)       | (dBi)        | (dBm) | (dBm) | (dB)   |       |
| Low Ch  |            |           |            |              |       |       |        |       |
| 1850.20 | 8.72       | V         | 0.9        | 8.0          | 15.88 | 33.0  | -17.1  |       |
| 1850.20 | 20.05      | Н         | 0.9        | 8.0          | 27.21 | 33.0  | -5.8   |       |
| Mid Ch  |            |           |            |              |       |       |        |       |
| 1880.00 | 3.70       | V         | 0.9        | 8.0          | 10.86 | 33.0  | -22.1  |       |
| 1880.00 | 19.68      | Н         | 0.9        | 8.0          | 26.84 | 33.0  | -6.2   |       |
| High Ch |            |           |            |              |       |       |        |       |
| 1909.80 | 9.23       | V         | 0.9        | 8.0          | 16.39 | 33.0  | -16.6  |       |
| 1909.80 | 20.06      | Н         | 0.9        | 8.0          | 27.22 | 33.0  | -5.8   |       |

Rev. 3.17.11

Note: For Band 4 EIRP limit is 30dBm

# High Frequency Substitution Measurement UL Verification Services, Inc.

Company: Samsung
Project #: 15/20736
Date: 5/11/2015
Test Engineer: D. Mun

Configuration: EUT X-pos Mode: GPRS 1900

Band

Receiving: Horn T345, and Chamber B SMA Cables

Substitution: Horn T59 Substitution, 4ft SMA Cable Warehouse

GSM 1900

**GPRS** 

| f       | SG reading | Ant. Pol. | Cable Loss | Antenna Gain | EIRP  | Limit | Margin | Notes |
|---------|------------|-----------|------------|--------------|-------|-------|--------|-------|
| MHz     | (dBm)      | (H/V)     | (dB)       | (dBi)        | (dBm) | (dBm) | (dB)   |       |
| Low Ch  |            |           |            |              |       |       |        |       |
| 1850.20 | 10.02      | V         | 0.9        | 8.0          | 17.18 | 33.0  | -15.8  |       |
| 1850.20 | 24.08      | Н         | 0.9        | 8.0          | 31.24 | 33.0  | -1.8   |       |
| Mid Ch  |            |           |            |              |       |       |        |       |
| 1880.00 | 9.47       | V         | 0.9        | 8.0          | 16.63 | 33.0  | -16.4  |       |
| 1880.00 | 22.98      | Н         | 0.9        | 8.0          | 30.14 | 33.0  | -2.9   |       |
| High Ch |            |           |            |              |       | •     |        |       |
| 1909.80 | 10.29      | V         | 0.9        | 8.0          | 17.45 | 33.0  | -15.6  |       |
| 1909.80 | 23.84      | Н         | 0.9        | 8.0          | 31.00 | 33.0  | -2.0   |       |

Rev. 3.17.11

Test Equipment:

Note: For Band 4 EIRP limit is 30dBm

High Frequency Substitution Measurement UL Verification Services, Inc. Chamber B

 Company:
 Sony

 Project #:
 15/20736

 Date:
 05/11/15

 Test Engineer:
 David Mun

 Configuration:
 EUT Z-Position

 Mode:
 EGPRS850

Band

Receiving: Hybrid T243, and Chamber B N-type Cable Substitution: Dipole T273, 8ft SMA Cable Warehouse.

GSM 850

**EGPRS** 

| f       | SG reading | Ant. Pol. | Cable Loss | Antenna Gain | ERP   | Limit | Margin | Notes |
|---------|------------|-----------|------------|--------------|-------|-------|--------|-------|
| MHz     | (dBm)      | (H/V)     | (dB)       | (dBd)        | (dBm) | (dBm) | (dB)   |       |
| Low Ch  |            |           |            |              |       |       |        |       |
| 824.20  | 25.66      | V         | 0.9        | 0.0          | 24.76 | 38.5  | -13.7  |       |
| 824.20  | 8.25       | Н         | 0.9        | 0.0          | 7.35  | 38.5  | -31.1  |       |
| Mid Ch  |            |           |            |              |       |       |        |       |
| 836.60  | 25.56      | V         | 0.9        | 0.0          | 24.66 | 38.5  | -13.8  |       |
| 836.60  | 8.38       | Н         | 0.9        | 0.0          | 7.48  | 38.5  | -31.0  |       |
| High Ch |            |           |            |              |       |       |        |       |
| 848.80  | 25.48      | V         | 0.9        | 0.0          | 24.58 | 38.5  | -13.9  |       |
| 848.80  | 8.01       | Н         | 0.9        | 0.0          | 7.11  | 38.5  | -31.3  |       |

Rev. 3.17.11

**Test Equipment:** 

Note: For Band 13/17 ERP limit is 34.77dBm; For Band 26 limit is 50dBm

High Frequency Substitution Measurement UL Verification Services, Inc. Chamber B

 Company:
 Sony

 Project #:
 15/20736

 Date:
 05/11/15

 Test Engineer:
 David Mun

 Configuration:
 EUT Z-Position

 Mode:
 GPRS850

Band

Receiving: Hybrid T243, and Chamber B N-type Cable Substitution: Dipole T273, 8ft SMA Cable Warehouse.

GSM 850

**GPRS** 

| f       | SG reading | Ant. Pol. | Cable Loss | Antenna Gain | ERP   | Limit | Margin | Notes |
|---------|------------|-----------|------------|--------------|-------|-------|--------|-------|
| MHz     | (dBm)      | (H/V)     | (dB)       | (dBd)        | (dBm) | (dBm) | (dB)   |       |
| Low Ch  |            |           |            |              |       |       |        |       |
| 824.20  | 30.64      | V         | 0.9        | 0.0          | 29.74 | 38.5  | -8.7   |       |
| 824.20  | 13.02      | Н         | 0.9        | 0.0          | 12.12 | 38.5  | -26.3  |       |
| Mid Ch  |            |           |            |              |       |       |        |       |
| 836.60  | 30.10      | V         | 0.9        | 0.0          | 29.20 | 38.5  | -9.2   |       |
| 836.60  | 12.81      | Н         | 0.9        | 0.0          | 11.91 | 38.5  | -26.5  |       |
| High Ch |            |           |            |              |       |       |        |       |
| 848.80  | 30.23      | V         | 0.9        | 0.0          | 29.33 | 38.5  | -9.1   |       |
| 848.80  | 12.39      | Н         | 0.9        | 0.0          | 11.49 | 38.5  | -27.0  |       |

Rev. 3.17.11

**Test Equipment:** 

Note: For Band 13/17 ERP limit is 34.77dBm; For Band 26 limit is 50dBm

#### 11.2. FIELD STRENGTH OF SPURIOUS RADIATION

### **RULE PART(S)**

FCC: §2.1053, §22.917, §24.238, §27.53 and §90.691

#### **LIMIT**

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log (P) dB$ .

## **TEST PROCEDURE**

For Cellular equipment - Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 100 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

For PCS equipment - Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

#### **MODES TESTED**

GSM 850, GSM 1900, WCDMA Band 2, WCDMA Band 5, LTE Band 41

# 11.2.1. SPURIOUS RADIATION DATA

## LTE Band 5

UL Verfication Services, Inc.
Above 1GHz High Frequency Substitution Measurement

Company: Samsung
Project #: 15/20736
Date: 5/16/2015
Test Engineer: Charles Vergonio
Configuration: EUT/ AC Charger/ Headset

Location: Chamber B

Mode: LTE\_16QAM Band 5 Harmonics, 10MHz Bandwidth

Band LTE5

10MHz

16QAM

SG reading Ant. Pol. Distance Preamp Filter EIRP Delta Notes MHz (dBm) (H/V) (dB) (dBm) (dBm) (dB) (m) (dB) Low Ch, 829 -50.8 1658.00 3.0 37.0 1.0 -63.8 -13.0 2487.00 -22.9 3.0 36.4 1.0 -58.3 -13.0 -45.3 3316.00 -21.2 V 3.0 36.1 1.0 -56.3 -13.0 -43.3 1658.00 37.0 -63.3 -13.0 -50.3 -27.3 3.0 1.0 2487.00 Н 3.0 36.4 1.0 -59.8 -13.0 -46.8 -24.4 3316.00 -42.5 -20.4 Н 36.1 -55.5 -13.0 3.0 1.0 Mid Ch, 836.5 .27 A 37.0 1.0 -13.0 -50.4 1673.00 3.0 -63.4 2509.50 -22.7 V 3.0 36.4 1.0 -58.1 -13.0 -45.1 3346.00 -21.0 V 3.0 36.1 1.0 -56.1 -13.0 -43.1 1673.00 -26.9 Н 3.0 37.0 1.0 -62.9 -13.0 -49.9 2509.50 -24.6 3.0 36.4 1.0 -60.0 -13.0 -47.0 3346.00 -20.5 Н 3.0 36.1 1.0 -55.6 -13.0 -42.6 High Ch, 844 1688.00 -27.3 3.0 37.0 1.0 -63.3 -13.0 -50.3 2532.00 -22.4 3.0 36.4 1.0 -57.8 -44.8 V -13.0 -21.0 3376.00 43.1 V 3.0 36.1 1.0 -56.1 -13.0 1688.00 -26.8 Ή 3.0 37.0 1.0 -62.8 -13.0 -49.8 2532.00 -24.5 Н 3.0 36.4 1.0 -59.9 -13.0 -46.9 3376.00 -19.9 3.0 36.1 -55.0 -13.0 -42.0

UL Verfication Services, Inc.

Above 1GHz High Frequency Substitution Measurement

 Company:
 Samsung

 Project #:
 15/20736

 Date:
 5/16/2015

 Test Engineer:
 Charles Vergonio

 Configuration:
 EUT/ AC Charger/ Headset

Location: Chamber B

Mode: LTE\_QPSK Band 5 Harmonics, 10MHz Bandwidth

Band LTE5

10MHz QPSK

| f           | SG reading | Ant. Pol. | Distance | Preamp | Filter | EIRP     | Limit | Delta | Notes |
|-------------|------------|-----------|----------|--------|--------|----------|-------|-------|-------|
| MHz         | (dBm)      | (H/V)     | (m)      | (dB)   | (dB)   | (dBm)    | (dBm) | (dB)  |       |
| Low Ch, 82  | 9          |           |          |        |        |          |       |       |       |
| 1658.00     | -27.7      | V         | 3.0      | 37.0   | 1.0    | -63.7    | -13.0 | -50.7 |       |
| 2487.00     | -22.8      | V         | 3.0      | 36.4   | 1.0    | -58.3    | -13.0 | -45.3 |       |
| 3316.00     | -21.1      | V         | 3.0      | 36.1   | 1.0    | -56.2    | -13.0 | -43.2 |       |
| 1658.00     | -27.3      | Н         | 3.0      | 37.0   | 1.0    | -63.3    | -13.0 | -50.3 |       |
| 2487.00     | -24.7      | Н         | 3.0      | 36.4   | 1.0    | -60.2    | -13.0 | -47.2 |       |
| 3316.00     | -20.5      | Н         | 3.0      | 36.1   | 1.0    | -55.7    | -13.0 | -42.7 |       |
| Mid Ch, 836 | 5.5        |           |          |        |        |          |       |       |       |
| 1673.00     | -27.3      | V         | 3.0      | 37.0   | 1.0    | -63.3    | -13.0 | -50.3 |       |
| 2509.50     | -22.9      | V         | 3.0      | 36.4   | 1.0    | -58.3    | -13.0 | -45.3 |       |
| 3346.00     | -21.0      | V         | 3.0      | 36.1   | 1.0    | -56.1    | -13.0 | -43.1 |       |
| 1673.00     | -27.0      | Н         | 3.0      | 37.0   | 1.0    | -63.0    | -13.0 | -50.0 |       |
| 2509.50     | -24.6      | Н         | 3.0      | 36.4   | 1.0    | -60.0    | -13.0 | -47.0 |       |
| 3346.00     | -20.5      | Н         | 3.0      | 36.1   | 1.0    | -55.6    | -13.0 | -42.6 |       |
| High Ch, 84 | 4          |           |          |        |        |          |       |       |       |
| 1688.00     | -27.3      | V         | 3.0      | 37.0   | 1.0    | -63.2    | -13.0 | -50.2 |       |
| 2532.00     | -22.8      | V         | 3.0      | 36.4   | 1.0    | -58.2    | -13.0 | -45.2 |       |
| 3376.00     | -20.9      | V         | 3.0      | 36.1   | 1.0    | -56.0    | -13.0 | -43.0 |       |
| 1688.00     | -26.7      | Н         | 3.0      | 37.0   | 1.0    | -62.6    | -13.0 | -49.6 |       |
| 2532.00     | -24.3      | Н         | 3.0      | 36.4   | 1.0    | -59.7    | -13.0 | -46.7 |       |
| 3376.00     | -20.1      | Н         | 3.0      | 36.1   | 1.0    | -55.1    | -13.0 | -42.1 |       |
|             |            |           |          |        |        | <u> </u> |       |       |       |

FORM NO: CCSUP4701I

UL Verfication Services, Inc.

Above 1GHz High Frequency Substitution Measurement

 Company:
 Samsung

 Project #:
 15/20736

 Date:
 5/16/2015

 Test Engineer:
 Charles Vergonio

 Configuration:
 EUT/ AC Charger/ Headset

Location: Chamber B

Mode: LTE\_16QAM Band 5 Harmonics, 5MHz Bandwidth

Band LTE5

5MHz

16QAM

| f          | SG reading | Ant. Pol. | Distance | Preamp | Filter | EIRP  | Limit | Delta | Notes |
|------------|------------|-----------|----------|--------|--------|-------|-------|-------|-------|
| MHz        | (dBm)      | (H/V)     | (m)      | (dB)   | (dB)   | (dBm) | (dBm) | (dB)  |       |
| Low Ch, 8  | 26.5       |           |          |        |        |       |       |       |       |
| 1653.00    | -27.8      | V         | 3.0      | 37.0   | 1.0    | -63.9 | -13.0 | -50.9 |       |
| 2479.50    | -23.5      | V         | 3.0      | 36.4   | 1.0    | -58.9 | -13.0 | -45.9 |       |
| 3306.00    | -20.4      | V         | 3.0      | 36.1   | 1.0    | -55.6 | -13.0 | -42.6 |       |
| 1653.00    | -27.1      | Н         | 3.0      | 37.0   | 1.0    | -63.1 | -13.0 | -50.1 |       |
| 2479.50    | -25.0      | Н         | 3.0      | 36.4   | 1.0    | -60.5 | -13.0 | -47.5 |       |
| 3306.00    | -20.9      | Н         | 3.0      | 36.1   | 1.0    | -56.1 | -13.0 | -43.1 |       |
| Mid Ch, 83 | 6.5        |           |          |        |        |       |       |       |       |
| 1673.00    | -27.4      | V         | 3.0      | 37.0   | 1.0    | -63.4 | -13.0 | -50.4 |       |
| 2509.50    | -23.2      | V         | 3.0      | 36.4   | 1.0    | -58.7 | -13.0 | -45.7 |       |
| 3346.00    | -20.3      | V         | 3.0      | 36.1   | 1.0    | -55.4 | -13.0 | -42.4 |       |
| 1673.00    | -27.2      | Н         | 3.0      | 37.0   | 1.0    | -63.2 | -13.0 | -50.2 |       |
| 2509.50    | -25.0      | Н         | 3.0      | 36.4   | 1.0    | -60.4 | -13.0 | -47.4 |       |
| 3346.00    | -20.9      | Н         | 3.0      | 36.1   | 1.0    | -56.0 | -13.0 | -43.0 |       |
| High Ch, 8 | 46.5       |           |          |        |        |       |       |       |       |
| 1693.00    | -27.3      | V         | 3.0      | 37.0   | 1.0    | -63.3 | -13.0 | -50.3 |       |
| 2539.50    | -23.4      | V         | 3.0      | 36.4   | 1.0    | -58.8 | -13.0 | -45.8 |       |
| 3386.00    | -20.0      | V         | 3.0      | 36.1   | 1.0    | -55.1 | -13.0 | -42.1 |       |
| 1693.00    | -27.0      | Н         | 3.0      | 37.0   | 1.0    | -63.0 | -13.0 | -50.0 |       |
| 2539.50    | -24.8      | Н         | 3.0      | 36.4   | 1.0    | -60.2 | -13.0 | -47.2 |       |
| 3386.00    | -20.6      | Н         | 3.0      | 36.1   | 1.0    | -55.6 | -13.0 | -42.6 |       |

 Company:
 Samsung

 Project #:
 15/20736

 Date:
 5/16/2015

 Test Engineer:
 Charles Vergonio

 Configuration:
 EUT/ AC Charger/ Headset

Location: Chamber B

Mode: LTE\_QPSK Band 5 Harmonics, 5MHz Bandwidth

Band LTE5

5MHz

QPSK

| f<br>MHz   | SG reading<br>(dBm) | Ant. Pol.<br>(H/V) | Distance<br>(m) | Preamp<br>(dB) | Filter<br>(dB) | EIRP<br>(dBm) | Limit<br>(dBm) | Delta<br>(dB) | Notes |
|------------|---------------------|--------------------|-----------------|----------------|----------------|---------------|----------------|---------------|-------|
| Low Ch, 8  |                     | ()                 |                 | (42)           | (0.0)          | (42.11)       | (4.2)          | ()            | =     |
| 1653.00    | -27.7               | V                  | 3.0             | 37.0           | 1.0            | -63.7         | -13.0          | -50.7         |       |
| 2479.50    | -23.4               | V                  | 3.0             | 36.4           | 1.0            | -58.8         | -13.0          | -45.8         |       |
| 3306.00    | -20.4               | V                  | 3.0             | 36.1           | 1.0            | -55.6         | -13.0          | -42.6         |       |
| 1653.00    | -27.1               | Н                  | 3.0             | 37.0           | 1.0            | -63.1         | -13.0          | -50.1         |       |
| 2479.50    | -24.7               | Н                  | 3.0             | 36.4           | 1.0            | -60.2         | -13.0          | -47.2         |       |
| 3306.00    | -20.9               | Н                  | 3.0             | 36.1           | 1.0            | -56.1         | -13.0          | -43.1         |       |
| Mid Ch, 83 | 6.5                 |                    |                 |                |                |               |                |               |       |
| 1673.00    | -27.4               | V                  | 3.0             | 37.0           | 1.0            | -63.4         | -13.0          | -50.4         |       |
| 2509.50    | -23.2               | V                  | 3.0             | 36.4           | 1.0            | -58.6         | -13.0          | -45.6         |       |
| 3346.00    | -20.2               | V                  | 3.0             | 36.1           | 1.0            | -55.4         | -13.0          | -42.4         |       |
| 1673.00    | -27.0               | Н                  | 3.0             | 37.0           | 1.0            | -63.0         | -13.0          | -50.0         |       |
| 2509.50    | -25.1               | Н                  | 3.0             | 36.4           | 1.0            | -60.5         | -13.0          | -47.5         |       |
| 3346.00    | -20.8               | Н                  | 3.0             | 36.1           | 1.0            | -55.9         | -13.0          | -42.9         |       |
| High Ch, 8 | 46.5                |                    |                 |                |                |               |                |               |       |
| 1693.00    | -27.2               | V                  | 3.0             | 37.0           | 1.0            | -63.2         | -13.0          | -50.2         |       |
| 2539.50    | -23.3               | V                  | 3.0             | 36.4           | 1.0            | -58.7         | -13.0          | -45.7         |       |
| 3386.00    | -20.0               | V                  | 3.0             | 36.1           | 1.0            | -55.1         | -13.0          | -42.1         |       |
| 1693.00    | -26.9               | Н                  | 3.0             | 37.0           | 1.0            | -62.9         | -13.0          | -49.9         |       |
| 2539.50    | -24.8               | Н                  | 3.0             | 36.4           | 1.0            | -60.2         | -13.0          | -47.2         |       |
| 3386.00    | -20.5               | Н                  | 3.0             | 36.1           | 1.0            | -55.6         | -13.0          | -42.6         |       |

UL Verfication Services, Inc.

Above 1GHz High Frequency Substitution Measurement

 Company:
 Samsung

 Project #:
 15/20736

 Date:
 5/16/2015

 Test Engineer:
 Charles Vergonio

 Configuration:
 EUT/ AC Charger/ Headset

Location: Chamber B

Mode: LTE\_16QAM Band 5 Harmonics, 3MHz Bandwidth

Band LTE5

3MHz

16QAM

| f           | SG reading       | Ant. Pol. | Distance | Preamp | Filter | EIRP  | Limit | Delta | Notes |
|-------------|------------------|-----------|----------|--------|--------|-------|-------|-------|-------|
| MHz         | (dBm)            | (H/V)     | (m)      | (dB)   | (dB)   | (dBm) | (dBm) | (dB)  |       |
| Low Ch, 82  | 5.5              |           |          |        |        |       |       |       |       |
| 1651.00     | -27.5            | V         | 3.0      | 37.0   | 1.0    | -63.5 | -13.0 | -50.5 |       |
| 2476.50     | -23.7            | V         | 3.0      | 36.4   | 1.0    | -59.1 | -13.0 | -46.1 |       |
| 3302.00     | -20.1            | V         | 3.0      | 36.2   | 1.0    | -55.3 | -13.0 | -42.3 |       |
| 1651.00     | -27.3            | Н         | 3.0      | 37.0   | 1.0    | -63.4 | -13.0 | -50.4 |       |
| 2476.50     | -25.0            | Н         | 3.0      | 36.4   | 1.0    | -60.5 | -13.0 | -47.5 |       |
| 3302.00     | -21.4            | Н         | 3.0      | 36.2   | 1.0    | -56.5 | -13.0 | -43.5 |       |
| Mid Ch, 836 | <b>პ.</b> 5      |           |          |        |        |       |       |       |       |
| 1673.00     | -27.2            | V         | 3.0      | 37.0   | 1.0    | -63.2 | -13.0 | -50.2 |       |
| 2509.50     | -23.4            | V         | 3.0      | 36.4   | 1.0    | -58.8 | -13.0 | -45.8 |       |
| 3346.00     | -20.0            | V         | 3.0      | 36.1   | 1.0    | -55.1 | -13.0 | -42.1 |       |
| 1673.00     | -27.0            | Н         | 3.0      | 37.0   | 1.0    | -63.0 | -13.0 | -50.0 |       |
| 2509.50     | -25.0            | Н         | 3.0      | 36.4   | 1.0    | -60.4 | -13.0 | -47.4 |       |
| 3346.00     | -20.9            | Н         | 3.0      | 36.1   | 1.0    | -56.1 | -13.0 | -43.1 |       |
| High Ch, 84 | <del>1</del> 7.5 |           |          |        |        |       |       |       |       |
| 1695.00     | -26.9            | V         | 3.0      | 37.0   | 1.0    | -62.9 | -13.0 | -49.9 |       |
| 2542.50     | -23.3            | V         | 3.0      | 36.4   | 1.0    | -58.7 | -13.0 | -45.7 |       |
| 3390.00     | -19.8            | V         | 3.0      | 36.1   | 1.0    | -54.9 | -13.0 | -41.9 |       |
| 1695.00     | -26.9            | Н         | 3.0      | 37.0   | 1.0    | -62.9 | -13.0 | -49.9 |       |
| 2542.50     | -24.2            | Н         | 3.0      | 36.4   | 1.0    | -59.6 | -13.0 | -46.6 |       |
| 3390.00     | -20.8            | Н         | 3.0      | 36.1   | 1.0    | -55.9 | -13.0 | -42.9 |       |

FORM NO: CCSUP4701I

UL Verfication Services, Inc.

Above 1GHz High Frequency Substitution Measurement

 Company:
 Samsung

 Project #:
 15/20736

 Date:
 5/16/2015

 Test Engineer:
 Charles Vergonio

 Configuration:
 EUT/ AC Charger/ Headset

Location: Chamber B

Mode: LTE\_QPSK Band 5 Harmonics, 3MHz Bandwidth

Band LTE5

3MHz

QPSK

| f          | SG reading | Ant. Pol. | Distance | Preamp | Filter | EIRP  | Limit | Delta | Notes |
|------------|------------|-----------|----------|--------|--------|-------|-------|-------|-------|
| MHz        | (dBm)      | (H/V)     | (m)      | (dB) . | (dB)   | (dBm) | (dBm) | (dB)  |       |
| Low Ch, 82 | 25.5       |           |          |        |        |       |       |       |       |
| 1651.00    | -27.5      | V         | 3.0      | 37.0   | 1.0    | -63.5 | -13.0 | -50.5 |       |
| 2476.50    | -23.6      | V         | 3.0      | 36.4   | 1.0    | -59.1 | -13.0 | -46.1 |       |
| 3302.00    | -20.1      | V         | 3.0      | 36.2   | 1.0    | -55.2 | -13.0 | -42.2 |       |
| 1651.00    | -27.3      | Н         | 3.0      | 37.0   | 1.0    | -63.3 | -13.0 | -50.3 |       |
| 2476.50    | -25.0      | Н         | 3.0      | 36.4   | 1.0    | -60.5 | -13.0 | -47.5 |       |
| 3302.00    | -21.3      | Н         | 3.0      | 36.2   | 1.0    | -56.4 | -13.0 | -43.4 |       |
| Mid Ch, 83 | 6.5        |           |          |        |        |       |       |       |       |
| 1673.00    | -27.1      | V         | 3.0      | 37.0   | 1.0    | -63.1 | -13.0 | -50.1 |       |
| 2509.50    | -23.3      | V         | 3.0      | 36.4   | 1.0    | -58.7 | -13.0 | -45.7 |       |
| 3346.00    | -19.9      | V         | 3.0      | 36.1   | 1.0    | -55.0 | -13.0 | -42.0 |       |
| 1673.00    | -27.0      | Н         | 3.0      | 37.0   | 1.0    | -63.0 | -13.0 | -50.0 |       |
| 2509.50    | -25.0      | Н         | 3.0      | 36.4   | 1.0    | -60.4 | -13.0 | -47.4 |       |
| 3346.00    | -20.9      | Н         | 3.0      | 36.1   | 1.0    | -56.0 | -13.0 | -43.0 |       |
| High Ch, 8 | 47.5       |           |          |        |        |       |       |       |       |
| 1695.00    | -26.9      | V         | 3.0      | 37.0   | 1.0    | -62.9 | -13.0 | -49.9 |       |
| 2542.50    | -23.3      | V         | 3.0      | 36.4   | 1.0    | -58.7 | -13.0 | -45.7 |       |
| 3390.00    | -19.8      | V         | 3.0      | 36.1   | 1.0    | -54.9 | -13.0 | -41.9 |       |
| 1695.00    | -26.9      | Н         | 3.0      | 37.0   | 1.0    | -62.9 | -13.0 | -49.9 |       |
| 2542.50    | -24.8      | Н         | 3.0      | 36.4   | 1.0    | -60.2 | -13.0 | -47.2 |       |
| 3390.00    | -20.9      | Н         | 3.0      | 36.1   | 1.0    | -56.0 | -13.0 | -43.0 |       |
|            |            |           |          |        |        |       |       |       |       |

UL Verfication Services, Inc.

Above 1GHz High Frequency Substitution Measurement

 Company:
 Samsung

 Project #:
 15/20736

 Date:
 5/16/2015

 Test Engineer:
 Charles Vergonio

 Configuration:
 EUT/ AC Charger/ Headset

Location: Chamber B

Mode: LTE\_16QAM Band 5 Harmonics, 1.4MHz Bandwidth

Band LTE5

1.4MHz

16QAM

| f           | SG reading | Ant. Pol. | Distance | Preamp | Filter | EIRP  | Limit | Delta | Notes |
|-------------|------------|-----------|----------|--------|--------|-------|-------|-------|-------|
| MHz         | (dBm)      | (H/V)     | (m)      | (dB)   | (dB)   | (dBm) | (dBm) | (dB)  |       |
| Low Ch, 82  | 4.7        |           |          |        |        |       |       |       |       |
| 1649.40     | -27.5      | V         | 3.0      | 37.0   | 1.0    | -63.5 | -13.0 | -50.5 |       |
| 2474.10     | -22.9      | V         | 3.0      | 36.4   | 1.0    | -58.3 | -13.0 | -45.3 |       |
| 3298.80     | -20.4      | V         | 3.0      | 36.2   | 1.0    | -55.6 | -13.0 | -42.6 |       |
| 1649.40     | -27.1      | Н         | 3.0      | 37.0   | 1.0    | -63.1 | -13.0 | -50.1 |       |
| 2474.10     | -24.5      | Н         | 3.0      | 36.4   | 1.0    | -59.9 | -13.0 | -46.9 |       |
| 3298.80     | -20.2      | Н         | 3.0      | 36.2   | 1.0    | -55.3 | -13.0 | -42.3 |       |
| Mid Ch, 83  | 6.5        |           |          |        |        |       |       |       |       |
| 1673.00     | -27.0      | V         | 3.0      | 37.0   | 1.0    | -63.0 | -13.0 | -50.0 |       |
| 2509.50     | -22.7      | V         | 3.0      | 36.4   | 1.0    | -58.1 | -13.0 | -45.1 |       |
| 3346.00     | -20.4      | V         | 3.0      | 36.1   | 1.0    | -55.5 | -13.0 | -42.5 |       |
| 1673.00     | -27.0      | Н         | 3.0      | 37.0   | 1.0    | -63.0 | -13.0 | -50.0 |       |
| 2509.50     | -24.4      | Н         | 3.0      | 36.4   | 1.0    | -59.8 | -13.0 | -46.8 |       |
| 3346.00     | -20.4      | Н         | 3.0      | 36.1   | 1.0    | -55.5 | -13.0 | -42.5 |       |
| High Ch, 84 | 48.3       |           |          |        |        |       |       |       |       |
| 1696.60     | -26.8      | V         | 3.0      | 37.0   | 1.0    | -62.7 | -13.0 | -49.7 |       |
| 2544.90     | -22.4      | V         | 3.0      | 36.4   | 1.0    | -57.8 | -13.0 | -44.8 |       |
| 3393.20     | -20.4      | V         | 3.0      | 36.1   | 1.0    | -55.4 | -13.0 | -42.4 |       |
| 1696.60     | -26.8      | Н         | 3.0      | 37.0   | 1.0    | -62.8 | -13.0 | -49.8 |       |
| 2544.90     | -24.2      | Н         | 3.0      | 36.4   | 1.0    | -59.6 | -13.0 | -46.6 |       |
| 3393.20     | -20.0      | Н         | 3.0      | 36.1   | 1.0    | -55.1 | -13.0 | -42.1 |       |
|             |            |           |          |        |        |       |       |       |       |

FORM NO: CCSUP4701I

 Company:
 Samsung

 Project #:
 15/20736

 Date:
 5/16/2015

 Test Engineer:
 Charles Vergonio

 Configuration:
 EUT/ AC Charger/ Headset

Location: Chamber B

Mode: LTE\_QPSK Band 5 Harmonics, 1.4MHz Bandwidth

Band LTE5

1.4MHz

QPSK

SG reading Ant. Pol. Distance Preamp Filter FIRP Limit Delta Notes MHz (dBm) (H/V) (dB) (dB) (dBm) (dBm) (dB) (m) Low Ch, 824.7 1649.40 -27.5 V 3.0 37.0 1.0 -63.5 -13.0 -50.5 2474.10 -22.9 V 3.0 36.4 1.0 -58.3 -13.0 -45.3 3298.80 -20.6 V 3.0 36.2 1.0 -55.7 -13.0 -42.7 1649.40 27.4 Н 3.0 37.0 1.0 -63.4 -13.0 -50.4 2474.10 -24.8 3.0 36.4 1.0 -60.3 -13.0 -47.3 3298.80 -20.4 Н 3.0 36.2 1.0 -55.5 -13.0 -42.5 Mid Ch, 836.5 -27.2 1673.00 3.0 37.0 1.0 -63.2 -13.0 -50.2 2509.50 -22.8 V 3.0 36.4 1.0 -58.2 -13.0 45.2 3346.00 -20.5 V 3.0 36.1 1.0 -55.7 -13.0 42.7 1673.00 -27.1 Н 3.0 37.0 1.0 -63.1 -13.0 -50.1 2509.50 -24.6 3.0 36.4 1.0 -60.0 -13.0 -47.0 3346.00 -20.4 3.0 36.1 1.0 -55.5 -13.0 High Ch, 848.3 1696.60 26.9 3.0 37.0 1.0 -62.9 -13.0 -49.9 2544.90 -22.7 3.0 36.4 1.0 -58.1 -13.0 -45.1 3.0 3393.20 V 36.1 -55.6 -42.6 20.5 1.0 -13.0 1696.60 26.9 Н 3.0 37.0 1.0 -62.8 -13.0 49.8 2544.90 -24.2 Н 3.0 36.4 1.0 -59.6 -13.0 -46.6 3393.20 -19.9 Н 3.0 36.1 1.0 -55.0 -13.0 -42.0

# **WCDMA**

### UL Verfication Services, Inc. Above 1GHz High Frequency Substitution Measurement

 Company:
 Samsung

 Project #:
 15/20736

 Date:
 5/16/2015

 Test Engineer:
 Charles Vergonio

 Configuration:
 EUT only

 Location:
 Chamber B

Mode: HSDPA Band 2 Harmonics

Band

Band 2 HSDPA

| f          | SG reading | Ant. Pol. | Distance | Preamp | Filter | EIRP  | Limit | Delta | Notes |
|------------|------------|-----------|----------|--------|--------|-------|-------|-------|-------|
| MHz        | (dBm)      | (H/V)     | (m)      | (dB)   | (dB)   | (dBm) | (dBm) | (dB)  |       |
| Low Ch, 18 | 852.4      |           |          |        |        |       |       |       |       |
| 3704.80    | -13.2      | V         | 3.0      | 35.9   | 1.0    | -48.1 | -13.0 | -35.1 |       |
| 5557.20    | -7.7       | V         | 3.0      | 35.5   | 1.0    | -42.2 | -13.0 | -29.2 |       |
| 7409.60    | -7.2       | V         | 3.0      | 35.7   | 1.0    | -42.0 | -13.0 | -29.0 |       |
| 3704.80    | -12.2      | Н         | 3.0      | 35.9   | 1.0    | -47.1 | -13.0 | -34.1 |       |
| 5557.20    | -7.7       | Н         | 3.0      | 35.5   | 1.0    | -42.1 | -13.0 | -29.1 |       |
| 7409.60    | -7.3       | Н         | 3.0      | 35.7   | 1.0    | -42.1 | -13.0 | -29.1 |       |
| Mid Ch, 18 | 80         |           |          |        |        |       |       |       |       |
| 3760.00    | -13.1      | V         | 3.0      | 35.8   | 1.0    | -47.9 | -13.0 | -34.9 |       |
| 5640.00    | -9.0       | V         | 3.0      | 35.5   | 1.0    | -43.4 | -13.0 | -30.4 |       |
| 7520.00    | -7.2       | V         | 3.0      | 35.7   | 1.0    | -41.9 | -13.0 | -28.9 |       |
| 3760.00    | -12.3      | Н         | 3.0      | 35.8   | 1.0    | -47.1 | -13.0 | -34.1 |       |
| 5640.00    | -7.2       | Н         | 3.0      | 35.5   | 1.0    | -41.6 | -13.0 | -28.6 |       |
| 7520.00    | -7.1       | Н         | 3.0      | 35.7   | 1.0    | -41.8 | -13.0 | -28.8 |       |
| High Ch, 1 | 907.6      |           |          |        |        |       |       |       |       |
| 3815.20    | -12.8      | V         | 3.0      | 35.8   | 1.0    | -47.6 | -13.0 | -34.6 |       |
| 5722.80    | -5.9       | V         | 3.0      | 35.5   | 1.0    | -40.4 | -13.0 | -27.4 |       |
| 7630.40    | -6.7       | V         | 3.0      | 35.8   | 1.0    | -41.4 | -13.0 | -28.4 |       |
| 3815.20    | -11.9      | Н         | 3.0      | 35.8   | 1.0    | -46.7 | -13.0 | -33.7 |       |
| 5722.80    | -6.9       | Н         | 3.0      | 35.5   | 1.0    | -41.4 | -13.0 | -28.4 |       |
| 7630.40    | -6.1       | Н         | 3.0      | 35.8   | 1.0    | -40.9 | -13.0 | -27.9 |       |

Company: Samsung Project #: 15120736 Date: 5/16/2015 Test Engineer: Charles Vergonio Configuration: EUT only Location: Chamber B

Mode: Rel99 Band 2 Harmonics

Band

Band 2

REL99

| ow Ch, 1852.4 1704.80 -1 1557.20 -7 1409.60 -7 1557.20 -7 1409.60 -7 1409.60 -7 1409.60 -7 16640.00 -1 16640.00 -7 1760.00 -1 | 13.2 \\ -7.5 \\ -7.4 \\ -7.3 \\ 12.9 \\ -7.1 \ | 7 3.0<br>7 3.0<br>H 3.0<br>H 3.0                   | 35.9<br>35.5<br>35.7<br>35.9<br>35.5<br>35.7<br>35.8<br>35.8 | 1.0<br>1.0<br>1.0<br>1.0<br>1.0<br>1.0 | 48.0<br>42.0<br>42.2<br>47.4<br>41.9<br>42.0 | -13.0<br>-13.0<br>-13.0<br>-13.0<br>-13.0<br>-13.0<br>-13.0 | 35.0<br>-29.0<br>-29.2<br>-34.4<br>-28.9<br>-29.0 |  |
|---|--|--|--|--|--|---|---|--|
| 704.80 -1 557.20 -7 409.60 -7 704.80 -1 557.20 -7 409.60 -7 lid Ch, 1880 760.00 -1 640.00 -7 760.00 -1 640.00 -7              | 7.5 \\ 7.4 \\ 12.5 \\ 7.4 \\ 12.5 \\ 7.4 \\ 12.7.3 \\ 12.9 \\ 7.1 \\ 1.1 | V 3.0<br>V 3.0<br>H 3.0<br>H 3.0<br>H 3.0<br>V 3.0 | 35.5<br>35.7<br>35.9<br>35.5<br>35.7<br>35.7                 | 1.0<br>1.0<br>1.0<br>1.0<br>1.0        | -42.0<br>-42.2<br>-47.4<br>-41.9<br>-42.0    | -13.0<br>-13.0<br>-13.0<br>-13.0<br>-13.0                   | -29.0<br>-29.2<br>-34.4<br>-28.9<br>-29.0         |  |
| 557.20 -7 409.60 -7 704.80 -1 557.20 -7 409.60 -7 flid Ch, 1880 760.00 -1 640.00 -7 760.00 -1                                 | 7.5 \\ 7.4 \\ 12.5 \\ 7.4 \\ 12.5 \\ 7.4 \\ 12.7.3 \\ 12.9 \\ 7.1 \\ 1.1 | V 3.0<br>V 3.0<br>H 3.0<br>H 3.0<br>H 3.0<br>V 3.0 | 35.5<br>35.7<br>35.9<br>35.5<br>35.7<br>35.7                 | 1.0<br>1.0<br>1.0<br>1.0<br>1.0        | -42.0<br>-42.2<br>-47.4<br>-41.9<br>-42.0    | -13.0<br>-13.0<br>-13.0<br>-13.0<br>-13.0                   | -29.0<br>-29.2<br>-34.4<br>-28.9<br>-29.0         |  |
| 7409.60 -7 3704.80 -1 5557.20 -7 7409.60 -7 Mid Ch, 1880 3760.00 -1 5640.00 -7 57520.00 -7 3760.00 -1                         | 7.4 \ \\ 12.5 \ \ \  -7.4 \ \\ -7.3 \ \ \  \\ 12.9 \ \\ -7.1 \ \\ \\   | V 3.0<br>H 3.0<br>H 3.0<br>H 3.0<br>V 3.0          | 35.7<br>35.9<br>35.5<br>35.7<br>35.8                         | 1.0<br>1.0<br>1.0<br>1.0               | -42.2<br>-47.4<br>-41.9<br>-42.0             | -13.0<br>-13.0<br>-13.0<br>-13.0                            | -29.2<br>-34.4<br>-28.9<br>-29.0                  |  |
| 3704.80 -1<br>5557.20 -7<br>7409.60 -7<br>Mid Ch, 1880 -7<br>3760.00 -1<br>5640.00 -7<br>7520.00 -7<br>3760.00 -1             | 12.5   1.7.4   1.7.3   1.7.3   1.7.3   1.7.1   | 1 3.0<br>1 3.0<br>1 3.0<br>1 3.0<br>1 3.0          | 35.9<br>35.5<br>35.7<br>35.8                                 | 1.0<br>1.0<br>1.0                      | -47.4<br>-41.9<br>-42.0                      | -13.0<br>-13.0<br>-13.0                                     | -34.4<br>-28.9<br>-29.0                           |  |
| 5557.20 -7<br>7409.60 -7<br>Wid Ch, 1880<br>3760.00 -1<br>56640.00 -7<br>3760.00 -1<br>5640.00 -1                             | 7.4    -<br>-7.3    -<br>12.9   \<br>-7.1   \  | 1 3.0<br>1 3.0<br>V 3.0                            | 35.5<br>35.7<br>35.8   | 1.0<br>1.0                             | -41.9<br>-42.0                               | -13.0<br>-13.0  | -28.9<br>-29.0                                    |  |
| 7409.60 -7 Mid Ch, 1880 3760.00 -1 5640.00 -7 7520.00 -7 3760.00 -1 5640.00 -7  | -7.3 h<br>12.9 \<br>-7.1 \   | d 3.0<br>/ 3.0                                     | 35.7<br>35.8   | 1.0<br>1.0                             | -42.0  | -13.0   | -29.0   |  |
| Mid Ch, 1880 3760.00 -1 5640.00 -7 7520.00 -7 3760.00 -1 5640.00 -7   | 12.9 \<br>-7.1 \   | / 3.0  | 35.8   | 1.0                                    |  |   |   |  |
| 3760.00 -1<br>5640.00 -7<br>7520.00 -7<br>3760.00 -1<br>5640.00 -7  | -7.1 \   |  |  |  | 47.9   |   |   |  |
| 5640.00 -7<br>7520.00 -7<br>3760.00 -1<br>5640.00 -7  | -7.1 \   |  |  |  | 47 Q   |   |   |  |
| 7520.00 -7<br>3760.00 -1<br>5640.00 -7  |  | / 3.0  | 35.5   |  | -47.0  | -13.0   | -34.8   |  |
| 3760.00 -1<br>5640.00 -7  | 7.2  |  | 33.3   | 1.0                                    | -41.6  | -13.0   | -28.6   |  |
| 5640.00 -7  | -1.3   | / 3.0  | 35.7   | 1.0                                    | -42.1  | -13.0   | -29.1   |  |
|   | 12.4 H   | H 3.0  | 35.8   | 1.0                                    | -47.2  | -13.0   | -34.2   |  |
| 7500 00   | -7.3 H   | H 3.0  | 35.5   | 1.0                                    | -41.8  | -13.0   | -28.8   |  |
| 7520.00 -8  | -8.1 H   | H 3.0  | 35.7   | 1.0                                    | -42.9  | -13.0   | -29.9   |  |
| High Ch, 1907.6   |  |  |  |  |  |   |   |  |
| 3815.20 -1  | 13.2   | / 3.0  | 35.8   | 1.0                                    | -48.0  | -13.0   | -35.0   |  |
| 5722.80 -6  | -6.9 \   | / 3.0  | 35.5   | 1.0                                    | -41.4  | -13.0   | -28.4   |  |
| 7630.40 -7  | -7.1 \   | / 3.0  | 35.8   | 1.0                                    | -41.9  | -13.0   | -28.9   |  |
| 3815.20 -1  | 12.1 H   | H 3.0  | 35.8   | 1.0                                    | -46.9  | -13.0   | -33.9   |  |
| 5722.80 -7  | -7.3 H   | d 3.0  | 35.5   | 1.0                                    | -41.8  | -13.0   | -28.8   |  |
| 7630.40 -7  | -7.1 H   | 1 3.0  | 35.8   | 1.0                                    | -41.8  | -13.0   | -28.8   |  |

# UL Verfication Services, Inc.

#### Above 1GHz High Frequency Substitution Measurement

 Company:
 Samsung

 Project #:
 15/20736

 Date:
 5/16/2015

 Test Engineer:
 Charles Vergonio

Configuration: Z-pos EUT w/ AC Adapter + Headset

Location: Chamber B

Mode: HSDPA Band 5 Harmonics

Band

Band 5

**HSDPA** 

| f          | SG reading | Ant. Pol. | Distance | Preamp | Filter | EIRP  | Limit | Delta | Notes |
|------------|------------|-----------|----------|--------|--------|-------|-------|-------|-------|
| MHz        | (dBm)      | (H/V)     | (m)      | (dB)   | (dB)   | (dBm) | (dBm) | (dB)  |       |
| Low Ch, 8  | 26.4       |           |          |        |        |       |       |       |       |
| 1652.80    | -27.3      | V         | 3.0      | 37.0   | 1.0    | -63.3 | -13.0 | -50.3 |       |
| 2479.20    | -21.9      | V         | 3.0      | 36.4   | 1.0    | -57.3 | -13.0 | -44.3 |       |
| 3305.60    | -21.1      | V         | 3.0      | 36.1   | 1.0    | -56.2 | -13.0 | -43.2 |       |
| 1652.80    | -27.3      | Н         | 3.0      | 37.0   | 1.0    | -63.3 | -13.0 | -50.3 |       |
| 2479.20    | -24.7      | Н         | 3.0      | 36.4   | 1.0    | -60.2 | -13.0 | -47.2 |       |
| 3305.60    | -21.7      | Н         | 3.0      | 36.1   | 1.0    | -56.8 | -13.0 | -43.8 |       |
| Mid Ch, 83 | 6.6        |           |          |        |        |       |       |       |       |
| 1673.20    | -27.0      | V         | 3.0      | 37.0   | 1.0    | -63.0 | -13.0 | -50.0 |       |
| 2509.80    | -21.5      | V         | 3.0      | 36.4   | 1.0    | -56.9 | -13.0 | -43.9 |       |
| 3346.40    | -20.9      | V         | 3.0      | 36.1   | 1.0    | -56.0 | -13.0 | -43.0 |       |
| 1673.20    | -27.2      | Н         | 3.0      | 37.0   | 1.0    | -63.2 | -13.0 | -50.2 |       |
| 2509.80    | -25.0      | Н         | 3.0      | 36.4   | 1.0    | -60.4 | -13.0 | -47.4 |       |
| 3346.40    | -21.1      | Н         | 3.0      | 36.1   | 1.0    | -56.2 | -13.0 | -43.2 |       |
| High Ch, 8 | 46.6       |           |          |        |        |       |       |       |       |
| 1693.20    | -27.0      | V         | 3.0      | 37.0   | 1.0    | -62.9 | -13.0 | -49.9 |       |
| 2539.80    | -21.4      | V         | 3.0      | 36.4   | 1.0    | -56.8 | -13.0 | -43.8 |       |
| 3386.40    | -20.9      | V         | 3.0      | 36.1   | 1.0    | -56.0 | -13.0 | -43.0 |       |
| 1693.20    | -26.9      | Н         | 3.0      | 37.0   | 1.0    | -62.9 | -13.0 | -49.9 |       |
| 2539.80    | -24.8      | Н         | 3.0      | 36.4   | 1.0    | -60.2 | -13.0 | -47.2 |       |
| 3386.40    | -20.9      | Н         | 3.0      | 36.1   | 1.0    | -55.9 | -13.0 | -42.9 |       |
|            |            |           |          |        |        |       |       |       |       |

FORM NO: CCSUP4701I

 Company:
 Samsung

 Project #:
 15/20736

 Date:
 5/16/2015

 Test Engineer:
 Charles Vergonio

Configuration: Z-pos EUT w/ AC Adapter + Headset

Location: Chamber B

Mode: Rel99 Band 5 Harmonics

Band

Band 5

REL99

| t<br>MHz    | SG reading<br>(dBm) | Ant. Pol.<br>(H/V) | Distance<br>(m) | Preamp<br>(dB) | Filter<br>(dB) | EIRP<br>(dBm) | Limit<br>(dBm) | Delta<br>(dB) | Notes |
|-------------|---------------------|--------------------|-----------------|----------------|----------------|---------------|----------------|---------------|-------|
| Low Ch, 82  | <u> </u>            | (                  |                 |                | 11             | (             | \              | 1/            |       |
| 1652.80     | -27.2               | V                  | 3.0             | 37.0           | 1.0            | -63.3         | -13.0          | -50.3         |       |
| 2479.20     | -21.7               | V                  | 3.0             | 36.4           | 1.0            | -57.2         | -13.0          | -44.2         |       |
| 3305.60     | -21.0               | V                  | 3.0             | 36.1           | 1.0            | -56.1         | -13.0          | -43.1         |       |
| 1652.80     | -27.3               | Н                  | 3.0             | 37.0           | 1.0            | -63.3         | -13.0          | -50.3         |       |
| 2479.20     | -24.9               | Н                  | 3.0             | 36.4           | 1.0            | -60.4         | -13.0          | -47.4         |       |
| 3305.60     | -21.7               | Н                  | 3.0             | 36.1           | 1.0            | -56.8         | -13.0          | -43.8         |       |
| Mid Ch, 83  | 5.6                 |                    |                 |                |                |               |                |               |       |
| 1673.20     | -26.9               | V                  | 3.0             | 37.0           | 1.0            | -62.9         | -13.0          | -49.9         |       |
| 2509.80     | -21.5               | V                  | 3.0             | 36.4           | 1.0            | -56.9         | -13.0          | -43.9         |       |
| 3346.40     | -20.8               | V                  | 3.0             | 36.1           | 1.0            | -55.9         | -13.0          | -42.9         |       |
| 1673.20     | -27.1               | Н                  | 3.0             | 37.0           | 1.0            | -63 <b>.1</b> | -13.0          | -50.1         |       |
| 2509.80     | -24.9               | Н                  | 3.0             | 36.4           | 1.0            | -60.3         | -13.0          | -47.3         |       |
| 3346.40     | -20.9               | Н                  | 3.0             | 36.1           | 1.0            | -56.1         | -13.0          | -43.1         |       |
| High Ch, 84 | 16.6                |                    |                 |                |                |               |                |               |       |
| 1693.20     | -27.1               | V                  | 3.0             | 37.0           | 1.0            | -63.1         | -13.0          | -50.1         |       |
| 2539.80     | -21.4               | V                  | 3.0             | 36.4           | 1.0            | -56.8         | -13.0          | -43.8         |       |
| 3386.40     | -20.8               | V                  | 3.0             | 36.1           | 1.0            | -55.9         | -13.0          | -42.9         |       |
| 1693.20     | -26.9               | Н                  | 3.0             | 37.0           | 1.0            | -62.9         | -13.0          | -49.9         |       |
| 2539.80     | -24.7               | Н                  | 3.0             | 36.4           | 1.0            | -60.1         | -13.0          | -47.1         |       |
| 3386.40     | -20.8               | Н                  | 3.0             | 36.1           | 1.0            | -55.9         | -13.0          | -42.9         |       |

# **GSM**

### UL Verfication Services, Inc. Above 1GHz High Frequency Substitution Measurement

 Company:
 Samsung

 Project #:
 15/20736

 Date:
 5/16/2015

 Test Engineer:
 Charles Vergonio

 Configuration:
 EUT only

 Location:
 Chamber B

Mode: EGPRS 1900 MHz Harmonics

Band GSM 1900

EGPRS

| f<br>MHz   | SG reading<br>(dBm) | Ant. Pol.<br>(H/V) | Distance<br>(m) | Preamp<br>(dB) | Filter<br>(dB) | EIRP<br>(dBm) | Limit<br>(dBm) | Delta<br>(dB) | Notes |
|------------|---------------------|--------------------|-----------------|----------------|----------------|---------------|----------------|---------------|-------|
| Low Ch, 18 | · \ / ·             | (11/0)             | (,              | (ub)           | (ub)           | (ubiii)       | (ubiii)        | (ub)          |       |
| 3700.40    | -10.6               | V                  | 3.0             | 35.9           | 1.0            | -45.4         | -13.0          | -32.4         |       |
| 5550.60    | -5.7                | V                  | 3.0             | 35.5           | 1.0            | -40.2         | -13.0          | -27.2         |       |
| 7400.80    | -8.4                | V                  | 3.0             | 35.7           | 1.0            | -43.1         | -13.0          | -30.1         |       |
| 3700.40    | -10.4               | Н                  | 3.0             | 35.9           | 1.0            | -45.2         | -13.0          | -32.2         |       |
| 5550.60    | -5.4                | Н                  | 3.0             | 35.5           | 1.0            | -39.9         | -13.0          | -26.9         |       |
| 7400.80    | -6.0                | Н                  | 3.0             | 35.7           | 1.0            | -40.7         | -13.0          | -27.7         |       |
| Mid Ch, 18 | 80                  |                    |                 |                |                |               |                |               |       |
| 3760.00    | -10.4               | V                  | 3.0             | 35.8           | 1.0            | -45.2         | -13.0          | -32.2         |       |
| 5640.00    | -5.9                | V                  | 3.0             | 35.5           | 1.0            | -40.4         | -13.0          | -27.4         |       |
| 7520.00    | -4.2                | V                  | 3.0             | 35.7           | 1.0            | -39.0         | -13.0          | -26.0         |       |
| 3760.00    | -11.5               | Н                  | 3.0             | 35.8           | 1.0            | -46.3         | -13.0          | -33.3         |       |
| 5640.00    | -5.5                | Н                  | 3.0             | 35.5           | 1.0            | -40.0         | -13.0          | -27.0         |       |
| 7520.00    | -2.8                | Н                  | 3.0             | 35.7           | 1.0            | -37.5         | -13.0          | -24.5         |       |
| High Ch, 1 | 909.8               |                    |                 |                |                |               |                |               |       |
| 3819.60    | -10.2               | V                  | 3.0             | 35.8           | 1.0            | -45.0         | -13.0          | -32.0         |       |
| 5729.40    | -5.8                | V                  | 3.0             | 35.5           | 1.0            | -40.3         | -13.0          | -27.3         |       |
| 7639.20    | -6.8                | V                  | 3.0             | 35.8           | 1.0            | -41.6         | -13.0          | -28.6         |       |
| 3819.60    | -10.3               | Н                  | 3.0             | 35.8           | 1.0            | -45.0         | -13.0          | -32.0         |       |
| 5729.40    | -5.0                | Н                  | 3.0             | 35.5           | 1.0            | -39.5         | -13.0          | -26.5         |       |
| 7639.20    | -4.2                | Н                  | 3.0             | 35.8           | 1.0            | -39.0         | -13.0          | -26.0         |       |
|            |                     |                    |                 |                |                |               |                |               |       |

UL Verfication Services, Inc.

Above 1GHz High Frequency Substitution Measurement

 Company:
 Samsung

 Project #:
 15/20736

 Date:
 5/16/2015

 Test Engineer:
 Charles Vergonio

 Configuration:
 EUT only

 Location:
 Chamber B

Mode: GPRS 1900 MHz Harmonics

GSM 1900

**GPRS** 

| f           | SG reading | Ant. Pol. | Distance | Preamp | Filter | EIRP  | Limit | Delta | Notes |
|-------------|------------|-----------|----------|--------|--------|-------|-------|-------|-------|
| MHz         | (dBm)      | (H/V)     | (m)      | (dB)   | (dB)   | (dBm) | (dBm) | (dB)  |       |
| Low Ch, 18  | 350.2      |           |          |        |        |       |       |       |       |
| 3700.40     | -10.1      | V         | 3.0      | 35.9   | 1.0    | -45.0 | -13.0 | -32.0 |       |
| 5550.60     | -5.6       | V         | 3.0      | 35.5   | 1.0    | -40.1 | -13.0 | -27.1 |       |
| 7400.80     | -6.9       | V         | 3.0      | 35.7   | 1.0    | -41.7 | -13.0 | -28.7 |       |
| 3700.40     | -10.9      | Н         | 3.0      | 35.9   | 1.0    | -45.8 | -13.0 | -32.8 |       |
| 5550.60     | -5.3       | Н         | 3.0      | 35.5   | 1.0    | -39.8 | -13.0 | -26.8 |       |
| 7400.80     | -6.7       | Н         | 3.0      | 35.7   | 1.0    | -41.4 | -13.0 | -28.4 |       |
| Mid Ch, 18  | 80         |           |          |        |        |       |       |       |       |
| 3760.00     | -9.9       | V         | 3.0      | 35.8   | 1.0    | -44.7 | -13.0 | -31.7 |       |
| 5640.00     | -5.6       | V         | 3.0      | 35.5   | 1.0    | -40.1 | -13.0 | -27.1 |       |
| 7520.00     | -7.1       | V         | 3.0      | 35.7   | 1.0    | -41.8 | -13.0 | -28.8 |       |
| 3760.00     | -10.8      | Н         | 3.0      | 35.8   | 1.0    | -45.6 | -13.0 | -32.6 |       |
| 5640.00     | -5.0       | Н         | 3.0      | 35.5   | 1.0    | -39.5 | -13.0 | -26.5 |       |
| 7520.00     | -6.6       | Н         | 3.0      | 35.7   | 1.0    | -41.3 | -13.0 | -28.3 |       |
| High Ch, 19 | 909.8      |           |          |        |        |       |       |       |       |
| 3819.60     | -9.8       | V         | 3.0      | 35.8   | 1.0    | -44.5 | -13.0 | -31.5 |       |
| 5729.40     | -5.5       | V         | 3.0      | 35.5   | 1.0    | -40.0 | -13.0 | -27.0 |       |
| 7639.20     | -6.7       | V         | 3.0      | 35.8   | 1.0    | -41.5 | -13.0 | -28.5 |       |
| 3819.60     | -10.6      | Н         | 3.0      | 35.8   | 1.0    | -45.3 | -13.0 | -32.3 |       |
| 5729.40     | -5.4       | Н         | 3.0      | 35.5   | 1.0    | -39.9 | -13.0 | -26.9 |       |
| 7639.20     | -5.6       | Н         | 3.0      | 35.8   | 1.0    | -40.3 | -13.0 | -27.3 |       |

 Company:
 Samsung

 Project #:
 15/20736

 Date:
 5/16/2015

 Test Engineer:
 Charles Vergonio

Configuration: Z-pos EUT w/ AC Adapter + Headset

Location: Chamber B

Mode: EGPRS 850 MHz Harmonics

GSM 850

**EGPRS** 

| f          | SG reading | Ant. Pol. | Distance | Preamp | Filter | EIRP  | Limit | Delta | Notes |
|------------|------------|-----------|----------|--------|--------|-------|-------|-------|-------|
| MHz        | (dBm)      | (H/V)     | (m)      | (dB)   | (dB)   | (dBm) | (dBm) | (dB)  |       |
| Low Ch, 82 | 24.2       |           |          |        |        |       |       |       |       |
| 1648.40    | -24.0      | V         | 3.0      | 37.0   | 1.0    | -60.0 | -13.0 | -47.0 |       |
| 2472.60    | -18.8      | V         | 3.0      | 36.4   | 1.0    | -54.3 | -13.0 | -41.3 |       |
| 3296.80    | -17.2      | V         | 3.0      | 36.2   | 1.0    | -52.4 | -13.0 | -39.4 |       |
| 1648.40    | -24.0      | Н         | 3.0      | 37.0   | 1.0    | -60.1 | -13.0 | -47.1 |       |
| 2472.60    | -20.5      | Н         | 3.0      | 36.4   | 1.0    | -55.9 | -13.0 | -42.9 |       |
| 3296.80    | -17.0      | Н         | 3.0      | 36.2   | 1.0    | -52.1 | -13.0 | -39.1 |       |
| Mid Ch, 83 | 6.6        |           |          |        |        |       |       | i     |       |
| 1673.20    | -23.6      | V         | 3.0      | 37.0   | 1.0    | -59.6 | -13.0 | -46.6 |       |
| 2509.80    | -18.6      | V         | 3.0      | 36.4   | 1.0    | -54.0 | -13.0 | -41.0 |       |
| 3346.40    | -17.3      | V         | 3.0      | 36.1   | 1.0    | -52.4 | -13.0 | -39.4 |       |
| 1673.20    | -23.7      | Н         | 3.0      | 37.0   | 1.0    | -59.7 | -13.0 | -46.7 |       |
| 2509.80    | -20.3      | Н         | 3.0      | 36.4   | 1.0    | -55.8 | -13.0 | -42.8 |       |
| 3346.40    | -16.9      | Н         | 3.0      | 36.1   | 1.0    | -52.0 | -13.0 | -39.0 |       |
| High Ch, 8 | 48.8       |           |          |        |        |       |       |       |       |
| 1697.60    | -23.3      | V         | 3.0      | 37.0   | 1.0    | -59.3 | -13.0 | -46.3 |       |
| 2546.40    | -18.5      | V         | 3.0      | 36.4   | 1.0    | -53.9 | -13.0 | -40.9 |       |
| 3395.20    | -17.0      | V         | 3.0      | 36.1   | 1.0    | -52.1 | -13.0 | -39.1 |       |
| 1697.60    | -23.3      | Н         | 3.0      | 37.0   | 1.0    | -59.3 | -13.0 | -46.3 |       |
| 2546.40    | -20.1      | Н         | 3.0      | 36.4   | 1.0    | -55.5 | -13.0 | -42.5 |       |
| 3395.20    | -16.6      | Н         | 3.0      | 36.1   | 1.0    | -51.7 | -13.0 | -38.7 |       |

 Company:
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 Project #:
 15/20736

 Date:
 5/16/2015

 Test Engineer:
 Charles Vergonio

Configuration: Z-pos EUT w/ AC Adapter + Headset

Location: Chamber B

Mode: GPRS 850 MHz Harmonics

GSM 850

**GPRS** 

| f           | SG reading | Ant. Pol. | Distance | Preamp | Filter | EIRP  | Limit | Delta | Notes                                   |
|-------------|------------|-----------|----------|--------|--------|-------|-------|-------|---|
| MHz         | (dBm)      | (H/V)     | (m)      | (dB)   | (dB)   | (dBm) | (dBm) | (dB)  |   |
| Low Ch, 82  | 4.2        |           |          |        | 1      |       |       |       |   |
| 1648.40     | -23.1      | V         | 3.0      | 37.0   | 1.0    | -59.1 | -13.0 | -46.1 |   |
| 2472.60     | -18.0      | V         | 3.0      | 36.4   | 1.0    | -53.4 | -13.0 | -40.4 |   |
| 3296.80     | -16.9      | V         | 3.0      | 36.2   | 1.0    | -52.0 | -13.0 | -39.0 |   |
| 1648.40     | -24.0      | Н         | 3.0      | 37.0   | 1.0    | -60.1 | -13.0 | -47.1 |   |
| 2472.60     | -19.7      | Н         | 3.0      | 36.4   | 1.0    | -55.1 | -13.0 | -42.1 |   |
| 3296.80     | -15.8      | Н         | 3.0      | 36.2   | 1.0    | -51.0 | -13.0 | -38.0 |   |
| Mid Ch, 836 | 6.6        | ĺ         |          | į į    | ·      |       | 1     |       |   |
| 1673.20     | -23.0      | V         | 3.0      | 37.0   | 1.0    | -59.0 | -13.0 | -46.0 |   |
| 2509.80     | -17.9      | V         | 3.0      | 36.4   | 1.0    | -53.3 | -13.0 | -40.3 |   |
| 3346.40     | -16.9      | V         | 3.0      | 36.1   | 1.0    | -52.0 | -13.0 | -39.0 |   |
| 1673.20     | -23.8      | Н         | 3.0      | 37.0   | 1.0    | -59.8 | -13.0 | -46.8 |   |
| 2509.80     | -19.8      | Н         | 3.0      | 36.4   | 1.0    | -55.2 | -13.0 | -42.2 |   |
| 3346.40     | -15.9      | Н         | 3.0      | 36.1   | 1.0    | -51.0 | -13.0 | -38.0 |   |
| High Ch, 84 | 48.8       | ĺ         |          |        | i      |       |       |       |   |
| 1697.60     | -22.7      | V         | 3.0      | 37.0   | 1.0    | -58.7 | -13.0 | -45.7 |   |
| 2546.40     | -17.6      | V         | 3.0      | 36.4   | 1.0    | -53.0 | -13.0 | -40.0 |   |
| 3395.20     | -16.3      | V         | 3.0      | 36.1   | 1.0    | -51.4 | -13.0 | -38.4 |   |
| 1697.60     | -23.2      | Н         | 3.0      | 37.0   | 1.0    | -59.1 | -13.0 | -46.1 | ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, |
| 2546.40     | -19.3      | Н         | 3.0      | 36.4   | 1.0    | -54.7 | -13.0 | -41.7 |   |
| 3395.20     | -15.7      | Н         | 3.0      | 36.1   | 1.0    | -50.8 | -13.0 | -37.8 |   |