



# PCTEST ENGINEERING LABORATORY, INC.

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## MEASUREMENT REPORT FCC Part 90

**Applicant:**  
Samsung Electronics Co., Ltd.  
129, Samsung-ro,  
Yeongtong-gu, Suwon-si  
Gyeonggi-do, 16677, Korea


**Date of Testing:**  
1/18 - 2/15/2016  
**Test Site/Location:**  
PCTEST Lab., Columbia, MD, USA  
**Test Report Serial No.:**  
0Y1602290415.A3L

<b>FCC ID:</b>	<b>A3LSMG930US</b>
<b>APPLICANT:</b>	<b>SAMSUNG ELECTRONICS CO., LTD.</b>



**Applicant Type:** Class II Permissive Change  
**FCC Classification:** PCS Licensed Transmitter Held to Ear (PCE)  
**FCC Rule Part:** §90.691  
**Test Procedure(s):** ANSI/TIA-603-D:2010, KDB 971168 D01 v02r02  
**EUT Type:** Portable Handset  
**Model(s):** SM-G930V, SM-G930A, SM-G930P, SM-G930T, SM-G930R4  
**Test Device Serial No.:** *identical prototype* [S/N: 14389]  
**Class II Permissive Change:** Adding Wireless Charging Battery Pack Accessory  
**Original Grant Date:** 2/3/2016

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in §2.947. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

  
 Randy Ortanez  
 President





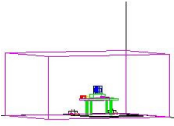
<b>FCC ID:</b> A3LSMG930US		<b>Part 90 CDMA / EvDO / LTE MEASUREMENT REPORT CLASS II PERMISSIVE Change</b>		<b>Reviewed by:</b> Quality Manager
<b>Test Report S/N:</b> 0Y1602290415.A3L	<b>Test Dates:</b> 1/18 - 2/15/2016	<b>EUT Type:</b> Portable Handset	Page 1 of 15	

# T A B L E O F C O N T E N T S

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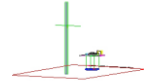
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# MEASUREMENT REPORT

## FCC Part 90 LTE Band 26 and BC10 CDMA

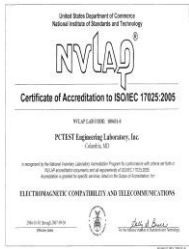
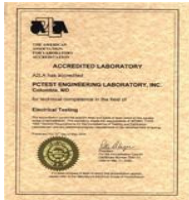


### §2.1033 General Information



**APPLICANT:** Samsung Electronics Co., Ltd.  
**APPLICANT ADDRESS:** 129, Samsung-ro,  
 Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea  
**TEST SITE:** PCTEST ENGINEERING LABORATORY, INC.  
**TEST SITE ADDRESS:** 7185 Oakland Mills Road, Columbia, MD 21045 USA  
**BASE MODEL:** SM-G930V, SM-G930A, SM-G930P, SM-G930T, SM-G930R4  
**FCC CLASSIFICATION:** PCS Licensed Transmitter Held to Ear (PCE)  
**MODE:** CDMA / EvDO / LTE  
**FREQUENCY TOLERANCE:** ±0.00025 % (2.5 ppm)  
**Test Device Serial No.:** 14389       Production     Pre-Production     Engineering  
**DATE(S) OF TEST:** 1/18 - 2/15/2016  
**TEST REPORT S/N:** 0Y1602290415.A3L

### Test Facility / Accreditations

Measurements were performed at PCTEST Engineering Lab. located in Columbia, MD 21046, U.S.A.



- PCTEST facility is an FCC registered (PCTEST Reg. No. 159966) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules.
- PCTEST Lab is accredited to ISO 17025 by U.S. National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP Lab code: 100431-0) in EMC, FCC and Telecommunications.
- PCTEST Lab is accredited to ISO 17025-2005 by the American Association for Laboratory Accreditation (A2LA) in Specific Absorption Rate (SAR) testing, Hearing Aid Compatibility (HAC) testing, CTIA Test Plans, and wireless testing for FCC.
- PCTEST Lab is a recognized U.S. Conformity Assessment Body (CAB) in EMC and R&TTE (n.b. 0982) under the U.S.-EU Mutual Recognition Agreement (MRA).
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC Guide 65 by the American National Standards Institute (ANSI) in all scopes of FCC Rules.
- PCTEST is a CTIA Authorized Test Laboratory (CATL) for AMPS, CDMA, and EvDO wireless devices and for Over-the-Air (OTA) Antenna Performance testing for AMPS, CDMA, GSM, GPRS, EGPRS, UMTS (W-CDMA), CDMA 1xEVDO, and CDMA 1xRTT.

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# 1.0 INTRODUCTION

## 1.1 Scope

Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Industry Canada Certification and Engineering Bureau.

## 1.2 Testing Facility

The map below shows the location of the PCTEST LABORATORY, its proximity to the FCC Laboratory, the Columbia vicinity, the Baltimore-Washington Intern't'l (BWI) airport, the city of Baltimore and the Washington, DC area. (See Figure 1-1).

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility located at 7185 Oakland Mills Road, Columbia, MD 21046. The site coordinates are 39° 10'23" N latitude and 76° 49'50" W longitude. The facility is 0.4 miles North of the FCC laboratory, and the ambient signal and ambient signal strength are approximately equal to those of the FCC laboratory. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4-2014 on January 22, 2015.

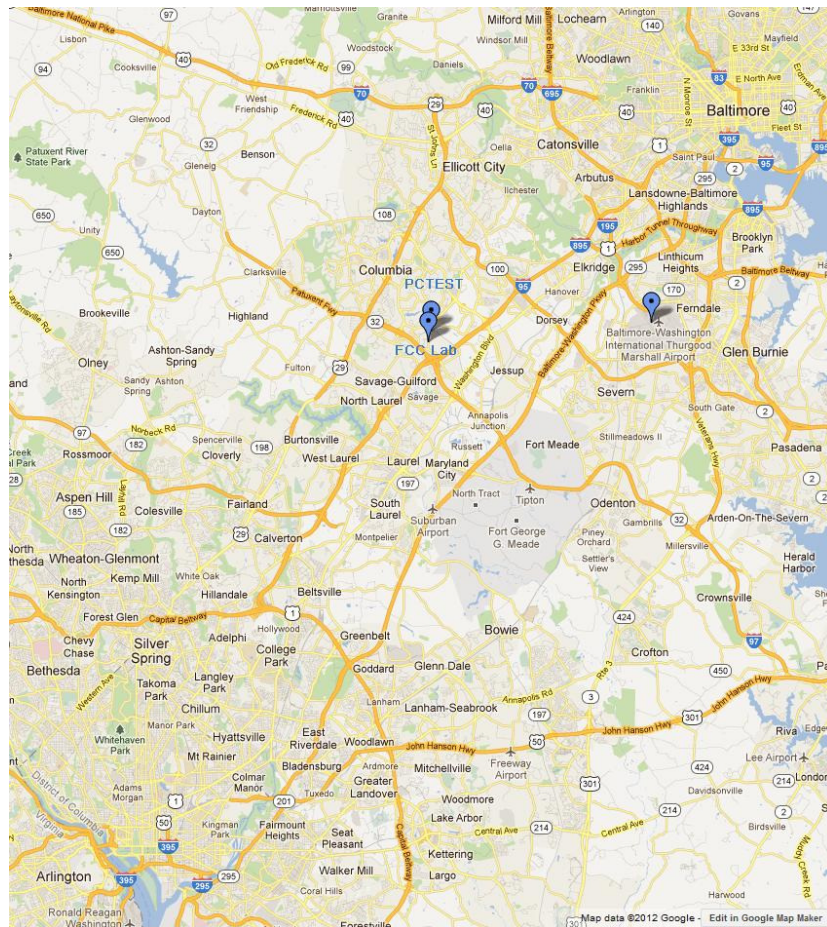




Figure 1-1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area

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## 2.0 PRODUCT INFORMATION

### 2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung Portable Handset FCC ID: A3LSMG930US**. The test data contained in this report pertains only to the emissions due to the EUT's licensed transmitters that operate under the provisions of Part 90.691.

This device uses a closed-loop tuner circuit that dynamically updates the antenna impedance parameters to optimize antenna performance. The tuner for this device was set to simulate a "free space" condition in which the transmit antenna is matched to the medium into which it is transmitting and, thus, all power is at its maximum level.

This device also employs an antenna switching diversity (ASDiv) mechanism that allows for radiated transmission from one of two antennas at a time for BC10 CDMA/ EvDO and LTE Band 26. Both antennas cannot transmit simultaneously so dual transmission conditions were not investigated. The two antennas share the same conducted circuitry so only one set of conducted measurements is included. The main transmit antenna data is labeled as "Antenna A" and the secondary transmit antenna data is labeled as "Antenna B" in the radiated section of this report.

### 2.2 Device Capabilities

This device contains the following capabilities:

850/1900 CDMA/EvDO Rev0/A (BC0, BC1, BC10), 850/1900 GSM/GPRS/EDGE, 850/1700/1900 WCDMA/HSPA, Multi-band LTE, 802.11b/g/n WLAN, 802.11a/n/ac UNII, Bluetooth (1x, EDR, LE), NFC, ANT+



### 2.3 Test Configuration

The Samsung Portable Handset FCC ID: A3LSMG930US was tested per the guidance of ANSI/TIA-603-D:2010 and KDB 971168 D01 v02r02. See Section 7.0 of this test report for a description of the radiated emissions tests.

This device supports wireless charging capability and, thus, is subject to the test requirements of KDB 648474 D03 v01r04. Additional radiated spurious emission measurements were performed with a wireless charging battery pack accessory (WCBP) while operating under normal conditions in a simulated call or data transmission configuration. The worst case radiated emissions data is shown in this report.

### 2.4 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and no modifications were made during testing.

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## 3.0 DESCRIPTION OF TESTS

### 3.1 Evaluation Procedure

The measurement procedures described in the document titled “Land Mobile FM or PM – Communications Equipment – Measurements and Performance Standards” (ANSI/TIA-603-D:2010) and “Procedures for Compliance Measurement of the Fundamental Emission Power of Licensed Wideband (> 1 MHz) Digital Transmission Systems” (KDB 971168 D01 v02r02) were used in the measurement of the **Samsung Portable Handset FCC ID: A3LSMG930US**.

### 3.2 Radiated Power and Radiated Spurious Emissions

\$2.1053, \$90.635, \$90.691

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Figure 5.7 of Clause 5 in ANSI C63.4-2014. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements, a 72.4cm high PVC support structure is placed on top of the turntable. A 3” (~7.6cm) sheet of high density polystyrene is used as the table top and is placed on top of the PVC supports to bring the total height of the table to 80cm.

The equipment under test was transmitting while connected to its integral antenna and is placed on a wooden turntable 80cm above the ground plane and 3 meters from the receive antenna. The receive antenna height is adjusted between 1 and 4 meter height, the turntable is rotated through 360 degrees, and the EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest reading on the receive spectrum analyzer. Radiated power levels are also investigated with the receive antenna horizontally and vertically polarized. The maximized power level is recorded using the spectrum analyzer “Channel Power” function with the integration band set to the emissions’ occupied bandwidth, a RMS detector, RBW = 100kHz, VBW = 300kHz, and a 1 second sweep time over a minimum of 10 sweeps, per the guidelines of KDB 971168 D01 v02r02.



Per the guidance of ANSI/TIA-603-D:2010, a half-wave dipole is then substituted in place of the EUT. For emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator with the level of the signal generator being adjusted to obtain the same receive spectrum analyzer level previously recorded from the spurious emission from the EUT. The power of the emission is calculated using the following formula:

$$P_d \text{ [dBm]} = P_g \text{ [dBm]} - \text{cable loss} \text{ [dB]} + \text{antenna gain} \text{ [dBd/dBi]}$$

Where,  $P_d$  is the dipole equivalent power,  $P_g$  is the generator output into the substitution antenna, and the antenna gain is the gain of the substitute antenna used relative to either a half-wave dipole (dBd) or an isotropic source (dBi). The substitute level is equal to  $P_g \text{ [dBm]} - \text{cable loss} \text{ [dB]}$ .

The calculated  $P_d$  levels are then compared to the absolute spurious emission limit of -13dBm which is equivalent to the required minimum attenuation of  $43 + 10\log_{10}(\text{Power} \text{ [Watts]})$  specified in 90.691.



For fundamental radiated power measurements, the guidance of KDB 971168 D01 v02r02 is used to record the EUT power level that is subsequently matched via the aforementioned substitution method given in ANSI/TIA-603-D:2010.

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## 4.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4-2014. All measurement uncertainty values are shown with a coverage factor of  $k = 2$  to indicate a 95% level of confidence. The measurement data shown herein meets or exceeds the  $U_{\text{CISPR}}$  measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Contribution	Expanded Uncertainty ( $\pm$ dB)
Conducted Bench Top Measurements	1.13
Radiated Disturbance (<1GHz)	4.98
Radiated Disturbance (>1GHz)	5.07
Radiated Disturbance (>18GHz)	5.09

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## 5.0 TEST EQUIPMENT CALIBRATION DATA



Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST).

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
-	RE1	Radiated Emissions Cable Set (UHF/EHF)	4/28/2015	Annual	4/28/2016	RE1
Agilent	N9020A	MXA Signal Analyzer	11/5/2015	Annual	11/5/2016	US46470561
ETS Lindgren	3117	1-18 GHz DRG Horn (Medium)	4/8/2014	Biennial	4/8/2016	125518
K & L	13SH10-1000/U1000	N Type High Pass Filter	7/18/2015	Annual	7/18/2016	13SH10-1000/U1000-1
Rohde & Schwarz	CMU200	Base Station Simulator	N/A			836536/0005
Rohde & Schwarz	CMW500	LTE Radio Communication Tester	N/A			103962
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	3/12/2015	Annual	3/12/2016	100342
Schwarzbeck	UHA 9105	Dipole Antenna (400 - 1GHz) Rx	11/18/2015	Biennial	11/18/2017	91052523RX

**Table 5-1. Test Equipment**

**Notes:**

1. Equipment with a calibration date of "N/A" shown in this list was not used to make direct calibrated measurements.

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## 6.0 SAMPLE CALCULATIONS

### Spurious Radiated Emission – BC10



#### **Example: Channel 476 CDMA BC10 Mode 3<sup>rd</sup> Harmonic (2453.70MHz)**

The average spectrum analyzer reading at 3 meters with the EUT on the turntable was –81.0 dBm. The gain of the substituted antenna is 8.1 dBi. The signal generator connected to the substituted antenna terminals is adjusted to produce a reading of –81.0 dBm on the spectrum analyzer. The loss of the cable between the signal generator and the terminals of the substituted antenna is 2.0 dB at 2453.70 MHz. So 6.1 dB is added to the signal generator reading of –30.9 dBm yielding –24.80 dBm. The fundamental EIRP was 25.501 dBm so this harmonic was 25.501 dBm – (-24.80) = 50.3 dBc.

### Spurious Radiated Emission – LTE Band

#### **Example: Middle Channel LTE Mode 2<sup>nd</sup> Harmonic (1564 MHz)**

The average spectrum analyzer reading at 3 meters with the EUT on the turntable was –81.0 dBm. The gain of the substituted antenna is 8.1 dBi. The signal generator connected to the substituted antenna terminals is adjusted to produce a reading of –81.0 dBm on the spectrum analyzer. The loss of the cable between the signal generator and the terminals of the substituted antenna is 2.0 dB at 1564 MHz. So 6.1 dB is added to the signal generator reading of –30.9 dBm yielding –24.80 dBm. The fundamental EIRP was 25.501 dBm so this harmonic was 25.501 dBm – (-24.80).

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## 7.0 TEST RESULTS

### 7.1 Summary



Company Name: Samsung Electronics Co., Ltd.  
 FCC ID: A3LSMG930US  
 FCC Classification: PCS Licensed Transmitter Held to Ear (PCE)  
 Mode(s): CDMA / EvDO / LTE  
 Band: Band Class 10 / Band 26

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
<b>TRANSMITTER MODE (TX)</b>					
2.1053 90.691	Radiated Spurious Emissions	> 43 + log <sub>10</sub> (P[Watts]) for all out-of-band emissions except > 50 + 10log <sub>10</sub> (P[Watts]) at Band Edge and for all out-of-band emissions within 37.5kHz of Block Edge	RADIATED	PASS	Section 7.2

**Table 7-1. Summary of Test Results**

**Notes:**

- 1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.

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## 7.2 Radiated Spurious Emissions Measurements

§2.1053, §90.691

### Test Overview

Radiated spurious emissions measurements are performed using the substitution method described in ANSI/TIA-603-D:2010 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using horizontally and vertically polarized tuned dipole antennas. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband horn antennas. All measurements are performed as peak measurements while the EUT is operating at maximum power, and at the appropriate frequencies.



### Test Procedures Used

KDB 971168 D01 v02r02 – Section 5.8

ANSI/TIA-603-D:2010 – Section 2.2.12

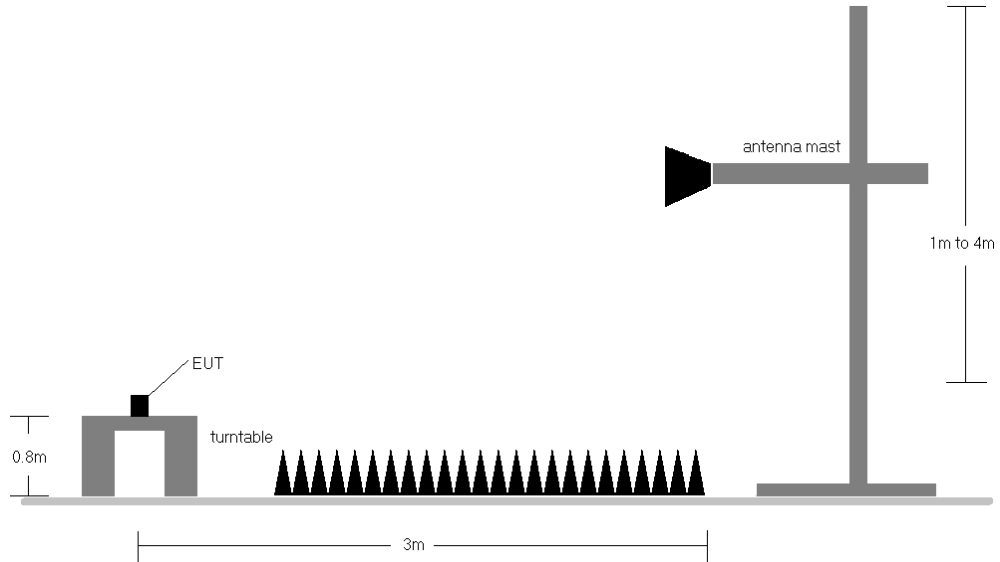
### Test Settings

1. RBW = 100kHz for emissions below 1GHz and 1MHz for emissions above 1GHz
2. VBW  $\geq$  3 x RBW
3. Span = 1.5 times the OBW
4. No. of sweep points  $\geq$  2 x span / RBW
5. Detector = Peak
6. Trace mode = max hold
7. The trace was allowed to stabilize

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**Test Setup**



The EUT and measurement equipment were set up as shown in the diagram below.



**Figure 7-1. Test Instrument & Measurement Setup**

**Test Notes**

1. For CDMA mode, this device was tested under all R.C.s and S.O.s and the worst case is reported with RC3/SO55 with "All Up" power control bits.
2. For LTE mode, the device was tested under all modulations, RB sizes and offsets, and channel bandwidth configurations and the worst case emissions are reported with 1 RB.
3. This unit was tested with its standard battery.
4. The EUT was tested in three orthogonal planes (while the WCBP was attached to the phone) and in all possible test configurations and positioning. The worst case setup is reported in the tables below.

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OPERATING FREQUENCY: 823.10 MHz  
 CHANNEL: 684  
 MODULATION SIGNAL: CDMA  
 DISTANCE: 3 meters  
 LIMIT:  $43 + 10 \log_{10}(W) =$  -13.00 dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	Spurious Emission Level [dBm]	Margin [dB]
1646.20	H	100	238	-63.94	6.56	-57.38	-44.4

**Table 7-2. CDMA BC10 Radiated Spurious Data with Antenna-A (Ch. 684)**

OPERATING FREQUENCY: 823.10 MHz  
 CHANNEL: 684  
 MODULATION SIGNAL: CDMA  
 DISTANCE: 3 meters  
 LIMIT:  $43 + 10 \log_{10}(W) =$  -13.00 dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	Spurious Emission Level [dBm]	Margin [dB]
1646.20	H	100	105	-61.40	6.56	-54.84	-41.8
2469.30	H	100	215	-58.45	7.29	-51.16	-38.2
3292.40	H	-	-	-59.18	7.36	-51.82	-38.8

**Table 7-3. CDMA BC10 Radiated Spurious Data with Antenna-B (Ch. 684)**

OPERATING FREQUENCY: 821.50 MHz  
 CHANNEL: 26765  
 MODULATION SIGNAL: QPSK  
 BANDWIDTH: 5.0 MHz  
 DISTANCE: 3 meters  
 LIMIT:  $43 + 10 \log_{10}(W) =$  -13.00 dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	Spurious Emission Level [dBm]	Margin [dB]
1643.00	H	110	105	-49.59	3.64	-45.96	-33.0
2464.50	H	-	-	-54.14	3.58	-50.56	-37.6

**Table 7-4. Radiated Spurious Data with Antenna-A (Ch. 26765)**



OPERATING FREQUENCY: 816.50 MHz  
 CHANNEL: 26715  
 MODULATION SIGNAL: QPSK  
 BANDWIDTH: 5.0 MHz  
 DISTANCE: 3 meters  
 LIMIT:  $43 + 10 \log_{10}(W) =$  -13.00 dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	Spurious Emission Level [dBm]	Margin [dB]
1633.00	H	100	110	-54.66	3.67	-50.99	-38.0
2449.50	H	-	-	-54.94	3.59	-51.35	-38.3

**Table 7-5. Radiated Spurious Data with Antenna-B (Ch. 26715)**

## 8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Samsung Portable Handset FCC ID: A3LSMG930US** complies with all the requirements of Parts 90 of the FCC rules.

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