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FCC LTE REPORT

Class II Permissive Change

Applicant Name:
SAMSUNG Electronics Co., Ltd.

Address:
129, Samsung-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Rep. of Korea

Date of Issue:
November 21, 2019

Location:
HCT CO., LTD.,
74, Seoicheon-ro 578beon-gil, Majang-myeon,
Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA

Report No.: HCT-RF-1911-FC013-R2

FCC ID: **A3LSMR825**

APPLICANT: **SAMSUNG Electronics Co., Ltd.**

Model(s): SM-R825F
EUT Type: Smart Watch
FCC Classification: PCS Licensed Transmitter (PCB)
FCC Rule Part(s): §22, §2

Mode (MHz)	Tx Frequency (MHz)	Emission Designator	Modulation	ERP	
				Max. Power (W)	Max. Power (dBm)
LTE – Band5 (1.4)	824.7 – 848.3	1M10G7D	QPSK	0.014	11.45
		1M10W7D	16QAM	0.009	9.54
LTE – Band5 (3)	825.5 – 847.5	2M72G7D	QPSK	0.016	12.05
		2M71W7D	16QAM	0.009	9.52
LTE – Band5 (5)	826.5 – 846.5	4M51G7D	QPSK	0.016	12.07
		4M52W7D	16QAM	0.009	9.58
LTE – Band5 (10)	829.0 – 844.0	9M04G7D	QPSK	0.016	12.02
		9M00W7D	16QAM	0.009	9.48

The measurements shown in this report were made in accordance with the procedures specified in CFR47 section §2.947. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them.

HCT CO., LTD. Certifies that no party to this application has subject to a denial of Federal benefits that includes FCC benefits pursuant to section 5301 of the Anti-Drug Abuse Act of 1998,21 U.S. C.853(a)

Report prepared by : Jae Ryang Do
Engineer of Telecommunication Testing Center

Report approved by : Seul Ki Lee
Manager of Telecommunication Testing Center

Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-1911-FC013	November 12, 2019	- First Approval Report
HCT-RF-1911-FC013-R1	November 20, 2019	- Revised Model name. - Added R.S.E Result below 1GHz. (Page 23)
HCT-RF-1911-FC013-R2	November 21, 2019	- Added Worst case description.

The result shown in this test report refer only to the sample(s) tested unless otherwise stated.

This laboratory is not accredited for the test results marked *.
The above Test Report is the accredited test result by KOLAS(Korea Laboratory Accreditation Scheme), which signed the ILAC-MRA. (HCT Accreditation No.: KT197)

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MEASUREMENT REPORT

1. GENERAL INFORMATION

Applicant Name:	SAMSUNG Electronics Co., Ltd.
Address:	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
FCC ID:	A3LSMR825
Application Type:	Class II Permissive Change
FCC Classification:	PCS Licensed Transmitter (PCB)
FCC Rule Part(s):	§22, §2
EUT Type:	Smart Watch
Model(s):	SM-R825F
Tx Frequency:	824.7 MHz – 848.3 MHz (LTE – Band 5 (1.4 MHz)) 825.5 MHz – 847.5 MHz (LTE – Band 5 (3 MHz)) 826.5 MHz – 846.5 MHz (LTE – Band 5 (5 MHz)) 829.0 MHz – 844.0 MHz (LTE – Band 5 (10 MHz))
Date(s) of Tests:	October 21, 2019~ October 31, 2019

2. INTRODUCTION

2.1. DESCRIPTION OF EUT

The EUT was a Smart Watch with UMTS and LTE.
It also supports IEEE 802.11 b/g/n (HT20), Bluetooth, BT LE.

2.2. MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

2.3. TEST FACILITY

The Fully-anechoic chamber and conducted measurement facility used to collect the radiated data are located at the **74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA.**

3. DESCRIPTION OF TESTS

3.1 TEST PROCEDURE

Test Description	Test Procedure Used
Occupied Bandwidth	- KDB 971168 D01 v03r01 – Section 4.3 - ANSI C63.26-2015 – Section 5.4.4
Band Edge	- KDB 971168 D01 v03r01 – Section 6.0 - ANSI C63.26-2015 – Section 5.7
Spurious and Harmonic Emissions at Antenna Terminal	- KDB 971168 D01 v03r01 – Section 6.0 - ANSI C63.26-2015 – Section 5.7
Conducted Output Power	- N/A (See SAR Report)
Frequency stability	- ANSI C63.26-2015 – Section 5.6
Effective Radiated Power/ Effective Isotropic Radiated Power	- KDB 971168 D01 v03r01 – Section 5.2 & 5.8 - ANSI/TIA-603-E-2016 – Section 2.2.17
Radiated Spurious and Harmonic Emissions	- KDB 971168 D01 v03r01 – Section 6.2 - ANSI/TIA-603-E-2016 – Section 2.2.12

3.2 RADIATED POWER

Test Overview

Radiated tests are performed in the Fully-anechoic chamber.

The equipment under test is placed on a non-conductive table 3-meters away from the receive antenna in accordance with ANSI/TIA-603-E-2016 Clause 2.2.17.

Test Settings

1. Radiated power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation.
2. RBW = 1 – 5% of the expected OBW, not to exceed 1MHz
3. VBW ≥ 3 x RBW
4. Span = 1.5 times the OBW
5. No. of sweep points > 2 x span / RBW
6. Detector = RMS
7. Trigger is set to "free run" for signals with continuous operation with the sweep times set to "auto".
8. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation.
9. Trace mode = trace averaging (RMS) over 100 sweeps
10. The trace was allowed to stabilize

Test Note

1. The turntable is rotated through 360 degrees, and the receiving antenna scans in order to determine the level of the maximized emission.
2. 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 and the previously recorded signal was duplicated.

   The power is calculated by the following formula;

   $$P_{d(dBm)} = Pg_{(dBm)} - \text{cable loss}_{(dB)} + \text{antenna gain}_{(dB)}$$

   Where: P_d is the dipole equivalent power and P_g is the generator output power into the substitution antenna.
3. The maximum value is calculated by adding the forward power to the calibrated source plus its appropriate gain value.

   These steps are repeated with the receiving antenna in both vertical and horizontal polarization. the difference between the gain of the horn and an isotropic antenna are taken into consideration
4. The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning.
5. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

3.3 RADIATED SPURIOUS EMISSIONS

Test Overview

Radiated tests are performed in the Fully-anechoic chamber.

Radiated Spurious Emission Measurements at 3 meters by Substitution Method according to ANSI/TIA-603-E-2016.

Test Settings

1. RBW = 100kHz for emissions below 1GHz and 1MHz for emissions above 1GHz
2. VBW ≥ 3 x RBW
3. Span = 1.5 times the OBW
4. No. of sweep points > 2 x span / RBW
5. Detector = Peak
6. Trace mode = Max Hold
7. The trace was allowed to stabilize
8. Test channel : Low/ Middle/ High
9. Frequency range : We are performed all frequency to 10^{th} harmonics from 9 kHz.

Test Note

1. Measurements value show only up to 3 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
2. The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the test data
3. For spurious emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator and the previously recorded signal was duplicated.

   The spurious emissions is calculated by the following formula;

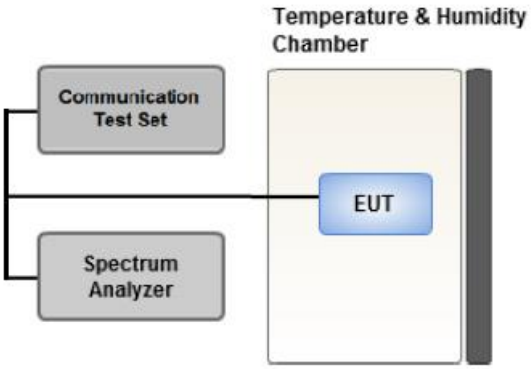
   $$Result_{(dBm)} = Pg_{(dBm)} - \text{cable loss}_{(dB)} + \text{antenna gain}_{(dBi)}$$

   Where: P_g is the generator output power into the substitution antenna.

   If the fundalmatal frequency is below 1GHz, RF output power has been converted to EIRP.

   $$EIRP_{(dBm)} = ERP_{(dBm)} + 2.15$$

3.4 OCCUPIED BANDWIDTH.



Test setup

The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 % of the total mean power of a given emission.

The EUT makes a call to the communication simulator.

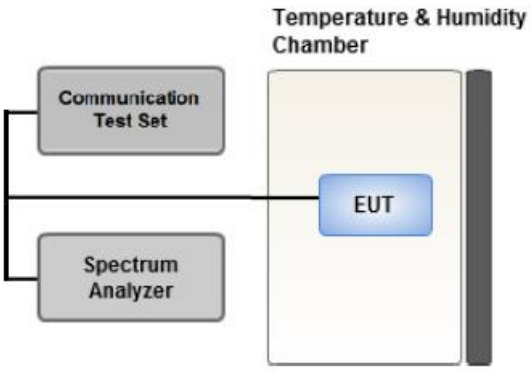
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency. Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth

Test Settings

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth and the 26dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW ≥ 3 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

3.5 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL



Test setup

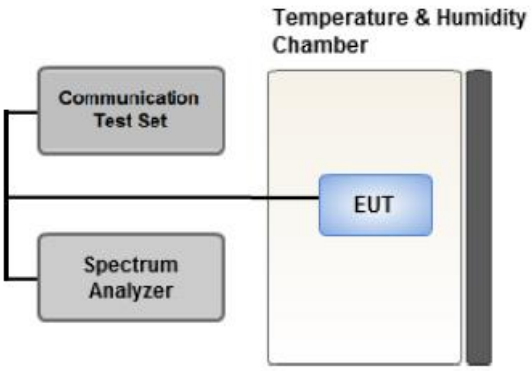
Test Overview

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

Test Settings

1. RBW = 1 MHz
2. VBW ≥ 3 MHz
3. Detector = RMS
4. Trace Mode = Average
5. Sweep time = auto
6. Number of points in sweep ≥ 2 * Span / RBW

3.6 BAND EDGE



Test setup

Test Overview

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

Test Settings

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW > 1% of the emission bandwidth
4. VBW > 3 x RBW
5. Detector = RMS
6. Number of sweep points ≥ 2 x Span/RBW
7. Trace mode = trace average
8. Sweep time = auto couple
9. The trace was allowed to stabilize

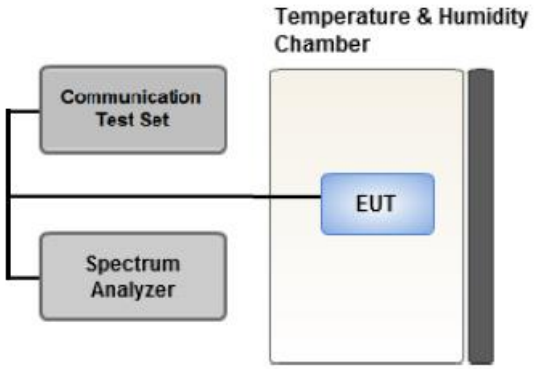
Test Notes

According to FCC 22.917, 24.238, 27.53 specified that 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. 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.

All measurements were done at 2 channels(low and high operational frequency range.)

The band edge measurement used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

3.7 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE



Test setup

Test Overview

Frequency stability testing is performed in accordance with the guidelines of ANSI C63.26-2015.

The frequency stability of the transmitter is measured by:

1. Temperature:

   The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.

2. Primary Supply Voltage:

   .- Unless otherwise specified, vary primary supply voltage from 85% to 115% of the nominal value for other than hand carried battery equipment.

   .- For hand carried, battery powered equipment, reduce the primary ac or dc supply voltage to the battery operating end point, which shall be specified by the manufacturer.

Test Settings

1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
2. The equipment is turned on in a “standby” condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

3.8 WORST CASE(RADIATED TEST)

- The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning.
- All modes of operation were investigated and the worst case configuration results are reported.
- The worst case is reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the test data.
- Please refer to the table below.
- All modes of operation were tested and the worst case results are reported.

Mode : Stand alone, Stand alone+ wireless charging dock

(Worst case : Stand alone + wireless charging dock)

[Worst case]

Test Description	Modulation	RB size	RB offset	Axis
Effective Radiated Power	QPSK, 16QAM	1	0	X
Radiated Spurious and Harmonic Emissions	QPSK	1	0	X

3.9 WORST CASE(CONDUCTED TEST)

- Worst case : Of all modulation, We have tested modulation of the high Conducted Output Power.
  Conducted Output Power value can be confirmed on the SAR report.

[Worst case]

Test Description	Modulation	Bandwidth (MHz)	Frequency	RB size	RB offset
Occupied Bandwidth	QPSK, 16QAM	1.4, 3, 5, 10	Mid	Full RB	0
Band Edge	* QPSK	1.4	Low	1	0
			High	1	5
		3	Low	1	0
			High	1	14
		5	Low	1	0
			High	1	24
		10	Low	1	0
			High	1	49
		1.4, 3, 5, 10	Low, High	Full RB	0
Spurious and Harmonic Emissions at Antenna Terminal	* QPSK	1.4, 3, 5, 10	Low, Mid, High	1	0

4. LIST OF TEST EQUIPMENT

Manufacture	Model/ Equipment	Serial Number	Calibration Date	Calibration Interval	Calibration Due
T&M SYSTEM	FBSR-02B(WHK1.2/15G-10EF)/H.P.F	-	06/10/2019	Annual	06/10/2020
T&M SYSTEM	FBSR-02B(WHK3.3/18G-10EF)/H.P.F	-	06/10/2019	Annual	06/10/2020
Hewlett Packard	11667B / Power Splitter(DC~26.5 GHz)	11275	05/03/2019	Annual	05/03/2020
Agilent	E3632A/DC Power Supply	MY40004326	07/01/2019	Annual	07/01/2020
Schwarzbeck	UHAP/ Dipole Antenna	557	03/29/2019	Biennial	03/29/2021
Schwarzbeck	UHAP/ Dipole Antenna	558	03/29/2019	Biennial	03/29/2021
ESPEC	SU-642 / Chamber	93000717	08/14/2019	Annual	08/14/2020
Schwarzbeck	BBHA 9120D/ Horn Antenna(1~18GHz)	147	08/29/2019	Biennial	08/29/2021
Schwarzbeck	BBHA 9120D/ Horn Antenna(1~18GHz)	9120D-1298	09/25/2019	Biennial	09/25/2021
Schwarzbeck	BBHA 9170/ Horn Antenna(15~40GHz)	BBHA9170342	04/29/2019	Biennial	04/29/2021
Schwarzbeck	BBHA 9170/ Horn Antenna(15~40GHz)	BBHA9170124	01/28/2019	Biennial	01/28/2021
Agilent	N9020A/Signal Analyzer(10Hz~26.5GHz)	MY51110063	05/08/2019	Annual	05/08/2020
Hewlett Packard	8493C/ATTENUATOR(20dB)	17280	06/04/2019	Annual	06/04/2020
REOHDE & SCHWARZ	FSV40/Spectrum Analyzer(10Hz~40GHz)	100931	10/14/2019	Annual	10/14/2020
Agilent	8960 (E5515C)/ Base Station	MY48360800	08/27/2019	Annual	08/27/2020
Schwarzbeck	FMZB1513/ Loop Antenna(9kHz~30MHz)	1513-175	08/23/2018	Biennial	08/23/2020
Schwarzbeck	VULB9160/ Bilog Antenna	9160-3368	08/09/2018	Biennial	08/09/2020
Schwarzbeck	VULB9160/ Hybrid Antenna	760	03/22/2019	Biennial	03/22/2021
Anritsu Corp.	MT8821C/Wideband Radio Communication Tester	6201502997	08/09/2019	Annual	08/09/2020
Anritsu Corp.	MT8820C/Wideband Radio Communication Tester	6201026545	01/30/2019	Annual	01/30/2020
REOHDE & SCHWARZ	SMB100A/ SIGNAL GENERATOR (100kHz~40GHz)	177633	07/15/2019	Annual	07/15/2020
REOHDE & SCHWARZ	ESU40 / EMI TEST RECEIVER	100524	05/17/2019	Annual	05/17/2020
HCT CO., LTD.,	FCC LTE Mobile Conducted RF Automation Test Software	-	-	-	-

Note:

1. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.
2. Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2017).

5. 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_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty (±dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	1.82
Radiated Disturbance (9 kHz ~ 30 MHz)	3.40
Radiated Disturbance (30 MHz ~ 1 GHz)	4.80
Radiated Disturbance (1 GHz ~ 18 GHz)	5.70
Radiated Disturbance (18 GHz ~ 40 GHz)	5.05

6. SUMMARY OF TEST RESULTS

6.1 Test Condition : Conducted Test

Test Description	FCC Part Section(s)	Test Limit	Test Result	Status
Occupied Bandwidth	§2.1049	N/A	PASS	NT Note4
Band Edge / Spurious and Harmonic Emissions at Antenna Terminal.	§2.1051, §22.917(a)	< 43 + 10log10 (P[Watts]) at Band Edge and for all out-of-band emissions	PASS	NT Note4
Conducted Output Power	§2.1046	N/A	**See Note1**	C Note5
Frequency stability / variation of ambient temperature	§2.1055, § 22.355	< 2.5 ppm	PASS	NT Note4

Note:

1. See SAR Report
2. C = Comply, NT = Not Tested, NA = Not Applicable, NC = Not Comply
3. C2PC models are electrically identical to the Original models.
   The Product Equality Declaration includes detailed information about the changes between the devices.
4. The data from that application has been verified through appropriate spot checks to demonstrate compliance for this device as shown in the test result of section 8
5. Output power was verified to be within the expected tune up tolerances prior to performing the spot checks for radiated spurious emissions, E.R.P and E.I.R.P to confirm that the proposed changes to the digital circuitry had not adversely affected the previously reported values in the original filing.
6. The same samples were used for SAR and EMC

6.2 Test Condition : Radiated Test

Test Description	FCC Part Section(s)	Test Limit	Test Result	Status
Effective Radiated Power	§22.913(a)(5)	< 7 Watts max. ERP	PASS	C[Note3]
Radiated Spurious and Harmonic Emissions	§2.1053, §22.917(a),	< 43 + 10log10 (P[Watts]) for all out-of band emissions	PASS	C[Note3]

Note:

1. C = Comply, NT = Not Tested, NA = Not Applicable, NC = Not Comply
2. C2PC models are electrically identical to the Original models.
   The Product Equality Declaration includes detailed information about the changes between the devices.
3. The data from that application has been verified through appropriate spot checks to demonstrate compliance for this device as shown in the test result of section 8
4. The same samples were used for SAR and EMC

7. SAMPLE CALCULATION

7.1 ERP Sample Calculation

Ch./ Freq.		Measured Level(dBm)	Substitute Level(dBm)	Ant. Gain (dBd)	C.L	Pol.	ERP	
channel	Freq.(MHz)						W	dBm
128	824.20	-21.37	38.40	-10.61	0.95	H	0.483	26.84

ERP = Substitute LEVEL(dBm) + Ant. Gain – CL(Cable Loss)

1) The EUT mounted on a non-conductive turntable is 2.5 meter above test site ground level.
2) During the test , the turn table is rotated until the maximum signal is found.
3) Record the field strength meter's level.
4) Replace the EUT with dipole/Horn antenna that is connected to a calibrated signal generator.
5) Increase the signal generator output till the field strength meter's level is equal to the item (3).
6) The signal generator output level with Ant. Gain and cable loss are the rating of effective radiated power.

7.2 EIRP Sample Calculation

Ch./ Freq.		Measured Level(dBm)	Substitute Level(dBm)	Ant. Gain (dBi)	C.L	Pol.	EIRP	
channel	Freq.(MHz)						W	dBm
20175	1,732.50	-15.75	18.45	9.90	1.76	H	0.456	26.59

EIRP = Substitute LEVEL(dBm) + Ant. Gain – CL(Cable Loss)

1) The EUT mounted on a non-conductive turntable is 2.5 meter above test site ground level.
2) During the test , the turn table is rotated until the maximum signal is found.
3) Record the field strength meter's level.
4) Replace the EUT with dipole/Horn antenna that is connected to a calibrated signal generator.
5) Increase the signal generator output till the field strength meter's level is equal to the item (3).
6) The signal generator output level with Ant. Gain and cable loss are the rating of equivalent isotropic radiated power.

7.3. Emission Designator

GSM Emission Designator

Emission Designator = 249KGXW

GSM BW = 249 kHz

G = Phase Modulation

X = Cases not otherwise covered

W = Combination (Audio/Data)

EDGE Emission Designator

Emission Designator = 249KG7W

GSM BW = 249 kHz

G = Phase Modulation

7 = Quantized/Digital Info

W = Combination (Audio/Data)

WCDMA Emission Designator

Emission Designator = 4M17F9W

WCDMA BW = 4.17 MHz

F = Frequency Modulation

9 = Composite Digital Info

W = Combination (Audio/Data)

QPSK Modulation

Emission Designator = 4M48G7D

LTE BW = 4.48 MHz

G = Phase Modulation

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

16QAM Modulation

Emission Designator = 4M48W7D

LTE BW = 4.48 MHz

W = Amplitude/Angle Modulated

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

64QAM Modulation

Emission Designator = 4M48W7D

LTE BW = 4.48 MHz

W = Amplitude/Angle Modulated

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

8. TEST RESULT (E.R.P & Radiated Spurious Emissions)

8.1 EFFECTIVE RADIATED POWER

Freq (MHz)	Mod/ Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBd)	C.L	Pol	Limit	ERP	
								W	W	dBm
824.7	LTE B5 (1.4 MHz)	QPSK	-41.02	22.59	-10.24	1.28	H	< 7.00	0.013	11.07
		16-QAM	-43.15	20.46	-10.24	1.28	H		0.008	8.94
836.5		QPSK	-41.25	22.93	-10.19	1.29	H		0.014	11.45
		16-QAM	-43.16	21.02	-10.19	1.29	H		0.009	9.54
848.3		QPSK	-41.61	22.38	-10.14	1.30	H		0.012	10.94
		16-QAM	-43.32	20.67	-10.14	1.30	H		0.008	9.23

Freq (MHz)	Mod/ Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBd)	C.L	Pol	Limit	ERP	
								W	W	dBm
825.5	LTE B5 (3 MHz)	QPSK	-40.67	22.97	-10.24	1.28	H	< 7.00	0.014	11.45
		16-QAM	-43.15	20.49	-10.24	1.28	H		0.008	8.97
836.5		QPSK	-40.65	23.53	-10.19	1.29	H		0.016	12.05
		16-QAM	-43.18	21.00	-10.19	1.29	H		0.009	9.52
847.5		QPSK	-41.02	23.01	-10.15	1.30	H		0.014	11.56
		16-QAM	-43.47	20.56	-10.15	1.30	H		0.008	9.11

Freq (MHz)	Mod/ Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBd)	C.L	Pol	Limit	ERP	
								W	W	dBm
826.5	LTE B5 (5 MHz)	QPSK	-40.77	22.94	-10.24	1.28	H	< 7.00	0.014	11.43
		16-QAM	-43.04	20.67	-10.24	1.28	H		0.008	9.16
836.5		QPSK	-40.63	23.55	-10.19	1.29	H		0.016	12.07
		16-QAM	-43.12	21.06	-10.19	1.29	H		0.009	9.58
846.5		QPSK	-40.83	23.40	-10.15	1.30	H		0.016	11.95
		16-QAM	-43.30	20.93	-10.15	1.30	H		0.009	9.48

Freq (MHz)	Mod/ Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBd)	C.L	Pol	Limit	ERP	
								W	W	dBm
829.0	LTE B5 (10 MHz)	QPSK	-40.60	23.21	-10.22	1.28	H	< 7.00	0.015	11.71
		16-QAM	-43.22	20.59	-10.22	1.28	H		0.008	9.09
836.5		QPSK	-40.68	23.50	-10.19	1.29	H		0.016	12.02
		16-QAM	-43.22	20.96	-10.19	1.29	H		0.009	9.48
844.0		QPSK	-40.91	23.23	-10.16	1.30	H		0.015	11.77
		16-QAM	-43.22	20.92	-10.16	1.30	H		0.009	9.46

8.2 RADIATED SPURIOUS EMISSIONS

Frequency Range : 30 MHz ~ 1 GHz

Frequency	Reading	Ant. factor+Cable loss- Amp Gain	Ant. POL	Total	Limit	Margin
MHz	dBμV	dB /m	(H/V)	dBμV/m	dBμV/m	dB
No Peak Found						

▣ OPERATING FREQUENCY: 836.5 MHz

▣ MEASURED OUTPUT POWER: 13.60 dBm = 0.023 W

▣ MODE: LTE B5

▣ MODULATION SIGNAL: 1.4 MHz QPSK

▣ DISTANCE: 3 meters

▣ LIMIT: 43 + 10 log10 (W) = 26.60 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
20407 (824.7)	1,649.40	-37.42	9.50	-48.18	1.84	H	-40.52	54.13
	2,474.10	-52.24	10.60	-57.17	2.29	V	-48.86	62.46
	3,298.80	-57.69	12.30	-59.63	2.69	V	-50.02	63.62
20525 (836.5)	1,673.00	-34.53	9.65	-45.29	1.86	H	-37.50	51.10
	2,509.50	-51.30	10.75	-56.41	2.32	H	-47.98	61.59
	3,346.00	-58.26	12.48	-59.91	2.70	V	-50.14	63.74
20643 (848.3)	1,696.60	-35.70	9.77	-46.13	1.87	H	-38.24	51.84
	2,544.90	-53.47	10.88	-57.58	2.32	H	-49.02	62.63
	3,393.20	-58.49	12.65	-60.44	2.71	V	-50.50	64.11

▣ OPERATING FREQUENCY: 836.5 MHz

▣ MEASURED OUTPUT POWER: 14.20 dBm = 0.026 W

▣ MODE: LTE B5

▣ MODULATION SIGNAL: 3 MHz QPSK

▣ DISTANCE: 3 meters

▣ LIMIT: 43 + 10 log10 (W) = 27.20 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
20415 (825.5)	1,651.00	-35.73	9.50	-46.49	1.84	H	-38.83	53.04
	2,476.50	-56.06	10.60	-60.99	2.29	H	-52.68	66.88
	3,302.00	-57.78	12.30	-59.72	2.69	V	-50.11	64.31
20525 (836.5)	1,673.00	-34.92	9.65	-45.68	1.86	H	-37.89	52.09
	2,509.50	-51.93	10.75	-57.04	2.32	V	-48.61	62.82
	3,346.00	-58.80	12.48	-60.45	2.70	V	-50.68	64.88
20635 (847.5)	1,695.00	-34.07	9.77	-44.51	1.87	H	-36.61	50.81
	2,542.50	-54.62	10.85	-58.48	2.32	V	-49.95	64.16
	3,390.00	-58.91	12.65	-60.86	2.71	H	-50.92	65.13

▣ OPERATING FREQUENCY: 836.5 MHz

▣ MEASURED OUTPUT POWER: 14.22 dBm = 0.026 W

▣ MODE: LTE B5

▣ MODULATION SIGNAL: 5 MHz QPSK

▣ DISTANCE: 3 meters

▣ LIMIT: 43 + 10 log10 (W) = 27.22 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
20425 (826.5)	1,653.00	-37.49	9.54	-48.29	1.85	H	-40.60	54.82
	2,479.50	-49.04	10.60	-53.85	2.30	H	-45.55	59.77
	3,306.00	-57.20	12.33	-59.19	2.69	H	-49.55	63.78
20525 (836.5)	1,673.00	-34.96	9.65	-45.72	1.86	H	-37.93	52.15
	2,509.50	-51.47	10.75	-56.58	2.32	H	-48.15	62.38
	3,346.00	-58.80	12.48	-60.45	2.70	V	-50.68	64.90
20625 (846.5)	1,693.00	-35.41	9.73	-46.03	1.87	H	-38.17	52.40
	2,539.50	-49.61	10.85	-53.47	2.32	V	-44.94	59.17
	3,386.00	-58.32	12.63	-60.32	2.72	V	-50.41	64.63

▣ OPERATING FREQUENCY: 836.5 MHz

▣ MEASURED OUTPUT POWER: 14.17 dBm = 0.026 W

▣ MODE: LTE B5

▣ MODULATION SIGNAL: 10 MHz QPSK

▣ DISTANCE: 3 meters

▣ LIMIT: 43 + 10 log10 (W) = 27.17 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
20450 (829.0)	1,658.00	-39.58	9.58	-50.42	1.85	H	-42.69	56.87
	2,487.00	-49.85	10.65	-54.99	2.30	H	-46.64	60.82
	3,316.00	-57.68	12.38	-59.53	2.68	V	-49.83	64.01
20525 (836.5)	1,673.00	-38.10	9.65	-48.86	1.86	H	-41.07	55.24
	2,509.50	-47.09	10.75	-52.20	2.32	H	-43.77	57.95
	3,346.00	-57.71	12.48	-59.36	2.70	H	-49.59	63.76
20600 (844.0)	1,688.00	-35.95	9.73	-46.57	1.87	H	-38.71	52.89
	2,532.00	-48.10	10.80	-52.84	2.33	H	-44.37	58.55
	3,376.00	-56.95	12.60	-58.96	2.72	V	-49.08	63.25

8.3 GEO-LOCATION MECHANISM

The device uses a geo-location mechanism based on the cellular MCC codes in order to only enable certain LTE bands when the device is not in the USA.

The validation of this mechanism is provided below. The device was configured for cellular communications to a test set and the MCC code was adjusted on the test set between the US MCC and then an MCC code valid for a country where the LTE band is supported.

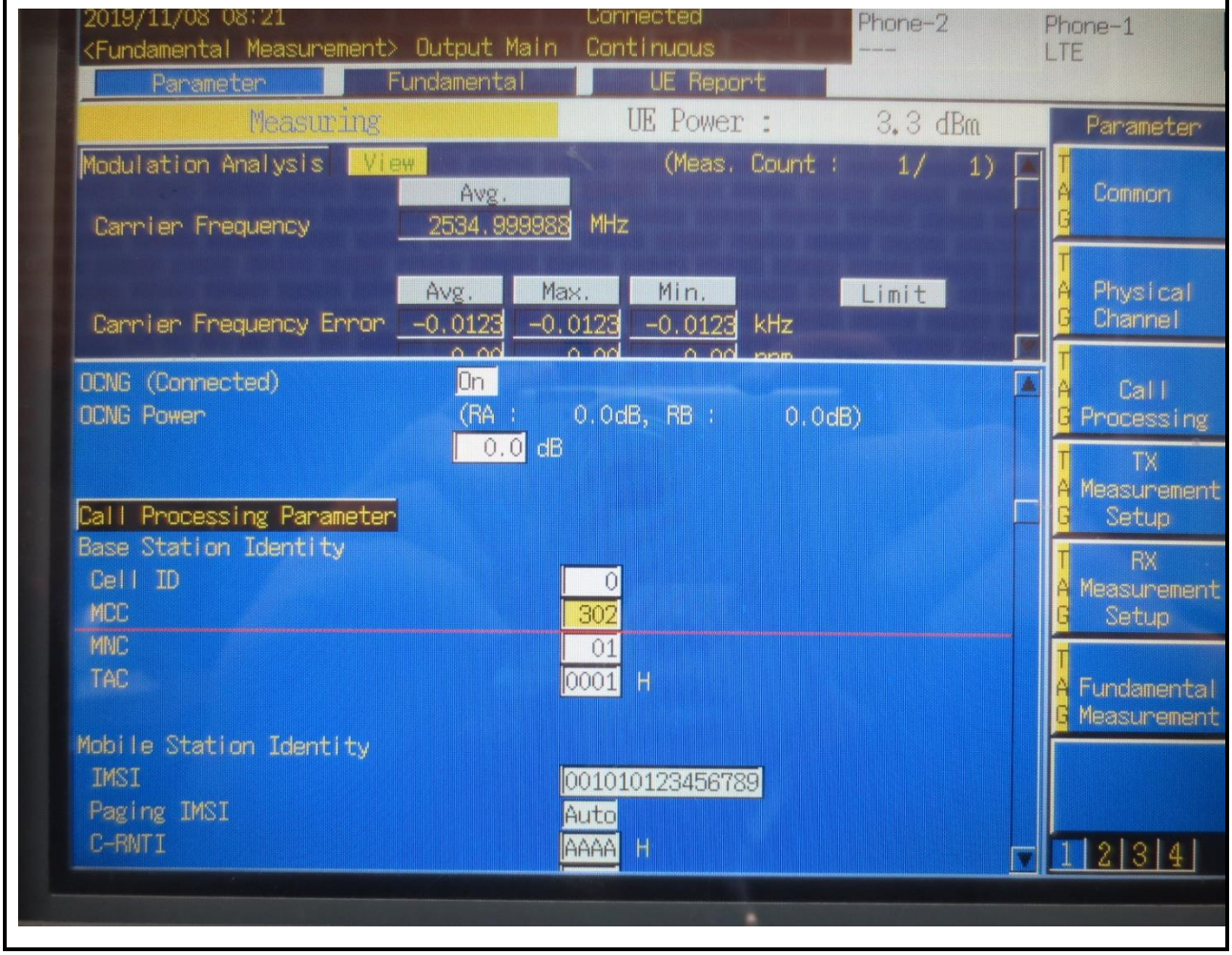
Band	MCC = USA	MCC = non US
7	Did not connect	Connected (Canada)

The verification tests confirmed the operational of the geo-location mechanism.

Verification test

Did not connect (LTE B7)

(MCC = US)

Connected (LTE B7) (MCC = Canada)


9. ANNEX A_ TEST SETUP PHOTO

Please refer to test setup photo file no. as follows;

No.	Description
1	HCT-RF-1911-FC013-P