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SAR EVALUATION REPORT

Applicant Name:

Samsung Electronics Co., Ltd.
129, Samsung-ro, Maetan dong,
Yeongtong-gu, Suwon-si
Gyeonggi-do, 16677, Korea

Date of Testing:

03/08/2017

Test Site/Location:

PCTEST Lab, Columbia, MD, USA

Document Serial No.:

1M1703080088-01.A3L

FCC ID:

A3LSMA520W

APPLICANT:

SAMSUNG ELECTRONICS CO., LTD.

DUT Type:

Portable Handset

Application Type:

Class II Permissive Change

FCC Rule Part(s):

CFR §2.1093

Model(s):

SM-A520W

Test Device Serial No.:

[S/N: 08881, 09301]

Permissive Change(s):

Adding Additional DL Carrier Aggregation Combinations

Date of Original Certification:

02/10/2017

Note: The following test data was evaluated for the current test report. Please refer to RF Exposure Technical Report S/N 1M1701050017-01.A3L for original compliance evaluation.

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE C95.1-1992 and has been tested in accordance with the measurement procedures specified in Section 1.4 of this report; for North American frequency bands only.

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. Test results reported herein relate only to the item(s) tested.


Randy Ortanez
President



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FCC ID: A3LSMA520W		SAR EVALUATION REPORT		Approved by: Quality Manager
Document S/N: 1M1703080088-01.A3L	Test Dates: 03/08/17	DUT Type: Portable Handset		Page 1 of 11

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

1	DEVICE UNDER TEST	3
2	LTE INFORMATION	5
3	FCC MEASUREMENT PROCEDURES.....	6
4	RF CONDUCTED POWERS	7
5	EQUIPMENT LIST	8
6	CONCLUSION	9
7	REFERENCES	10

FCC ID: A3LSMA520W	 SAR EVALUATION REPORT 	Approved by: Quality Manager
Document S/N: 1M1703080088-01.A3L	Test Dates: 03/08/17	DUT Type: Portable Handset
		Page 2 of 11

1 DEVICE UNDER TEST

1.1 Device Overview

Band & Mode	Operating Modes	Tx Frequency
GSM/GPRS/EDGE 850	Voice/Data	824.20 - 848.80 MHz
UMTS 850	Voice/Data	826.40 - 846.60 MHz
UMTS 1750	Voice/Data	1712.4 - 1752.6 MHz
GSM/GPRS/EDGE 1900	Voice/Data	1850.20 - 1909.80 MHz
UMTS 1900	Voice/Data	1852.4 - 1907.6 MHz
LTE Band 12	Voice/Data	699.7 - 715.3 MHz
LTE Band 17	Voice/Data	706.5 - 713.5 MHz
LTE Band 13	Voice/Data	779.5 - 784.5 MHz
LTE Band 5 (Cell)	Voice/Data	824.7 - 848.3 MHz
LTE Band 66 (AWS)	Voice/Data	1710.7 - 1779.3 MHz
LTE Band 4 (AWS)	Voice/Data	1710.7 - 1754.3 MHz
LTE Band 2 (PCS)	Voice/Data	1850.7 - 1909.3 MHz
2.4 GHz WLAN	Voice/Data	2412 - 2462 MHz
U-NII-1	Voice/Data	5180 - 5240 MHz
U-NII-2A	Voice/Data	5260 - 5320 MHz
U-NII-2C	Voice/Data	5500 - 5720 MHz
U-NII-3	Voice/Data	5745 - 5825 MHz
Bluetooth	Data	2402 - 2480 MHz
NFC	Data	13.56 MHz
ANT+	Data	2402 - 2480 MHz
MST	Data	1 - 8.3 kHz

1.2 Power Reduction for SAR

This device utilizes a single step power reduction mechanism for SAR compliance under portable hotspot conditions for some wireless modes and bands. Detailed descriptions of the power reduction mechanism are included in the operational description.

FCC ID: A3LSMA520W	 SAR EVALUATION REPORT 		Approved by: Quality Manager
Document S/N: 1M1703080088-01.A3L	Test Dates: 03/08/17	DUT Type: Portable Handset	Page 3 of 11

1.3 Nominal and Maximum Output Power Specifications

This device operates using the following maximum and nominal output power specifications for LTE B66. See RF Exposure Technical Report S/N 1M1701050017-01.A3L for complete maximum and nominal output power specifications.

1.3.1 Maximum Power

Mode / Band		Modulated Average (dBm)
LTE Band 66 (AWS)	Maximum	22.5
	Nominal	22.0

1.3.2 Reduced Power

Mode / Band		Modulated Average (dBm)
LTE Band 66 (AWS)	Maximum	20.5
	Nominal	20.0

1.4 SAR Test Exclusion

The output power with downlink only carrier aggregation active was not > 0.25 dB higher than with carrier aggregation active not active. Therefore, additional SAR measurements were not required per FCC KDB Publication 941225 D05Av01r02. See RF Exposure Technical Report S/N 1M1701050017-01.A3L for SAR compliance evaluation and complete RF conducted output power measurements.

1.5 Guidance Applied

- IEEE 1528-2013
- FCC KDB Publication 941225 D05v02r04, D05Av01r02 (4G)
- FCC KDB Publication 447498 D01v06 (General SAR Guidance)
- FCC KDB Publication 865664 D01v01r04, D02v01r02 (SAR Measurements up to 6 GHz)

FCC ID: A3LSMA520W	 SAR EVALUATION REPORT 	Approved by: Quality Manager
Document S/N: 1M1703080088-01.A3L	Test Dates: 03/08/17	DUT Type: Portable Handset
		Page 4 of 11

LTE Information					
FCC ID	A3LSMA520W				
Form Factor	Portable Handset				
Frequency Range of each LTE transmission band	LTE Band 12 (699.7 - 715.3 MHz)				
	LTE Band 17 (706.5 - 713.5 MHz)				
	LTE Band 13 (779.5 - 784.5 MHz)				
	LTE Band 5 (Cell) (824.7 - 848.3 MHz)				
	LTE Band 66 (AWS) (1710.7 - 1779.3 MHz)				
	LTE Band 4 (AWS) (1710.7 - 1754.3 MHz)				
Channel Bandwidths	LTE Band 2 (PCS) (1850.7 - 1909.3 MHz)				
	LTE Band 12: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz				
	LTE Band 17: 5 MHz, 10 MHz				
	LTE Band 13: 5 MHz, 10 MHz				
	LTE Band 5 (Cell): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz				
	LTE Band 66 (AWS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz				
Channel Numbers and Frequencies (MHz)	LTE Band 4 (AWS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz				
	LTE Band 2 (PCS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz				
	Low	Low-Mid	Mid	Mid-High	High
LTE Band 12: 1.4 MHz	699.7 (23017)	N/A	707.5 (23095)	N/A	715.3 (23173)
LTE Band 12: 3 MHz	700.5 (23025)	N/A	707.5 (23095)	N/A	714.5 (23165)
LTE Band 12: 5 MHz	701.5 (23035)	N/A	707.5 (23095)	N/A	713.5 (23155)
LTE Band 12: 10 MHz	704 (23060)	N/A	707.5 (23095)	N/A	711 (23130)
LTE Band 17: 5 MHz	706.5 (23755)	N/A	710 (23790)	N/A	713.5 (23825)
LTE Band 17: 10 MHz	709 (23780)	N/A	710 (23790)	N/A	711 (23800)
LTE Band 13: 5 MHz	779.5 (23205)	N/A	782 (23230)	N/A	784.5 (23255)
LTE Band 13: 10 MHz	N/A	N/A	782 (23230)	N/A	N/A
LTE Band 5 (Cell): 1.4 MHz	824.7 (20407)	N/A	836.5 (20525)	N/A	848.3 (20643)
LTE Band 5 (Cell): 3 MHz	825.5 (20415)	N/A	836.5 (20525)	N/A	847.5 (20635)
LTE Band 5 (Cell): 5 MHz	826.5 (20425)	N/A	836.5 (20525)	N/A	846.5 (20625)
LTE Band 5 (Cell): 10 MHz	829 (20450)	N/A	836.5 (20525)	N/A	844 (20600)
LTE Band 66 (AWS): 1.4 MHz	1710.7 (131979)	1733.6 (132208)	N/A	1756.4 (132436)	1779.3 (132665)
LTE Band 66 (AWS): 3 MHz	1711.5 (131987)	N/A	1745 (132322)	N/A	1778.5 (132657)
LTE Band 66 (AWS): 5 MHz	1712.5 (131997)	N/A	1745 (132322)	N/A	1777.5 (132647)
LTE Band 66 (AWS): 10 MHz	1715 (132022)	N/A	1745 (132322)	N/A	1775 (132622)
LTE Band 66 (AWS): 15 MHz	1717.5 (132047)	N/A	1745 (132322)	N/A	1772.5 (132597)
LTE Band 66 (AWS): 20 MHz	1720 (132072)	N/A	1745 (132322)	N/A	1770 (132572)
LTE Band 4 (AWS): 1.4 MHz	1710.7 (19957)	N/A	1732.5 (20175)	N/A	1754.3 (20393)
LTE Band 4 (AWS): 3 MHz	1711.5 (19965)	N/A	1732.5 (20175)	N/A	1753.5 (20385)
LTE Band 4 (AWS): 5 MHz	1712.5 (19975)	N/A	1732.5 (20175)	N/A	1752.5 (20375)
LTE Band 4 (AWS): 10 MHz	1715 (20000)	N/A	1732.5 (20175)	N/A	1750 (20350)
LTE Band 4 (AWS): 15 MHz	1717.5 (20025)	N/A	1732.5 (20175)	N/A	1747.5 (20325)
LTE Band 4 (AWS): 20 MHz	1720 (20050)	N/A	1732.5 (20175)	N/A	1745 (20300)
LTE Band 2 (PCS): 1.4 MHz	1850.7 (18607)	N/A	1880 (18900)	N/A	1909.3 (19193)
LTE Band 2 (PCS): 3 MHz	1851.5 (18615)	N/A	1880 (18900)	N/A	1908.5 (19185)
LTE Band 2 (PCS): 5 MHz	1852.5 (18625)	N/A	1880 (18900)	N/A	1907.5 (19175)
LTE Band 2 (PCS): 10 MHz	1855 (18650)	N/A	1880 (18900)	N/A	1905 (19150)
LTE Band 2 (PCS): 15 MHz	1857.5 (18675)	N/A	1880 (18900)	N/A	1902.5 (19125)
LTE Band 2 (PCS): 20 MHz	1860 (18700)	N/A	1880 (18900)	N/A	1900 (19100)
UE Category	6				
Modulations Supported in UL	QPSK, 16QAM				
LTE MPR Permanently implemented per 3GPP TS 36.101 section 6.2.3~6.2.5? (manufacturer attestation to be provided)	YES				
A-MPR (Additional MPR) disabled for SAR Testing?	YES				
LTE Carrier Aggregation Possible Combinations	The technical description includes all the possible carrier aggregation combinations				
LTE Release 10 Additional Information	This device does not support full CA features on 3GPP Release 10. It supports a maximum of 2 carriers in the downlink. All uplink communications are identical to the Release 8 Specifications. Uplink communications are done on the PCC. The following LTE Release 10 Features are not supported: Relay, HetNet, Enhanced MIMO, eICIC, WIFI Offloading, MDH, eMBMS, Cross-Carrier Scheduling, Enhanced SC-FDMA				

FCC ID: A3LSMA520W	 SAR EVALUATION REPORT 		Approved by: Quality Manager
Document S/N: 1M1703080088-01.A3L	Test Dates: 03/08/17	DUT Type: Portable Handset	Page 5 of 11

3 FCC MEASUREMENT PROCEDURES

Power measurements for licensed transmitters are performed using a base station simulator under digital average power.

3.1 Downlink Only Carrier Aggregation

Conducted power measurements with LTE Carrier Aggregation (CA) (downlink only) active are made in accordance to KDB Publication 941225 D05Av01r02. The RRC connection is only handled by one cell, the primary component carrier (PCC) for downlink and uplink communications. After making a data connection to the PCC, the UE device adds secondary component carrier(s) (SCC) on the downlink only. All uplink communications and acknowledgements remain identical to specifications when downlink carrier aggregation is inactive on the PCC. For every supported combination of downlink only carrier aggregation, additional conducted output powers are measured with the downlink carrier aggregation active for the configuration with highest measured maximum conducted power with downlink carrier aggregation inactive measured among the channel bandwidth, modulation, and RB combinations in each frequency band. Per FCC KDB Publication 941225 D05Av01r02, no SAR measurements are required for carrier aggregation configurations when the average output power with downlink only carrier aggregation active is not more than 0.25 dB higher than the average output power with downlink only carrier aggregation inactive.

The downlink PCC channel was paired with the selected PCC uplink channel according to normal configurations without carrier aggregation. For contiguous intra-band CA, the downlink channel spacing between the component carriers was set to multiple of 300 kHz less than the nominal channel spacing defined in section 5.4.1A of 3GPP TS 36.521. For non-contiguous intra-band CA, the downlink channel spacing between the component carriers was set to be larger than the nominal channel spacing and provided maximum separation between the component carriers. All selected downlink channels remained fully within the downlink transmission band of the respective component carrier.

FCC ID: A3LSMA520W	 SAR EVALUATION REPORT 		Approved by: Quality Manager
Document S/N: 1M1703080088-01.A3L	Test Dates: 03/08/17	DUT Type: Portable Handset	Page 6 of 11

4 RF CONDUCTED POWERS

4.1 LTE Conducted Powers

4.1.1 LTE Carrier Aggregation Conducted Powers

Table 4-1
LTE Carrier Aggregation Conducted Powers – Max Power

PCC									SCC				Power	
PCC Band	PCC Bandwidth [MHz]	PCC (UL) Channel	PCC (UL) Frequency [MHz]	Modulation	PCC UL# RB	PCC UL RB Offset	PCC (DL) Channel	PCC (DL) Frequency [MHz]	SCC Band	SCC Bandwidth [MHz]	SCC (DL) Channel	SCC (DL) Frequency [MHz]	LTE Rel 10 Tx.Power (dBm)	LTE Rel. 8 Tx.Power (dBm)
LTE B66	5	131997	1712.5	QPSK	1	12	66461	2112.5	LTE B66	20	67036	2170	21.74	22.08
LTE B66	5	131997	1712.5	QPSK	1	12	66461	2112.5	LTE B66	15	66560	2122.4	21.62	22.08
LTE B66	5	131997	1712.5	QPSK	1	12	66461	2112.5	LTE B66	20	66584	2124.8	21.64	22.08

Table 4-2
LTE Carrier Aggregation Conducted Powers – Reduced Power

PCC									SCC				Power	
PCC Band	PCC Bandwidth [MHz]	PCC (UL) Channel	PCC (UL) Frequency [MHz]	Modulation	PCC UL# RB	PCC UL RB Offset	PCC (DL) Channel	PCC (DL) Frequency [MHz]	SCC Band	SCC Bandwidth [MHz]	SCC (DL) Channel	SCC (DL) Frequency [MHz]	LTE Rel 10 Tx.Power (dBm)	LTE Rel. 8 Tx.Power (dBm)
LTE B66	15	132047	1717.5	QPSK	1	0	66511	2117.5	LTE B66	20	67036	2170	19.70	20.06
LTE B66	15	132047	1717.5	QPSK	1	0	66511	2117.5	LTE B66	5	66610	2127.4	19.88	20.06
LTE B66	15	132047	1717.5	QPSK	1	0	66511	2117.5	LTE B66	20	66685	2134.9	19.76	20.06

Notes:

1. The device only supports downlink Carrier Aggregation. Uplink Carrier Aggregation is not supported. For every supported combination of downlink carrier aggregation, power measurements were performed with the downlink carrier aggregation active for the configuration with highest measured maximum conducted power with downlink carrier aggregation inactive measured among the channel bandwidth, modulation, and RB combinations in each frequency band. For contiguous intra-band CA, the downlink channel spacing between the component carriers was set to multiple of 300 kHz less than the nominal channel spacing defined in section 5.4.1A of 3GPP TS 36.521. For non-contiguous intra-band CA, the downlink channel spacing between the component carriers was set to be larger than the nominal channel spacing and provided maximum separation between the component carriers. All selected downlink channels remained fully within the downlink transmission band of the respective component carrier.
2. All control and acknowledge data is sent on uplink channels that operate identical to specifications when downlink carrier aggregation is inactive.
3. Per KDB Publication 941225 D05Av01r02, SAR for LTE CA operations was not needed since the maximum average output power in LTE CA mode was not >0.25 dB higher than the maximum output power when downlink carrier aggregation was inactive.
4. See RF Exposure Technical Report S/N 1M1701050017-01.A3L for complete RF conducted output power measurements.



Figure 4-1
Power Measurement Setup

FCC ID: A3LSMA520W	 SAR EVALUATION REPORT 		Approved by: Quality Manager
Document S/N: 1M1703080088-01.A3L	Test Dates: 03/08/17	DUT Type: Portable Handset	Page 7 of 11

5 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Rohde & Schwarz	CMW500	Radio Communication tester	3/25/2016	Annual	3/25/2017	128633
Pasternack	NC-100	Torque Wrench	5/21/2015	Biennial	5/21/2017	N/A
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139

FCC ID: A3LSMA520W	 SAR EVALUATION REPORT 			Approved by: Quality Manager
Document S/N: 1M1703080088-01.A3L	Test Dates: 03/08/17	DUT Type: Portable Handset		Page 8 of 11

6 CONCLUSION

6.1 Measurement Conclusion

The SAR evaluation indicates that the EUT complies with the RF radiation exposure limits of the FCC and Innovation, Science, and Economic Development Canada, with respect to all parameters subject to this test. These measurements were taken to simulate the RF effects of RF exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The results and statements relate only to the item(s) tested.

Please note that the absorption and distribution of electromagnetic energy in the body are very complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease). Because various factors may interact with one another to vary the specific biological outcome of an exposure to electromagnetic fields, any protection guide should consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables. [3]

FCC ID: A3LSMA520W	 SAR EVALUATION REPORT 	Approved by: Quality Manager
Document S/N: 1M1703080088-01.A3L	Test Dates: 03/08/17	DUT Type: Portable Handset
		Page 9 of 11

7

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FCC ID: A3LSMA520W	 SAR EVALUATION REPORT 		Approved by: Quality Manager
Document S/N: 1M1703080088-01.A3L	Test Dates: 03/08/17	DUT Type: Portable Handset	Page 10 of 11

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FCC ID: A3LSMA520W	 SAR EVALUATION REPORT 		Approved by: Quality Manager
Document S/N: 1M1703080088-01.A3L	Test Dates: 03/08/17	DUT Type: Portable Handset	Page 11 of 11