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SAR CHAR REPORT

Applicant Name: SAMSUNG Electronics Co., Ltd. 129, Samsung-ro, Yeongtong-gu, Suwon-Si, Gyeonggi-do, 16677 Rep. of Korea	Date of Issue: Jul.20, 2022 Test Report No.: HCT-SR-2207-FC028-R1 Test Site: HCT CO., LTD.
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FCC ID:

A3LSMA536V

Report Type: Part 0 SAR Characterization
Application Type: Class II Permissive Change
Equipment Type: Mobile Phone
Model Name: SM-A536V

This device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in FCC KDB procedures and had been tested in accordance with the measurement procedures specified in FCC KDB procedures.

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.

Tested By

Moon-pyung Choi
Test Engineer
SAR Team
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Reviewed By

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REVISION HISTORY

The revision history for this test report is shown in table.

Revision No.	Date of Issue	Description
0	Jul. 15, 2022	Initial Release
1	Jul. 20, 2022	Revised Page 8

This test results were applied only to the test methods required by the standard.

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1. Test Location

1.1 Test Laboratory

Company Name	HCT Co., Ltd.
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1.2 Test Facilities

Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025.

Korea	National Radio Research Agency (Designation No. KR0032)
	KOLAS (Testing No. KT197)

2. DEVICE UNDER TEST

2.1 General Information of the EUT

Device Wireless specification overview		
Band & Mode	Operating Mode	Tx Frequency
GSM850	Voice / Data	824.2 MHz ~ 848.8 MHz
GSM1900	Voice / Data	1 850.2 MHz ~ 1 909.8 MHz
UMTS Band 5	Voice / Data	826.4 MHz ~ 846.6 MHz
UMTS Band 2	Voice / Data	1 852.4 MHz ~ 1 907.6 MHz
LTE Band 2 (PCS)	Voice / Data	1 850.7 MHz ~ 1 909.3 MHz
LTE Band 4 (AWS)	Voice / Data	1 710.7 MHz ~ 1 754.3 MHz
LTE Band 5 (Cell)	Voice / Data	824.7 MHz ~ 848.3 MHz
LTE Band 7	Voice / Data	2 502.5 MHz ~ 2 567.5 MHz
LTE Band 12	Voice / Data	699.7 MHz ~ 715.3 MHz
LTE Band 13	Voice / Data	779.5 MHz ~ 784.5 MHz
LTE TDD Band 48	Voice / Data	3 552.5 MHz ~ 3697.5 MHz
LTE Band 66 (AWS)	Voice / Data	1 710.7 MHz ~ 1 779.3 MHz
NR Band n2	Voice / Data	1 852.5 MHz ~ 1 907.5 MHz
NR Band n5	Voice / Data	826.5 MHz ~ 846.5 MHz
NR Band n48	Voice / Data	3 555 MHz ~ 3 694.98 MHz
NR Band n66	Voice / Data	1 712.5 MHz ~ 1 777.5 MHz
NR Band n77	Voice / Data	3 710 MHz ~ 3 969.99 MHz
NR Band 77(DoD)	Voice / Data	3 450 MHz ~ 3 550 MHz
NR Band n261	Data	27500 MHz ~ 28350 MHz
NR Band n260	Data	37000 MHz ~ 40000 MHz
U-NII-1	Voice / Data	5 180 MHz ~ 5 240 MHz
U-NII-2A	Voice / Data	5 260 MHz ~ 5 320 MHz
U-NII-2C	Voice / Data	5 500 MHz ~ 5 720 MHz
U-NII-3	Voice / Data	5 745 MHz ~ 5 825 MHz
2.4 GHz WLAN	Voice / Data	2 412 MHz ~ 2 472 MHz
Bluetooth / LE 5.0	Data	2 402 MHz ~ 2 480 MHz
NFC	Data	13.56 MHz

2.2 Introduction of SAR/PD compliance test with TAS algorithm

FCC RF exposure limit is based on time –averaged RF exposure. Both SAR and PD regulatory specifications are defined over certain measurement duration allowing for time-averaging. The Samsung S.LSI proprietary TAS (Time Average SAR) algorithm has been designed to meet the compliance limits over the required duration, while still allowing dynamic control of transmit power to satisfy the performance of the system.

This test report shows SAR and Power density characterization of sub 6 GHz and mmWave. The characterization is achieved by determination of Plimit.

This feature performs time averaging SAR algorithm in real time to control and manage transmitting power and ensure the time-averaged RF exposure is in compliance with FCC requirements all the time.

The The 2G/3G communication mode and WLAN/BT mode are not controlled by The Samsung S.LSI proprietary TAS (Time Average SAR) algorithm.

In the wireless mode of 2G/3G, the output power is not dynamically controlled by the TAS algorithm, but the static Plimit output is applied to comply with the SAR_Target specified by the manufacturer.

The Samsung S.LSI proprietary TAS (Time Average SAR) algorithm controls the output Power within the time window of the radio mode corresponding to each frequency band in real time to meet FCC's TER requirements with 2G/3G/4G/5G and 5G nr FR2 mmwave.

SAR Characterization confirms that Plimit in the 2G/3G4G/5G communication mode declared by the manufacturer satisfies SAR_target.

PD Characterization is determined by compensating Plimit satisfying PD_target for simulation results and actual deviation based on the Worst case result of simulation in 5GFR2n260/n261 mode of DUT carried out by the manufacturer.

The compliance test under the static transmission scenario and simultaneous transmission analysis are reported in SAR report for Sub 6GHz and PD Report for mmWave. The validation of The Samsung S.LSI proprietary TAS (Time Average SAR) algorithm and compliance under the time- varying transmission scenario for WWAN technologies are reported in TAS Validation report

Term	Description
Plimit	The Time-averaged RF power that corresponds to SAR_target or PD_target.
Pmax	Maximum Tx power that can be transmitted physically from RFIC for a given RAT.
SAR_target	Target SAR level used in TAS algorithm. This SAR value should be less than FCC limit and should be determined after accounting for all uncertainties and other design considerations.
SAR_FCC_Limit	SAR Limit specified by FCC 1.6 W/kg averaged over 1g, for head and body exposure and 4W/kg averaged over 10g, for Phablet SAR.
PD_target	Target PD level used in TAS algorithm. This PD value should be less than FCC limit and should be determined after accounting for all uncertainties and other design considerations.
PD_FCC_Limit	PD Limit specified by FCC 10 W/m ² averaged over 4cm ² .
SAR Characterization	Characterization of SAR value for mmWave technology..
PD Characterization	Characterization of PD value for mmWave technology.

3. SAR CHACTERIZATION.

It should be confirmed that Plimit and SAR_target applied by OEM to device in SAR characterization satisfy within the uncertainty of device through SAR measurement.

3.1 Design target for TAS

SAR_target is determined by ensuring that it is less than FCC SAR limit after accounting for total device designed related uncertainties specified by the manufacturer.

SAR_target			
$SAR_target < FCC_SAR_limit \times 10^{-Total\ Uncertainty/10}$			
1g SAR (W/kg)		10g SAR (W/kg)	
Total Uncertainty	1.0 dB	Total Uncertainty	1.0 dB
FCC_SAR_limit	1.6 W/kg	FCC_SAR_limit	4.0 W/kg
SAR_target	1.0 W/kg	SAR_target	2.5 W/kg

This device use differennt Radio SAR Index[RSI] to configure different Plimit based on certain exposure configurations for each 2G/3G/4G/5G wireless mode

Radio SAR Index (RSI)	Configuration
0	1.. Body Worn SAR 2. Phablet SAR measured at Maximum Power 3. Phablet SAR measured at 11, 7 and 13 mm spacing for back, front, bottom respectively 4. Phablet SAR measured at 0 mm for Top,Left and Right left and right surfaces
1	Head SAR conditions in wireless mode.
2	Hotspot SAR conditions in wireless mode. at 10 mm
3&4	Phablet SAR condition in which the grip sensor in the wireless mode is activated.. at 0 mm for back, front, and bottom surfaces. Ear jack inseted mode.

The SAR measurement results for each RSI in 2G/3G/4G/5G mode are included in Appendix A, and it can be seen that all Plimit outputs declared by the manufacturer are measured within SAR_Target

SAR_Target- specified by the manufacturer

SAR_Target [W/kg] For S.LSI TAS Algorithm									Pmax	
SAR Exposure Position			Max Power body Worn	Max Power Phablet SAR	Grip ON Phablet	RCV-ON Head	Hotspot (10mm)	EarJack	Burst Averaged Power	Uncertainty
Averaging volume			1g	10g	10g	1g	1g	1g		
Mode	Band	Antenna	RSI=0	RSI=0	RSI=3	RSI=1	RSI=2	RSI=4	[dBm]	[dB]
NR TDD	n48	Sub 3	17.5	17.5	17.5	17.5	17.5	17.5	22.5	1.0

Note :

1. All Plimit levels entered in above Table correspond to average power levels after accounting for duty cycle in the case of TDD modulation schemes (for e.g., GSM/LTE TDD/NR TDD).
2. The Pmax of GSM/LTE TDD/NR TDD was written as burst averaged power

Appendix A: Results of SAR in Plimit specified by the manufacturer.

Table A-1 RSI=1 – NR Head SAR

For some bands/modes, a lower *PLimit* was selected as a more conservative evaluation.

NR TDD Bands : In the case of the NR TDD bands, the duty factor =100% was applied to the burst power.SAR measurements of all NR bands were measured in FTM Mode.

MEASUREMENT RESULTS														
Frequency		Mode		Band width	Frame Averaged Conducted Power	Test Configurations		MPR	RB Size	RB offset	Duty Cycle	Meas. SAR(1g)	SAR_target (1g)	Plimit
Mhz	Ch.			(MHz)	(dBm)			(dB)				(W/kg)	(W/kg)	(dBm)
3 679.98	645332	NR Band n48	High	40	18.47	Left Cheek	DFT-s-OFDM QPSK	0	1	53	1:1	0.217	1.0	17.5
3 679.98	645332	NR Band n48	High	40	18.47	Left Tilt	DFT-s-OFDM QPSK	0	1	53	1:1	0.252	1.0	17.5
3 679.98	645332	NR Band n48	High	40	18.47	Right Cheek	DFT-s-OFDM QPSK	0	1	53	1:1	0.685	1.0	17.5
3 679.98	645332	NR Band n48	High	40	18.47	Right Tilt	DFT-s-OFDM QPSK	0	1	53	1:1	0.719	1.0	17.5

The Plimit of /NR TDD was written as Frame averaged power

Table A-2 RSI = 0 - NR Body-Worn SAR

For some bands/modes, a lower P_{Limit} was selected as a more conservative evaluation.

NR TDD Bands : In the case of the NR TDD bands, the P_{Limit} , the duty factor =100 was applied to the burst power.

SAR measurements of all NR bands were measured in FTM Mode.

MEASUREMENT RESULTS															
Frequency		Mode		Band width	Frame Averaged Conducted Power	Test Configurations		MPR	Spacing (mm)	RB Size	RB offset	Duty Cycle	Meas. SAR(1g)	SAR_target (1g)	Plimit
Mhz	Ch.			Mhz	(dBm)			(dB)					(W/kg)	(W/kg)	(dBm)
3 679.98	645332	NR Band n48	High	40	18.47	Back	DFT-s-OFDM QPSK	0	15	1	53	1:1	0.150	1.0	17.5
3 679.98	645332	NR Band n48	High	40	18.47	Front	DFT-s-OFDM QPSK	0	15	1	53	1:1	0.087	1.0	

The Plimit of NR TDD was written as Frame averaged power

Table A-3 RSI = 2 – NR Hotspot SAR

For some bands/modes, a lower P_{Limit} was selected as a more conservative evaluation.

NR TDD Bands : In the case of the NR TDD bands, the Plimit the duty factor=100% was applied to the burst power.

SAR measurements of all NR bands were measured in FTM Mode.

MEASUREMENT RESULTS															
Frequency		Mode		Band width	Frame Averaged Conducted Power	Test Position		MPR	Spacing (mm)	RB Size	RB offset	Duty Cycle	Meas. SAR(1g)	SAR_target (1g)	Plimit
Mhz	Ch.			Mhz	(dBm)			(dB)					(W/kg)	(W/kg)	(dBm)
3 679.98	645332	NR Band n48	High	40	18.47	Back	DFT-s-OFDM QPSK	0	10	1	53	1:1	0.247	1.0	17.5
3 679.98	645332	NR Band n48	High	40	18.47	Front	DFT-s-OFDM QPSK	0	10	1	53	1:1	0.210	1.0	
3 679.98	645332	NR Band n48	High	40	18.47	Left	DFT-s-OFDM QPSK	0	10	1	53	1:1	0.535	1.0	
3 679.98	645332	NR Band n48	High	40	18.47	TOP	DFT-s-OFDM QPSK	0	10	1	53	1:1	0.224	1.0	

The Plimit of NR TDD was written as Frame averaged power

Table A-4 RSI = 0 – NR Phablet Max SAR

For some bands/modes, a lower P_{Limit} was selected as a more conservative evaluation.

NR TDD Bands : In the case of the NR TDD bands, the Plimit the duty factor=100%, was applied to the burst power.

SAR measurements of all NR bands were measured in FTM Mode.

MEASUREMENT RESULTS															
Frequency		Mode		Band width	Frame Averaged Conducted Power	Test Position		MPR	Spacing (mm)	RB Size	RB offset	Duty Cycle	Meas. SAR(1g)	SAR_target 10g	Plimit
Mhz	Ch.			Mhz	(dBm)			(dB)					(W/kg)	(W/kg)	(dBm)
3 679.98	645332	NR Band n48	High	40	18.47	Back	DFT-s-OFDM QPSK	0	0	1	53	1:1	0.704	2.5	17.5
3 679.98	645332	NR Band n48	High	40	18.47	Front	DFT-s-OFDM QPSK	0	0	1	53	1:1	0.957	2.5	
3 679.98	645332	NR Band n48	High	40	18.47	Top	DFT-s-OFDM QPSK	0	0	1	53	1:1	0.639	2.5	
3 679.98	645332	NR Band n48	High	40	18.47	Left	DFT-s-OFDM QPSK	0	0	1	53	1:1	1.420	2.5	

The Plimit of NR TDD was written as Frame averaged power