D.1 Sub6 Antenna Groups

The 2nd generation of Smart Transmit (GEN2) operates based on pre-defined sub6 antenna groups (AG) and mmW module groups (MG). Sub6 Tx antennas in the device are grouped based on spatial variation of RF exposure distributions, where the RF exposure of one AG is mutually exclusive from other AG. This is accomplished by demonstrating either of below conditions for all exposure scenarios:

a) Sum of SAR of one antenna from each of the sub6 AGs and the RF exposure from radios outside Smart Transmit is less than regulatory limits. This condition must be demonstrated for all antenna combinations of sub6 AGs.

(or)

b) Every antenna from each sub6 AG meets SPLSR criteria (Section 4.3.2(c) in FCC KDB 447498 D01) with every antenna from another sub6 AG. This criteria must be demonstrated for all antenna combinations for each pair of AGs.

This device supports two sub6 AG: AG0 and AG1, with AG0 having 4 antennas (A, B, C, D) and AG1 having 4 antennas (E, F, G, H), and two WIFI/BT antennas outside of Smart Transmit. The conditions are verified through the following criterias:

i) (SAR1 + SAR2 criteria): If SPLSR criteria is not used, then the highest reported SAR at P_{limit} (or P_{max} when $P_{limit} > P_{max}$) for each antenna should be obtained out of all supported technologies and frequency bands for each DSI. Demonstrate that the sum of reported SAR of one antenna from each of the sub6 AGs and the sum of RF exposure from all supported radios outside of Smart Transmit should be less than the regulatory limit as given below for each DSI.

1. Obtain the worst-case reported SAR for each antenna group (i.e., maximum *reported* SAR at P_{limit} (or P_{max} when $P_{limit} > P_{max}$) out of all supported technologies, frequency bands and antennas in AG0 and AG1), denoted as max.SAR.AG0 and max.SAR.AG1, and obtain the worst-case RF exposure for each external radio, and demonstrate that the sum of these RF exposures meets: { [max.SAR.AG0+ max.SAR.AG1] + WIFI/BT Ant 1 + WIFI/BT Ant 2} ≤ 1.6 (for 1g, or 4.0 for 10g).

ii) (SPLSR criteria): For each antenna, obtain the highest reported SAR value at P_{limit} out of all supported technologies for each frequency band. Using these values, demonstrate for a given DSI that every antenna from one sub6 AG meets SPLSR criteria with every antenna in another sub6 AG for all frequency bands. This criteria must be demonstrated for all antenna pair combinations irrespective of supported simultaneous transmission scenarios as given below for each DSI:

- SPLSR criteria should be met for all antenna pair combinations of AG0 and AG1: {antenna (A, B, C, D) in AG0; antenna (E, F, G, H) in AG1. As it can be seen, these include all combinations of antenna groups, antennas, and frequency bands.

iii) (combination of SPLSR & SAR1+SAR2 criteria): If SPLSR criteria for all the combinations of sub6 antenna groups in (i) is demonstrated to show that each AG is mutually exclusive from other AGs, and if the WIFI/BT antennas supported outside of Smart Transmit do not meet SPLSR criteria, then the condition in (ii) reduces to: {max.SAR.AG0+ WIFI/BT Ant 1 + WIFI/BT Ant 2} ≤ 1.6 and {max.SAR.AG1+ WIFI/BT Ant 1 + WIFI/BT Ant 2} ≤ 1.6 for compliance demonstration (for 1g, or 4.0 for 10g).

FCC ID A3LSMS901U	**PCTEST** Proud to be part of element	**SAR EVALUATION REPORT**	SAMSUNG	**Approved by:** Quality Manager
Test Dates: 10/18/21 – 10/28/21	**DUT Type:** Portable Handset			APPENDIX D: Page 1 of 3

If SPLSR criteria evaluation and analysis is needed to determine compliance for a certain DSI configuration, SPLSR is performed by taking the highest reported SAR for each of the supported technologies and bands per antenna, along with the peak SAR locations. Per Qualcomm guidance, only Y-axis coordinates are recorded in the analysis for calculation simplicity (assumes all 0mm of separation on the x-axis). Peak locations are documented in Section D.7 below for each DSI configuration.

For bottom AG0, Y_max coordinate represents the worst case hotspot location that is closest to the top AG1. Similarly, for top AG1, Y_min coordinate represents the worst case hotspot location that is closest to the bottom AG0.

The following formula is used to calculate the SPLSR between AG0 and AG1 for each exposure configuration:

$$SPLSR = \frac{(Max\ SAR\ AG0 + Max\ SAR\ AG1)^{1.5}}{|Y_{max} - Y_{min}|}$$

Please see the original filing for the standalone reported SAR and antenna group separation distance for modes/bands/exposure conditions/positions that were not evaluated for this permissive change.

D.2 Head (DSI = 2) SAR Antenna Group Analysis

Table D-1
DSI=2 Held-to-ear AG1 Highest Reported SAR

	AG1					
Head SAR	Configuration	E	F	G	H	Max
	Right Cheek	0.423	0.589	0.840	0.002	0.840

Please see the original filing for highest reported simultaneous held-to-ear SAR of WLAN/BT antennas.

Table D-2
DSI=2 Held-to-ear AG Verification

	Configuration	AG0	AG1	WLAN/BT Worst-case Combination	AG0 + AG1 + WLAN/BT Worst-case
Head SAR	Right Cheek	0.350	0.840	0.558	See Table Below

Right Cheek							
	AG0		AG1		WLAN/BT	AG0 + AG1 +	SPLSR
Ant Combination	SAR	Position	SAR	Position	Worst-case	WLAN/BT	
Ant A-Ant G	0.350	-48.360	0.840	-18.340	0.558	See Note 2	0.04
Ant B-Ant G	0.071	N/A	0.840	N/A	0.558	1.469	N/A
Ant C-Ant G	0.015	N/A	0.840	N/A	0.558	1.413	N/A
Ant D-Ant G	0.000	N/A	0.840	N/A	0.558	1.398	N/A

Notes:
1. For all combinations where the sum of AG0+AG1+WLAN/BT is less than 1.6 W/kg, there's no further analysis required for compliance demonstration.
2. No evaluation was performed to determine the aggregate 1g SAR for these configurations as the SPLS ratio between the antenna pairs was not greater than 0.04 per FCC KDB 447498 D01v06. Please see Section D.7 for Y-axis peak locations

FCC ID A3LSMS901U	PCTEST *Proud to be part of ⊕ element*	**SAR EVALUATION REPORT**	SAMSUNG	**Approved by:** Quality Manager
Test Dates: 10/18/21 – 10/28/21	**DUT Type:** Portable Handset			APPENDIX D: Page 2 of 3

© 2022 PCTEST

D.3 Highest Report SAR and SAR Hotspot Locations

As a conservative assessment, the distances between AG0 and AG1 were determined using the y-axis coordinates of the peak locations only (assumes 0 mm separation on x/z axis).

Table D-3
DSI=2 Right Cheek Peak Y Coordinates

		AG1
		G
Mode/Band	Distance (mm)	0
NR Band n48	SAR	0.840
	Y-Axis	-18.340

D.4 Conclusion

The above SPLSR criteria for all of the combinations of sub6 antenna groups is demonstrated to show that AG0 is mutually exclusive from AG1. Additional analysis for simultaneous analysis for the antenna groups and WIFI/BT antennas compliance demonstration is included in Appendix E

FCC ID A3LSMS901U	PCTEST Proud to be part of element	**SAR EVALUATION REPORT**	SAMSUNG	**Approved by:** Quality Manager
Test Dates: 10/18/21 – 10/28/21	**DUT Type:** Portable Handset			APPENDIX D: Page 3 of 3

© 2022 PCTEST