



COMPLIANCE SUMMARY REPORT

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Document Serial No.:

1M2508270084-05.A3L

FCC ID:

A3LSMS942B

APPLICANT:

SAMSUNG ELECTRONICS CO., LTD

Report Type:

Compliance Summary

DUT Type:

Portable Handset

Model(s):

SM-S942B/DS

Additional Model(s):

SM-S942B



CERT #2041.01

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1 STRATEGY FOR COMPLIANCE DEMONSTRATION

1.1 RF Exposure Evaluation Strategy

This device implements the Samsung S.LSI Time-Averaged SAR (TAS) algorithm to dynamically control transmit power for 2G, 3G, 4G, and 5G WWAN operations, ensuring that time-averaged RF exposure remains compliant with applicable FCC requirements under all supported operating conditions.

For WLAN technologies, the device utilizes the Qualcomm FastConnect TAS feature, which independently manages WLAN transmit power to maintain compliance with applicable FCC RF exposure limits during both standalone and simultaneous transmission scenarios.

Radios not controlled by a TAS framework (e.g., NFC and WPT) are evaluated independently using static RF exposure evaluation procedures.

Demonstration of RF exposure compliance for the DUT configured with S.LSI TAS (WWAN) and Qualcomm FastConnect TAS (WLAN) is completed in three parts, as described below:

0. RF Exposure Compliance Test Report Part 0: SAR Characterization

RF exposure characterization is performed to establish the relationship between transmit power and RF exposure for each supported WWAN and WLAN radio configuration, frequency band, antenna configuration, and usage scenario. For WWAN technologies (2G/3G/4G/5G), SAR characterization data are used to derive the corresponding Plimit, which represents the maximum allowable time-averaged transmit power that satisfies FCC SAR requirements after accounting for device-related uncertainties. The derived Plimit values are stored in the device and used as inputs for the S.LSI TAS algorithm during operation. For WLAN, SAR characterization and conducted power measurements are used to support configuration of the Qualcomm FastConnect TAS, which independently controls WLAN transmit power.

1. RF Exposure Compliance Test Report Part 1: Test in Static Transmission Condition

Part 1 demonstrates compliance with FCC SAR limits under static transmission conditions, where the DUT operates at the predetermined maximum time-averaged power levels. For WWAN, the DUT transmits at the derived Plimit values controlled by the S.LSI TAS framework. For WLAN, the DUT operates at the corresponding FastConnect controlled power levels. Standalone and simultaneous transmission scenarios involving WWAN and WLAN/BT are evaluated in Part 1 to confirm compliance under static conditions.

2. RF Exposure Compliance Test Report Part 2: Test in Dynamic Transmission Condition

Part 2 demonstrates compliance under time-varying transmission conditions and validates the correct operation of both the S.LSI TAS algorithm for WWAN and the Qualcomm FastConnect TAS for WLAN. The test results confirm that the DUT remains compliant with FCC RF exposure requirements during time-varying operating scenarios involving dynamic transmit power variation and simultaneous transmission.

The S.LSI TAS and Qualcomm FastConnect TAS operate as independent RF exposure control mechanisms for WWAN and WLAN, respectively, each managing transmit power based on its own characterization and design targets. When both frameworks are active, simultaneous transmission compliance is evaluated under static transmission conditions in Part 1 Test Report.

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1.2 Nomenclature

Term	Description
P_{Limit}	Maximum allowable time-averaged transmit power corresponding to the SAR or PD design target, derived from SAR/PD characterization after accounting for all applicable device-related uncertainties
P_{Max}	Maximum transmit power that can be physically generated by the RFIC for a given RAT, corresponding to the maximum RF tune-up level.
T_{SAR}	Defined time-averaging window used for SAR evaluation for frequencies below 6 GHz, in accordance with the applicable regulatory requirements.
<i>SAR_design_target</i>	Target SAR level used in the TAS algorithm. This value is set below the SAR regulatory limit and is determined after accounting for total uncertainty and other design considerations.
<i>SAR Char</i>	SAR characterization table containing derived PLimit values for all supported technologies, frequency bands, antenna configurations, and usage scenarios.
<i>regulatory body</i>	Regulatory authority that the TAS algorithm is designed to comply with (e.g., FCC). The applicable time-averaging window and evaluation methodology are dependent on the regulatory body.
<i>SAR_regulatory_limit</i>	SAR limit specified by the FCC for RF exposure compliance.

1.3 Bibliography

Report Type	Report Serial Number
RF Exposure Part 0 Test Report	1M2508270084-02.A3L
RF Exposure Part 1 Test Report	1M2508270084-01.A3L
RF Exposure Part 2 WWAN Test Report	1M2508270084-03.A3L
RF Exposure Part 2 WLAN Test Report	1M2508270084-04.A3L

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2 TIME AVERAGING ALGORITHM

2.1 Algorithm Description

FCC RF exposure limits are defined in terms of time-averaged exposure over specified regulatory time windows. The DUT implements independent Time-Averaged SAR (TAS) mechanisms for WWAN and WLAN technologies to ensure compliance with the applicable FCC RF exposure limits under all operating conditions.

Each TAS mechanism controls transmit power based on pre-characterized RF exposure behavior, such that the applicable time-averaged SAR or power density (PD) limits are not exceeded.

Compliance under simultaneous transmission conditions is demonstrated through combined evaluation of the independently controlled WWAN and WLAN transmitters, as documented in this report.

2.1.1 S.LSI TAS Algorithm (WWAN)

The Samsung S.LSI TAS algorithm is implemented to control transmit power for WWAN operations in accordance with FCC RF exposure limits defined in terms of time-averaged exposure.

The algorithm dynamically manages instantaneous transmit power such that the RF exposure averaged over the applicable regulatory time window does not exceed the corresponding SAR or PD design target.

For a given device configuration, RF exposure is proportional to transmit power. Once RF exposure is characterized at a known transmit power level, RF exposure at other power levels for the same configuration is determined through linear scaling.

Accordingly, transmit power is controlled such that the time-averaged RF exposure remains within the applicable regulatory limits.

The S.LSI TAS algorithm applies across all supported WWAN frequency ranges. The applicable RF exposure metric is SAR for frequencies below 6 GHz and PD for frequencies above 6 GHz.

For simultaneous transmission scenarios within WWAN, the algorithm manages the aggregate RF exposure such that the total exposure ratio remains within the applicable regulatory limit.

2.1.2 Qualcomm FastConnect TAS (WLAN)

For WLAN technologies, the DUT utilizes the Qualcomm FastConnect TAS algorithm to control transmit power in accordance with FCC RF exposure requirements based on time-averaged exposure.

The algorithm manages RF exposure such that exposure, averaged over the defined regulatory time window, remains within the applicable SAR or PD limits.

The time-averaging windows are denoted as TSAR for SAR (frequencies below 6 GHz) and TPD for PD (frequencies above 6 GHz).

For WLAN operation, RF exposure is proportional to transmit power. Once RF exposure is characterized at a given transmit power level, RF exposure at other power levels for the same configuration is determined through linear scaling.

Accordingly, transmit power is controlled such that the time-averaged RF exposure remains within the applicable regulatory limits.

The Qualcomm FastConnect TAS algorithm regulates the time-averaged transmit power to remain at or below a predefined power limit (PLimit), corresponding to the applicable SAR or PD limit.

In simultaneous transmission scenarios involving multiple WLAN transmitters, the algorithm manages each transmitter such that the total RF exposure ratio remains within the applicable regulatory limit.

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2.2 TAS Control Framework

This section describes the TAS control framework applied to WWAN and WLAN operations in the frequency range below 6 GHz. The framework defines how time-averaged RF exposure is managed using the applicable regulatory metrics and control parameters for each technology.

The following subsections present the specific TAS implementations for S.LSI TAS (WWAN) and Qualcomm FastConnect TAS (WLAN), including the corresponding treatment of simultaneous transmission conditions.

2.2.1 Time-Averaged SAR Control - S.LSI TAS (WWAN)

For frequencies below 6 GHz, RF exposure compliance is evaluated using Specific Absorption Rate (SAR).

- The TAS framework ensures that the time-averaged SAR over the defined SAR averaging window (T_{SAR}) satisfies the following condition:

$$\frac{1}{T_{SAR}} \int_{t-T_{SAR}}^t SAR(\tau) d\tau \leq SAR_{design_target}$$

Equation 2-1

Where:

$SAR(\tau)$ is the instantaneous SAR corresponding to the instantaneous transmit power at time τ ,

T_{SAR} is the SAR averaging window defined by FCC requirements,

SAR_{design_target} is the predefined SAR design target derived from baseline characterization and uncertainty considerations.

- Instantaneous transmit power may temporarily exceed the power corresponding to the SAR design target; however, the TAS framework ensures that the integrated SAR over any averaging window remains within the SAR design target.
- In simultaneous transmission scenarios involving multiple radios or antenna groups, the TAS framework evaluates RF exposure using the Total Exposure Ratio (TER) concept. The TER represents the sum of normalized time-averaged exposure contributions from all active transmitters and is required to remain less than or equal to unity at all times. The TAS framework dynamically allocates exposure budget among active transmitters to ensure continued compliance under simultaneous operation.

2.2.2 Time-Averaged Tx Power Control - FastConnect TAS (WLAN)

The Qualcomm FastConnect algorithm controls and manages the instantaneous transmit power (Tx) to maintain the time-averaged Tx power and therefore, time-averaged RF exposure in compliance with FCC limits.

- If time-averaged transmit power approaches P_{Limit} , then the modem needs to limit instantaneous transmit power to ensure the time-averaged transmit power does not exceed P_{Limit} in any T_{SAR} time windows since the time-averaged RF exposure is required to comply with the FCC RF exposure limit in any T_{SAR} time window.
- The wireless device can instantaneously transmit at high transmit powers and exceed the P_{Limit} level for a short duration before limiting the power to maintain the time-averaged transmit power under P_{Limit} .
- If the wireless device transmits at high power for a long time, then the radio link needs to be dropped to be compliant with time-averaged Tx power requirement.

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- To avoid dropping the radio link, TAS algorithm starts the power limiting enforcement earlier in time to back off the Tx power to a reserve level (denoted as $P_{reserve}$), so the wireless device can maintain the radio link at a minimum reserve power level for as long as needed, and at the same time ensure the time-averaged Tx power over any defined time window is less than P_{Limit} at all times. At all times, TAS meets the below equation:

$$time.avg.Tx\ power = \frac{1}{T_{SAR}} \int_{t-T_{SAR}}^t inst.Tx\ power(t) dt \leq P_{limit}$$

Equation 2-2

where, *time.avg.Tx power* is the transmit power averaged between $t-T_{SAR}$ and t time period; T_{SAR} is the time window defined by FCC for time-averaging RF exposure for Tx frequency less than 6GHz (sub6); *inst. Tx power (t)* is the instantaneous transmit power at t time instant; P_{Limit} is the predefined time-averaged power limit.

- In the case of simultaneous transmission, TAS manages all active transmitters and make sure the total exposure ratio is less than 1

$$\sum \frac{\frac{1}{T_{SAR}} \int_{t-T_{SAR}}^t SAR(t) dt}{FCC\ SAR\ limit} \leq 1$$

Equation 2-3

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2.3 Definitions of uncertainty and design target

Term	Description
<i>SAR_regulatory_limit</i>	1.6W/Kg at 1g SAR for head 1.6 W/Kg at 1g SAR for body (Hotspot) 4.0W/Kg at 10g SAR for extremity
<i>total_uncertainty_SAR</i>	1.0 dB (considering Tx power variation, part to part deviation, etc.)
<i>SAR_design_target</i>	<i>SAR_design_target</i> should be less than 1.27 W/Kg Considering safety margin, 1.0 W/Kg is used as the value of <i>SAR_design_target</i>

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3 DUT DESCRIPTION

3.1 Device Overview

Band & Mode	Operating Modes	Tx Frequency
GSM/GPRS/EDGE 850	Voice/Data	824.20 - 848.80 MHz
GSM/GPRS/EDGE 1900	Voice/Data	1850.20 - 1909.80 MHz
UMTS 850	Voice/Data	826.40 - 846.60 MHz
UMTS 1750	Voice/Data	1712.4 - 1752.6 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 26	Voice/Data	814.7 - 848.3 MHz
LTE Band 5	Voice/Data	824.7 - 848.3 MHz
LTE Band 66	Voice/Data	1710.7 - 1779.3 MHz
LTE Band 4	Voice/Data	1710.7 - 1754.3 MHz
LTE Band 25	Voice/Data	1850.7 - 1914.3 MHz
LTE Band 2	Voice/Data	1850.7 - 1909.3 MHz
LTE Band 41	Voice/Data	2498.5 - 2687.5 MHz
NR Band n12	Voice/Data	701.5 - 713.5 MHz
NR Band n26	Voice/Data	816.5 - 846.5 MHz
NR Band n5	Voice/Data	826.5 - 846.5 MHz
NR Band n66	Voice/Data	1712.5 - 1777.5 MHz
NR Band n25	Voice/Data	1852.5 - 1912.5 MHz
NR Band n2	Voice/Data	1852.5 - 1907.5 MHz
NR Band n41	Voice/Data	2501.01 - 2685 MHz
NR Band n77	Voice/Data	3455.01 - 3544.98 MHz; 3705 - 3975 MHz
2.4 GHz WIFI	Voice/Data	2412 - 2472 MHz
5 GHz WIFI	Voice/Data	U-NII-1: 5180 - 5240 MHz U-NII-2A: 5260 - 5320 MHz U-NII-2C: 5500 - 5720 MHz U-NII-3: 5745 - 5825 MHz U-NII-4: 5845 - 5885 MHz
6 GHz WIFI	Voice/Data	U-NII-5: 5935 - 6415 MHz U-NII-6: 6435 - 6515 MHz U-NII-7: 6535 - 6875 MHz U-NII-8: 6895 - 7115 MHz
2.4 GHz Bluetooth	Data	2402 - 2480 MHz
NFC	Data	13.56 MHz
WPT	N/A	110 kHz - 145 kHz

This DUT implements independent Time-Averaged SAR (TAS) frameworks for its supported radio operations. For WWAN technologies, the DUT implements the Samsung S.LSI TAS framework to control and manage transmit power in real time in accordance with FCC time-averaged RF exposure requirements. For WLAN technologies, the DUT utilizes the Qualcomm FastConnect TAS framework to manage transmit power based on time-averaged RF exposure criteria..

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4 COMPLIANCE SUMMARY

4.1 RF Exposure Compliance Summary

All transmission scenarios supported by the DUT operate within the applicable FCC RF exposure requirements when the implemented TAS frameworks are applied. For radios controlled by TAS, worst-case static transmission and simultaneous transmission scenarios are addressed under Part 1 test conditions at the applicable power levels, while the correct operation of the TAS mechanisms under time-varying transmission conditions is validated separately under Part 2 test conditions.

For WWAN operations, RF exposure control is provided by the Samsung S.LSI TAS framework, and for WLAN operations, RF exposure control is provided by the Qualcomm FastConnect TAS framework.

Radios not controlled by the TAS framework are evaluated independently under Part 1 test conditions using applicable RF exposure evaluation procedures. Based on these evaluations, the DUT operates within the applicable FCC RF exposure limits for all supported operating conditions, including simultaneous transmission scenarios.

Table 4-1
Reported RF Exposure Levels

	RFx Evaluation	Power Level	FCC Limit	<u>Reported</u> RF Exposure Level	Test Report
SAR (W/kg)	Standalone 1g SAR	P_{limit}	1.6	1.18	RF Exposure Part 1 Test Report
	Standalone 10g SAR	P_{limit}	4.0	2.20	
	Simultaneous Tx 1g SAR	P_{limit}	1.6	1.59	
	Simultaneous Tx 10g SAR	P_{limit}	4.0	2.57	

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