SAR EVALUATION REPORT

FCC 47 CFR § 2.1093
IEEE Std. 1528-2013

For
Smart POS

FCC ID: : 2AGQ6-D60

Model: D60

Report Number: 4790950508-SAR-1

Issue Date: Oct. 18, 2023

Prepared for
Dspread Technology(Beijing) Inc
Rm.407, B12C, #10(Universal Business Park), Jiuxianqiao Road, Chaoyang District, Beijing, 100015, China

Prepared by
UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch
Building 10, Innovation Technology Park, No. 1, Li Bin Road, Song Shan Lake Hi-Tech Development Zone Dongguan, People's Republic of China

Tel: +86 769 22038881
Fax: +86 769 33244054
Website:

Revision History

Rev.	Date	Revisions	Revised By
V1.0	Oct. 18, 2023	Initial Issue	\

Note:

1. The Measurement result for the sample received is<Pass> according to < IEEE Std. 1528-2013> when <Accuracy Method> decision rule is applied.
2. This report is only published to and used by the applicant, and it is not for evidence purpose in China.

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1. Attestation of Test Results

Applicant Name	Dspread Technology(Beijing) Inc			
Address	Rm.407, B12C, #10(Universal Business Park), Jiuxianqiao Road, Chaoyang District, Beijing, 100015, China			
Manufacturer	Dspread Technology(Beijing) Inc			
Address	Rm.407, B12C, #10(Universal Business Park), Jiuxianqiao Road, Chaoyang District, Beijing, 100015, China			
EUT Name	Smart POS			
Model	D60			
Sample Status	Normal			
Sample Received Date	Aug 2, 2023			
Date of Tested	Aug 31,2023~ Oct 18,2023			
Applicable Standards	FCC 47 CFR § 2.1093 IEEE Std. 1528-2013 KDB publication			
SAR Limits (W/Kg)				
Exposure Category	Peak spatial-average (1g of tissue)		Extremities (hands, wrists, ankles, etc.) (10g of tissue)	
General population / Uncontrolled exposure	1.6		4	
The Highest Reported SAR (W/kg)				
RF Exposure Conditions	**Equipment Class**			
	PCB	**DTS**	**NII**	**DSS**
Body-(1-g)	1.325	0.716	1.234	0.165
Simultaneous Transmission (1-g)	1.446			
Test Results	Pass			
Prepared By: Burt Hu Burt Hu Laboratory Engineer	Reviewed By: Denny Huang Denny Huang Senior Project Engineer		Approved By: Stephen Guo Stephen Guo Laboratory Manager	

2. Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with IEEE Std.1528-2013 the following FCC Published RF exposure KDB procedures:

- 248227 D01 802.11 Wi-Fi SAR
- 447498 D01 General RF Exposure Guidance
- 690783 D01 SAR Listings on Grants
- 865664 D01 SAR measurement 100 MHz to 6 GHz
- 865664 D02 RF Exposure Reporting
- 941225 D05 SAR for LTE Devices v02r05
- 941225 D07 UMPC Mini Tablet v01r02
- 941225 D01 3G SAR Procedures

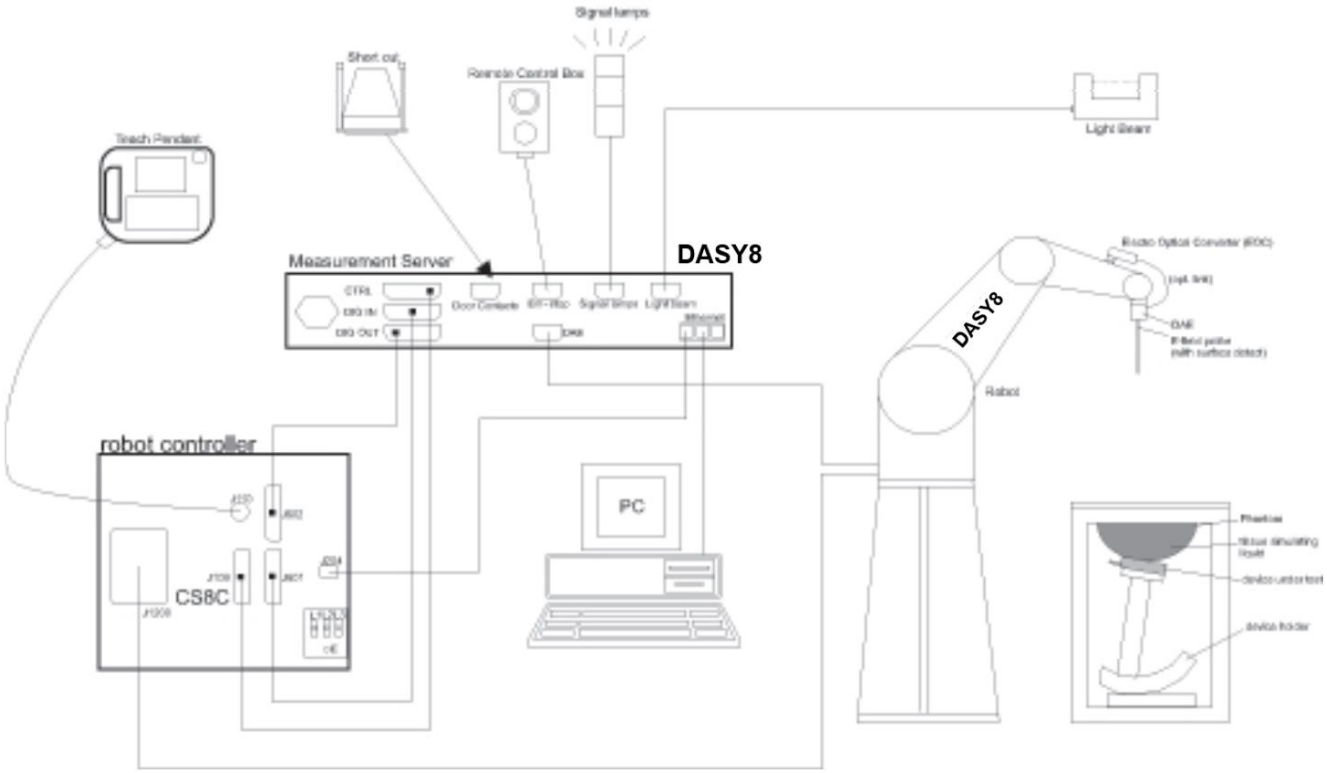
3. Facilities and Accreditation

Test Location	UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch.
Address	Building 10, Innovation Technology Park, Song Shan Lake Hi tech Development Zone, Dongguan, 523808, China
Accreditation Certificate	**A2LA (Certificate No.: 4102.01)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been assessed and proved to be in compliance with A2LA. **FCC (FCC Designation No.: CN1187)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. Has been recognized to perform compliance testing on equipment subject to the Commission's Delcaration of Conformity (DoC) and Certification rules **ISED (Company No.: 21320)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been registered and fully described in a report filed with ISED. The Company Number is 21320 and the test lab Conformity Assessment Body Identifier (CABID) is CN0046. **VCCI (Registration No.: G-20019, R-20004, C-20012 and T-20011)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been assessed and proved to be in compliance with VCCI, the Membership No. is 3793. Facility Name: Chamber D, the VCCI registration No. is G-20019 and R-20004 Shielding Room B , the VCCI registration No. is C-20012 and T-20011
Description	All measurement facilities use to collect the measurement data are located at Building 10, Innovation Technology Park, Song Shan Lake Hi tech Development Zone, Dongguan, 523808, China

4. SAR Measurement System & Test Equipment

4.1. SAR Measurement System

The DASY8 system used for performing compliance tests consists of the following items:



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running Win10 and the DASY8 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

4.2. SAR Scan Procedures

Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 2.1 mm. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

Step 2: Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE Standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

Area Scan Parameters extracted from KDB 865664 D01 v01r04 SAR Measurement 100 MHz to 6 GHz

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 mm ± 1 mm	$½ \cdot \delta \cdot \ln(2)$ mm ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}	≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

Step 3: Zoom Scan

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The Zoom Scan measures points (refer to table below) within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

Zoom Scan Parameters extracted from KDB 865664 D01 v01r04 SAR Measurement 100 MHz to 6 GHz

Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	≤ 1.5·$\Delta z_{Zoom}(n-1)$ mm	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm

Step 4: Power drift measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

Step 5: Z-Scan (FCC only)

The Z Scan measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. In order to get a reasonable extrapolation the extrapolated distance should not be greater than the step size in Z-direction.

4.3. Test Equipment

The measuring equipment used to perform the tests documented in this report has been calibrated in accordance with the manufacturers' recommendations, and is traceable to recognized national standards.

Name of equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
ENA Network Analyzer	Keysight	E5080A	MY55100583	2023.10.16
Dielectric Probe kit	SPEAG	SM DAK 040 SA	1155	2025.02.27
DC power supply	Keysight	E36103A	MY55350020	2023.10.16
Signal Generator	Rohde & Schwarz	SME06	837633\001	2024.08.06
BI-Directional Coupler	KRYTAR	1850	54733	2023.10.16
Peak and Average Power Sensor	Keysight	E9325A	MY62220002	2023.10.25
Peak and Average Power Sensor	Keysight	E9325A	MY62220003	2023.10.25
Dual Channel PK Power Meter	Keysight	N1912A	MY55416024	2023.10.16
Amplifier	CORAD TECHNOLOGY LTD	AMF-4D-00400600-50-30P	1983561	NCR
Dosimetric E-Field Probe	SPEAG	EX3DV4	7383	2024.06.04
Data Acquisition Electronic	SPEAG	DAE3	427	2024.05.16
Dipole Kit 2450 MHz	SPEAG	D2450V2	977	2024.12.16
Dipole Kit 750 MHz	SPEAG	D750V3	1153	2024.12.14
Dipole Kit 835 MHz	SPEAG	D835V2	4d206	2024.12.16
Dipole Kit 1800 MHz	SPEAG	D1800V2	2d212	2024.12.20
Dipole Kit 2600 MHz	SPEAG	D2600V2	1117	2024.12.19
Dipole Kit 5 GHz	SPEAG	D5GHzV2	1231	2024.12.15
Software	SPEAG	DASY8	N/A	NCR
ELI Phantom	SPEAG	ELI V8.0	2178	NCR
Thermometer	/	GX-138	150709653	2023.10.21
Thermometer	VICTOR	ITHX-SD-5	18470005	2023.10.21

Note:

1) As per KDB865664D01 requirements for dipole calibration, the test laboratory has adopted three-year extended calibration interval. Each measured dipole is expected to evaluate with the following criteria at least on annual interval in Appendix C.
   a) There is no physical damage on the dipole;
   b) System check with specific dipole is within 10% of calibrated value;
   c) The most recent return-loss result, measured at least annually, deviates by no more than 20% from the previous measurement.
   d) The most recent measurement of the real or imaginary parts of the impedance, measured at least annually is within 5Ω from the previous measurement.
2) Dielectric assessment kit is calibrated against air, distilled water and a shorting block performed before measuring liquid parameters.
3) NCR is short for "No Calibration Requirement".

5. Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg and the measured 10-g SAR within a frequency band is < 3.75 W/kg. The expanded SAR measurement uncertainty must be ≤ 30%, for a confidence interval of k =2. If these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE Std. 1528-2013 is not required in SAR reports submitted for equipment approval.
Therefore, the measurement uncertainty is not required.

6. Device Under Test (DUT) Information

6.1. DUT Description

EUT is a POS with GSM/WCDMA/HSDPA/ HSUPA /LTE/NFC radio, IEEE 802.11a/ b/g/n/ac and Bluetooth radio	
Dimension	Overall (Length x Width x Height): 176 mm x 78 mm x 54 mm
Accessory	None

6.2. Wireless Technology

Wireless technologies	Frequency bands	Operating mode
GSM	850 1900	GPRS (GMSK) EGPRS (8PSK)
W-CDMA (UMTS)	Band II Band IV Band V	UMTS Rel. 99 (Data) HSDPA (Rel. 7) HSUPA (Rel. 5)
LTE	FDD B2 FDD B4 FDD B5 FDD B7 FDD B12 FDD B17 FDD B25 FDD B26 FDD B38 FDD B41 FDD B66	QPSK 16QAM ☒ Rel. 10 Does not support Carrier Aggregation (CA) ☐ Rel. 10 Carrier Aggregation (Downlink only) ☐ Rel. 11 Carrier Aggregation (2 Uplink and 2 Downlinks)
Wi-Fi	2.4GHz	802.11b 802.11g 802.11n (HT20) 802.11n (HT40)
Wi-Fi	5GHz	802.11a 802.11n (HT20) 802.11n (HT40) 802.11ac (VHT20) 802.11ac (VHT40) 802.11ac (VHT80)
BT/BLE	2.4GHz	V5.1
NFC	13.56MHz	ASK

7. Conducted Output Power Measurement and tune-up tolerance

Detailed conducted power and tune-up tolerance please refer to Appendix A.

8. Test Configuration

8.1. GSM Test Configuration

SAR tests for GSM850 and GSM1900, a communication link is set up with a base station by air link. Using CMW500 the power lever is set to “5”and “0” in SAR of GSM850 and GSM1900. The tests in the band of GSM850 and GSM1900 are performed in the mode of GPRS/EGPRS function. Since the GPRS class is 12 for this EUT, it has at most 4 timeslots in uplink and at most 4 timeslots in downlink, the maximum total timeslot is 5. The EGPRS class is 12 for this EUT, it has at most 4 timeslots in uplink, and at most 4 timeslots in downlink, the maximum total timeslot is 5.

SAR test reduction for GPRS and EDGE modes is determined by the source-based time-averaged output power specified for production units, including tune-up tolerance. The data mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested.

8.2. UMTS Test Configuration

1. Output Power Verification

Maximum output power is verified on the High, Middle and Low channels according to the procedures description in section 5.2 of 3GPP TS 34.121, using the appropriate RMC or AMR with TPC(transmit power control) set to all “1s” for WCDMA/HSDPA or applying the required inner loop power control procedure to maintain maximum output power while HSUPA is active. Result for all applicable physical channel configurations (DPCCH, DPDCHn and spreading codes, HSDPA, HSPA) Should be tabulated in the SAR report .All configuration that are not supported by the DUT or cannot be measured due to technical or equipment limitation should be clearly identified.

2. WCDMA

Body SAR Measurements

SAR for body-worn accessory configurations is measured using a 12.2 kbps RMC with TPC bits configured to all “1"s”. The 3G SAR test reduction procedure is applied to other spreading codes and multiple DPDCHn configurations supported by the handset with 12.2 kbps RMC as the primary mode

3. HSDPA

SAR for body exposure configurations is measured according to the “Body SAR Measurements"" procedures of 3G device. When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode. This is referred to as the 3G SAR test reduction procedure in the following SAR test guidance, where the primary mode is identified in the applicable wireless mode test procedures and the secondary mode is wireless mode being considered for SAR test reduction by that procedure. When the 3G SAR test reduction procedure is not satisfied, it is identified as “otherwise” in the applicable procedures; SAR measurement is required for the secondary mode.

As per KDB941225 D01, the 3G SAR test reduction procedure is applied to HSDPA body configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for HSDPA using the HSDPA body SAR procedures for the highest reported SAR body exposure configuration in 12.2 kbps RMC.

HSDPA should be configured according to UE category of a test device. The number of HS-DSCH/HS-PDSCHs, HAPRQ processes, minimum inter-TTI interval, transport block sizes and RV coding sequence are defined by the H-set. To maintain a consistent test configuration and stable transmission condition, QPSK is used in the H-set for SAR testing. HS-DPCCH should be configured with a CQI feedback cycle of 4ms with a CQI repetition factor of 2 to maintain a constant rate of active CQI slots. The □c and □d gain factors for DPCCH and DPDCH were set according to the values in the below table, □hs for HS-DPCCH is set automatically to the correct value when ΔACK, ΔNACK, ΔCQI = 8. The variation of the □c /□d ratio causes a power reduction at sub-tests 2 - 4.

Sub-test	β_c	β_d	β_d (SF)	β_c /β_d	β_{hs} (1)	CM(dB)(2)	MPR (dB)
1	2/15	15/15	64	2/15	4/15	0.0	0
2	12/15(3)	15/15(3)	64	12/15(3)	24/15	1.0	0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note 1: △ACK, △NACK and △CQI = 8 $A_{hs} = \beta_{hs}/\beta_c = 30/15$ $\beta_{hs} = 30/15 * \beta_c$

Note 2 : CM=1 for β_c/β_d= 12/15, β_{hs}/β_c = 24/15. For all other combinations of DPDCH,DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Note 3 : For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1,TF1) to β_c = 11/15 and β_d = 15/15

The measurements were performed with a Fixed Reference Channel (FRC) and H-Set 1 QPSK.
Settings of required H-Set 1 QPSK acc. to 3GPP 34.121

Parameter	Value
Nominal average inf. bit rate	534 kbit/s
Inter-TTI Distance	3 TTI"s
Number of HARQ Processes	2 Processes
Information Bit Payload	3202 Bits
MAC-d PDU size	336 Bits
Number Code Blocks	1 Block
Binary Channel Bits Per TTI	4800 Bits
Total Available SMLs in UE	19200 SMLs
Number of SMLs per HARQ Process	9600 SMLs
Coding Rate	0.67
Number of Physical Channel Codes	5

HSDPA UE category

HS-DSCH Category	Maximum HS-DSCH Codes Received	Minimum Inter-TTI Interval	Maximum HS-DSCH Transport Block Bits/HS-DSCH TTI	Total Soft Channel Bits
1	5	3	7298	19200
2	5	3	7298	28800
3	5	2	7298	28800
4	5	2	7298	38400
5	5	1	7298	57600
6	5	1	7298	67200
7	10	1	14411	115200
8	10	1	14411	134400
9	15	1	25251	172800
10	15	1	27952	172800
11	5	2	3630	14400
12	5	1	3630	28800
13	15	1	34800	259200
14	15	1	42196	259200
15	15	1	23370	345600
16	15	1	27952	345600

4. HSUPA

SAR for body exposure configurations is measured according to the “Body SAR Measurements"" procedures of 3G device. When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the

ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode.

As per KDB941225 D01v03, the 3G SAR test reduction procedure is applied to HSPA (HSUPA/HSDPA with RMC) body configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for HSPA using the HSPA body SAR procedures for the highest reported body exposure SAR configuration in 12.2 kbps RMC.

Due to inner loop power control requirements in HSDPA, a commercial communication test set should be used for the output power and SAR tests. The 12.2 kbps RMC, FRC H-set 1 and E-DCH configurations for HSDPA should be configured according to the values indicated below as well as other applicable procedures described in the „WCDMA Handset" and „Release 5 HSDPA Data Device" sections of 3G device.

Subtests for WCDMA Release 6 HSUPA

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs}(1)	β_{ec}	β_{ed}	β_{ed} (SF)	β_{ed} (code)	CM(2) (dB)	MPR (dB)	AG(4) Index	E-TFCI
1	11/15(3)	15/15(3)	64	11/15(3)	22/15	209/225	1039/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed1}:47/15 β_{ed2}:47/15	4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15(4)	15/15(4)	64	15/15(4)	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: Δ ACK, Δ NACK and Δ CQI = 8 $A_{hs} = \beta_{hs}/\beta_c = 30/15$ $\beta_{hs} = 30/15 * \beta_c$

Note 2: CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$. For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference

Note 3 : For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1,TF1) to $\beta_c = 10/15$ and $\beta_d = 15/15$

Note 4 : For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1,TF1) to $\beta_c = 14/15$ and $\beta_d = 15/15$

Note 5 : Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Table 5.1g

Note 6: β_{ed} can not be set directly; it is set by Absolute Grant Value.

HSUPA UE category

UE E-DCH Category	Maximum E-DCH Codes Transmitted	Number of HARQ Processes	E-DCH TTI(ms)	Minimum Speading Factor	Maximum E-DCH Transport Block Bits	Max Rate (Mbps)
1	1	4	10	4	7110	0.7296
2	2	8	2	4	2798	1.4592
	2	4	10	4	14484	
3	2	4	10	4	14484	1.4592
4	2	8	2	2	5772	2.9185
	2	4	10	2	20000	2.00
5	2	4	10	2	20000	2.00
6 (No DPDCH)	4	8	10	2SF2&2SF4	11484	5.76
	4	4	2		20000	2.00
7 (No DPDCH)	4	8	2	2SF2&2SF4	22996	?
	4	4	10		20000	?

Note:

1) When 4 codes are transmitted in parallel, two codes shall be transmitted with SF2 and two with SF4.UE categories 1 to 6 support QPSK only. UE category 7 supports QPSK and 16QAM. (TS25.306-7.3.0).

5. DC-HSDPA

SAR is required for Rel. 8 DC-HSDPA when SAR is required for Rel. 5 HSDPA; otherwise, the 3G SAR test reduction procedure is applied to DC-HSDPA with 12.2 kbps RMC as the primary mode. Power is measured for DC-HSDPA according to the H-Set 12, FRC configuration in Table C.8.1.12 of 3GPP TS 34.121-1 to determine SAR test reduction. A primary and a Second serving HS-DSCH Cell are required to perform the power measurement and for the results to be acceptable.

The following tests were completed according to procedures in section 7.3.13 of 3GPP TS 34.108 v9.5.0. A summary of these settings are illustrated below:

Downlink Physical Channels are set as per 3GPP TS34.121-1 v9.0.0 E.5.0
Levels for HSDPA connection setup

Parameter During Connection setup	Unit	Value
P-CPICH_Ec/Ior	dB	-10
P-CCPCH and SCH_Ec/Ior	dB	-12
PICH _Ec/Ior	dB	-15
HS-PDSCH	dB	off
HS-SCCH_1	dB	off
DPCH_Ec/Ior	dB	-5
OCNS_Ec/Ior	dB	-3.1

Call is set up as per 3GPP TS34.108 v9.5.0 sub clause 7.3.13

The configurations of the fixed reference channels for HSDPA RF tests are described in 3GPP TS 34.121, annex C for FDD and 3GPP TS 34.122.

The measurements were performed with a Fixed Reference Channel (FRC) H-Set 12 with QPSK

Parameter	Value
Nominal average inf. bit rate	60 kbit/s
Inter-TTI Distance	1 TTI"s
Number of HARQ Processes	6 Processes
Information Bit Payload	120 Bits
Number Code Blocks	1 Block
Binary Channel Bits Per TTI	960 Bits
Total Available SMLs in UE	19200 SMLs
Number of SMLs per HARQ Process	3200 SMLs
Coding Rate	0.15
Number of Physical Channel Codes	1

Note:

1) The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table above.
2) Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used.

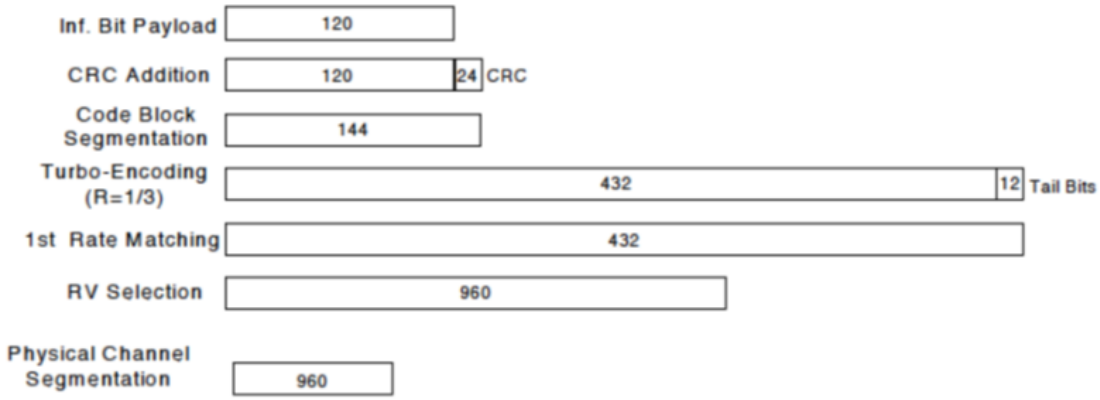


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

The following 4 Sub-tests for HSDPA were completed according to Release 5 procedures. A summary of subtest settings are illustrated below:

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs} (1)	CM(dB)(2)	MPR (dB)
1	2/15	15/15	64	2/15	4/15	0.0	0
2	12/15(3)	15/15(3)	64	12/15(3)	24/15	1.0	0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note 1: Δ ACK, Δ NACK and Δ CQI = 8 $A_{hs} = \beta_{hs}/\beta_c = 30/15$ $\beta_{hs} = 30/15 * \beta_c$

Note 2: CM=1 for β_c/β_d = 12/15, β_{hs}/β_c = 24/15. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Note 3: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 11/15 and β_d = 15/15

Up commands are set continuously to set the UE to Max power.

Note:

1) The Dual Carriers transmission only applies to HSDPA physical channels.
2) The Dual Carriers belong to the same Node and are on adjacent carriers.
3) The Dual Carriers do not support MIMO to serve UEs configured for dual cell operation.
4) The Dual Carriers operate in the same frequency band.
5) The device doesn't support the modulation of 16QAM in uplink but 64QAM in downlink for DC-HSDPA mode.

The device doesn't support carrier aggregation for it just can operate in Release 8.

8.3. LTE Test Configuration

Establishing connections with base station simulators ensure a consistent means for testing SAR and are recommended for evaluating SAR. The R&S CMW500 was used for LTE output power measurements and SAR testing. Max power control was used so the UE transmits with maximum output power during SAR testing. SAR must be measured with the maximum TTI (transmit time interval) supported by the device in each LTE configuration.

1) Spectrum Plots for RB configurations

A properly configured base station simulator was used for LTE output power measurements and SAR testing. Therefore, spectrum plots for RB configurations were not required to be included in this report.

2) MPR

MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3-6.2.5 under Table 6.2.3-1.

Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3

Modulation	Channel bandwidth / Transmission bandwidth (N_{RB})						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2

3) A-MPR

A-MPR (Additional MPR) has been disabled for all SAR tests by using Network Signaling Value of “NS=01”on the base station simulator.

4) SAR test requirements

A) Largest channel bandwidth standalone SAR test requirements

i) QPSK with 1 RB allocation

Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required for 1 RB allocation; otherwise, SAR is required for the remaining required test channels and only for the RB offset configuration with the highest output power for that channel. When the reported SAR of a required test channel is > 1.45 W/kg, SAR is required for all three RB offset configurations for that required test channel.

ii) QPSK with 50% RB allocation

The procedures required for 1 RB allocation in i) are applied to measure the SAR for QPSK with 50% RB allocation.

iii) QPSK with 100% RB allocation

For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation in i) and ii) are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.

iv) Higher order modulations

For each modulation besides QPSK; e.g., 16-QAM, 64-QAM, apply the QPSK procedures in above sections to determine the QAM configurations that may need SAR measurement. For each configuration identified as required for testing, SAR is required only when the highest maximum output power for the configuration in the higher order modulation is > ½ dB higher than the same configuration in QPSK or when the reported SAR for the QPSK configuration is > 1.45 W/kg.

B) Other channel bandwidth standalone SAR test requirements

For the other channel bandwidths used by the device in a frequency band, apply all the procedures required for the largest channel bandwidth in section A) to determine the channels and RB configurations that need SAR testing and only measure SAR when the highest maximum output power of a configuration requiring testing in the smaller channel bandwidth is > ½ dB higher than the equivalent channel configurations in the largest channel bandwidth configuration or the reported SAR of a configuration for the largest channel bandwidth is > 1.45 W/kg.

Table 4.2-1: Configuration of special subframe (lengths of DwPTS/GP/UpPTS)

Special subframe configuration	Normal cyclic prefix in downlink			Extended cyclic prefix in downlink		
	DwPTS	UpPTS		DwPTS	UpPTS	
		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink
0	$6592 \cdot T_s$	$2192 \cdot T_s$	$2560 \cdot T_s$	$7680 \cdot T_s$	$2192 \cdot T_s$	$2560 \cdot T_s$
1	$19760 \cdot T_s$			$20480 \cdot T_s$		
2	$21952 \cdot T_s$			$23040 \cdot T_s$		
3	$24144 \cdot T_s$			$25600 \cdot T_s$		
4	$26336 \cdot T_s$			$7680 \cdot T_s$	$4384 \cdot T_s$	$5120 \cdot T_s$
5	$6592 \cdot T_s$	$4384 \cdot T_s$	$5120 \cdot T_s$	$20480 \cdot T_s$		
6	$19760 \cdot T_s$			$23040 \cdot T_s$		
7	$21952 \cdot T_s$			$12800 \cdot T_s$		
8	$24144 \cdot T_s$			-	-	-
9	$13168 \cdot T_s$			-	-	-

Table 4.2-2: Uplink-downlink configurations

Uplink-downlink configuration	Downlink-to-Uplink Switch-point periodicity	Subframe number									
		0	1	2	3	4	5	6	7	8	9
0	5 ms	D	S	U	U	U	D	S	U	U	U
1	5 ms	D	S	U	U	D	D	S	U	U	D
2	5 ms	D	S	U	D	D	D	S	U	D	D
3	10 ms	D	S	U	U	U	D	D	D	D	D
4	10 ms	D	S	U	U	D	D	D	D	D	D
5	10 ms	D	S	U	D	D	D	D	D	D	D
6	5 ms	D	S	U	U	U	D	S	U	U	D

According to Figure 4.2-1, one radio frame is configured by 10 subframes, which consist of Uplink-subframe, Downlink-subframe and Special subframe. For TDD-LTE, the Duty Cycle should be calculated on Uplink-subframes and Special subframes, due to Special subframe containing both Uplink transmissions. So for one radio frame, Duty Cycle can be calculated with formula as below. The count of Uplink subframes are according to Table 4.2-2:

Duty cycle =(30720Ts*Ups+Uplink Component*Specials)/(307200Ts)

About the uplink component of Special subframes, we can figure out by Table 4.2-1:

Uplink Component=UpPTS

In conclusion, for the TDD LTE Band, Duty Cycle can be calculated with formula as below .all these sets are ok when we test, or we can set as below.

Duty cycle =[(30720Ts*Ups)+ UpPTS *Specials]/(307200Ts)

And we can get different Duty cycles under different configurations:

Uplink-downlink configuratin	Subframe number			Configuration of special subframe							
				Normal cyclic prefix in downlink				Extended cyclic prefix in downlink			
				Normal cyclic prefix in uplink		Extended cyclic prefix in uplink		Normal cyclic prefix in uplink		Extended cyclic prefix in uplink	
	D	S	U	configuration 0-4	configuration 5-9	configuration 0-4	configuration 5-9	configuration 0-3	configuration 4-7	configuration 0-3	configuration
0	2	2	6	61.43%	62.85%	61.67%	63.33%	61.43%	62.85%	61.67%	63.33%
1	4	2	4	41.43%	42.85%	41.67%	43.33%	41.43%	42.85%	41.67%	43.33%
2	6	2	2	21.43%	22.85%	21.67%	23.33%	21.43%	22.85%	21.67%	23.33%
3	6	1	3	30.71%	31.43%	30.83%	31.67%	30.71%	31.43%	30.83%	31.67%
4	7	1	2	20.71%	21.43%	20.83%	21.67%	20.71%	21.43%	20.83%	21.67%
5	8	1	1	10.71%	11.43%	10.83%	11.67%	10.71%	11.43%	10.83%	11.67%
6	3	2	5	51.43%	52.85%	51.67%	53.33%	51.43%	52.85%	51.67%	53.33%

For TDD LTE, SAR should be tested with the highest transmission duty factor (63.33%) using Uplink-downlink configuration 0 and Special subframe configuration 7 for Frame structure type 2.

For TDD LTE B40, SAR should be tested with the highest transmission duty factor (31.67%) using Uplink-downlink configuration 3 and Special subframe configuration 3 for Frame structure type 2.

8.4. 2.4GHz BT/BLE SAR Test Requirements

2.4GHz BT operating modes are tested independently according to the service requirements in each frequency band for each antenna. DH5 / 3DH5 / 1M/2M SISO modes are tested on the maximum average output power mode.

8.5. Wi-Fi Test Configuration

For Wi-Fi SAR testing, a communication link is set up with the testing software for Wi-Fi mode test. During the test, at the each test frequency channel, the EUT is operated at the RF continuous emission mode. The test procedures in KDB 248227D01 are applied.

8.5.1. Initial Test Position Procedure

For exposure condition with multiple test position, such as handsets operating next to the ear, devices with hotspot mode or UMPC mini-tablet, procedures for initial test position can be applied. Using the transmission mode determined by the DSSS procedure or initial test configuration, area scans are measured for all position in an exposure condition. The test position with the highest extrapolated (peak) SAR is used as the initial test position. When reported SAR for the initial test position is ≤ 0.4W/kg, no additional testing for the remaining test position is required. Otherwise, SAR is evaluated at the subsequent highest peak SAR position until the reported SAR result is ≤ 0.8W/kg or all test position are measured. For all positions/configurations tested using the initial test position and subsequent test positions, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.

8.5.2. Initial Test Configuration Procedure

An initial test configuration is determined for OFDM transmission modes according to the channel bandwidth, modulation and data rate combination(s) with the highest maximum output power specified for production units in each standalone and aggregated frequency band. SAR is measured using the highest measured maximum output power channel. For configurations with the same specified or measured maximum output power, additional transmission mode and test channel selection procedures are required (see section 5.3.2 of KDB 248227D01). SAR test reduction of subsequent highest output test channels is based on the reported SAR of the initial test configuration.

For next to the ear, hotspot mode and UMC mini-tablet exposure configurations where multiple test positions are required, the initial test position procedure is applied to minimize the number of test positions required for SAR measurement using the initial test configuration transmission mode. For fixed exposure conditions that do not have multiple SAR test positions, SAR is measured in the transmission mode determined by the initial test configuration.

When the reported SAR of the initial test configuration is > 0.8 W/kg, SAR measurement is required for the subsequent next highest measured output power channel(s) in the initial test configuration until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.

8.5.3. Sub Test Configuration Procedure

SAR measurement requirements for the remaining 802.11 transmission mode configurations that have not been tested in the initial test configuration are determined separately for each standalone and aggregated frequency band, in each exposure condition, according to the maximum output power specified for production units.

When the highest reported SAR for the initial test configuration, according to the initial test position or fixed exposure position requirements, is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for that subsequent test configuration.

8.5.4. 2.4GHz Wi-Fi SAR Test Procedures

Separate SAR procedures are applied to DSSS and OFDM configurations in the 2.4 GHz band to simplify DSSS test requirements. For 802.11b DSSS SAR measurements, DSSS SAR procedure applies to fixed exposure test position and initial test position procedure applies to multiple exposure test positions.

A) 802.11b DSSS SAR Test Requirements

SAR is measured for 2.4 GHz 802.11b DSSS using either a fixed test position or, when applicable, the initial test position procedure. SAR test reduction is determined according to the following:

1) When the reported SAR of the highest measured maximum output power channel (section 3.1 of KDB 248227D01) for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.
2) When the reported SAR is > 0.8 W/kg, SAR is required for that exposure configuration using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel; i.e., all channels require testing.

B) 2.4GHz 802.11g/n OFDM SAR Test Exclusion Requirements

When SAR measurement is required for 2.4 GHz 802.11g/n OFDM configurations, the measurement and test reduction procedures for OFDM are applied (section 5.3 of KDB 248227D01). SAR is not required for the following 2.4 GHz OFDM conditions.

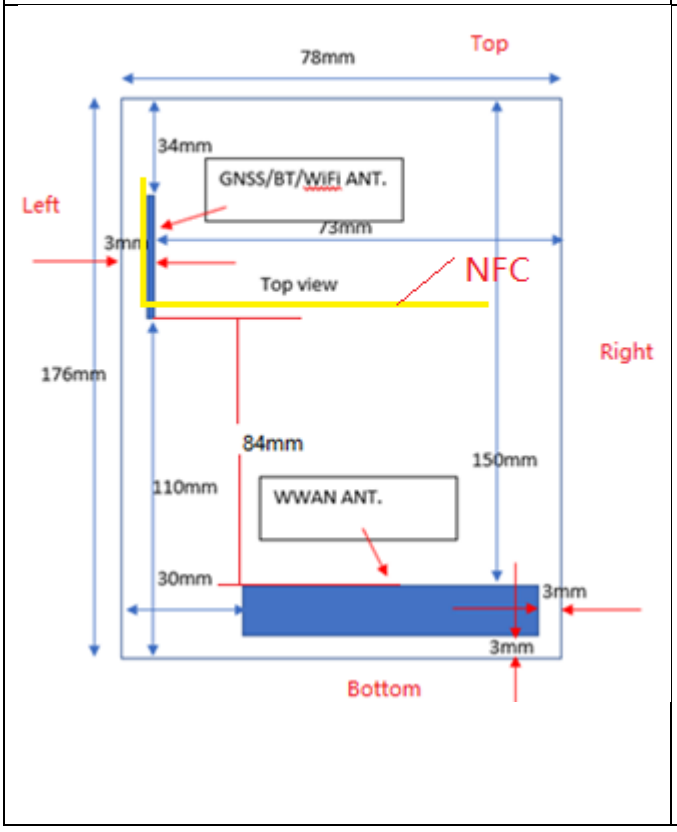
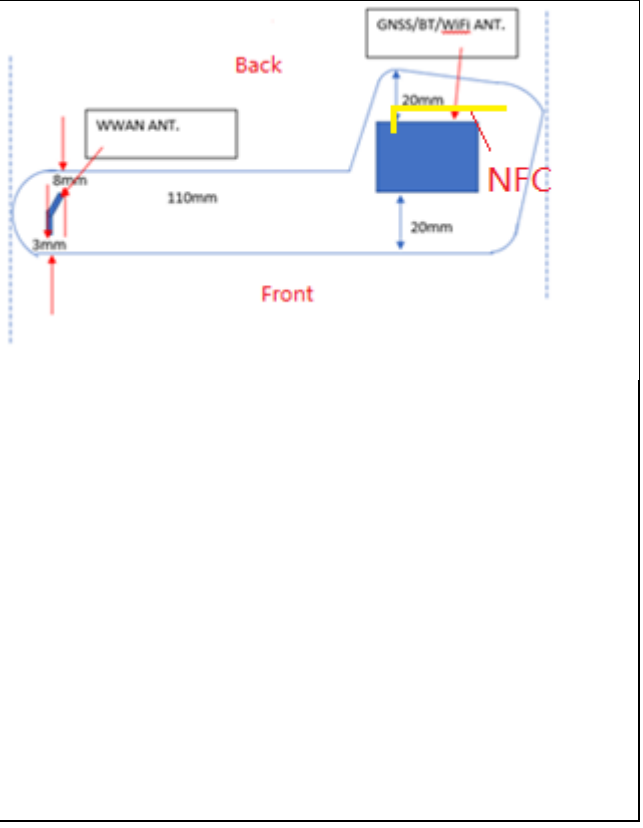
1) When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration.
2) When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

C) SAR Test Requirements for OFDM configurations

When SAR measurement is required for 802.11 g/n OFDM configurations, each standalone and frequency aggregated band is considered separately for SAR test reduction. In applying the initial test configuration and subsequent test configuration procedures, the 802.11 transmission configuration with the highest specified maximum output power and the channel within a test configuration with the highest measured maximum output power should be clearly distinguished to apply the procedures.

9. RF Exposure Conditions

Refer to the diagram inside the device which attached below for the specific details of the antenna-to-edges distances. As per KDB 941225 D06, when the antenna to-edge-distance is greater than 2.5 cm, SAR evaluation is not required for the corresponding position.

Front Review	Right Review
	

Note:

1) The EUT doesn't support operating next to the ear, so head SAR evaluation isn't considered.

	Test Position	antenna to-edge-distance	Test required
WWAN Ant	Front Edge	<25mm	Yes
	Back Edge	<25mm	Yes
	Left Edge	>25mm	No
	Right Edge	<25mm	Yes
	Top Edge	>25mm	No
	Bottom Edge	<25mm	Yes

	Test Position	antenna to-edge-distance	Test required
Wi-Fi/BT Ant	Front Edge	<25mm	Yes
	Back Edge	<25mm	Yes
	Left Edge	<25mm	Yes
	Right Edge	>25mm	No
	Top Edge	>25mm	No
	Bottom Edge	>25mm	No

Note

1) Limitations on positioning the device against the phantom for WLAN SAR measurements were addressed through a KDB inquiry.

9.1. Evaluation For NFC

Appendix C

SAR Test Exclusion Thresholds for < 100 MHz and < 200 mm

Approximate SAR test exclusion power thresholds at selected frequencies and test separation distances are illustrated in the following table. The equation and threshold in 4.3.1 must be applied to determine SAR test exclusion.

MHz	< 50	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	mm
100	237	474	481	487	494	501	507	514	521	527	534	541	547	554	561	567	
50	308	617	625	634	643	651	660	669	677	686	695	703	712	721	729	738	
10	474	948	961	975	988	1001	1015	1028	1041	1055	1068	1081	1095	1108	1121	1135	
1	711	1422	1442	1462	1482	1502	1522	1542	1562	1582	1602	1622	1642	1662	1682	1702	mW
0.1	948	1896	1923	1949	1976	2003	2029	2056	2083	2109	2136	2163	2189	2216	2243	2269	
0.05	1019	2039	2067	2096	2125	2153	2182	2211	2239	2268	2297	2325	2354	2383	2411	2440	
0.01	1185	2370	2403	2437	2470	2503	2537	2570	2603	2637	2670	2703	2737	2770	2803	2837	

For 13.56MHz NFC 1-g SAR

Frequency (MHz)	(dBμV/m)	Power (dBm)
13.56	21.53	-85.45

Position	Frequency (MHz)	Power (dBm)	Power (mW)	Separation Distance (mm)	Threshold (mW)	SAR Test
Front surface	13.56	-85.45	0.00	5	459.2	Excluded
Back surface	13.56	-85.45	0.00	5	459.2	Excluded
Left edge	13.56	-85.45	0.00	5	459.2	Excluded
Right edge	13.56	-85.45	0.00	5	459.2	Excluded
Top edge	13.56	-85.45	0.00	5	459.2	Excluded
Bottom edge	13.56	-85.45	0.00	5	459.2	Excluded

Note:
1) NFC antenna guide edge distance is evaluated with the worst case.
2) The threshold is calculated according to FCC KDB 447498 D01 Appendix C.

10. SAR Test Configuration

EUT is a portable POS machine that can be used very close to the human body, so consider 1g body SAR (5mm) assessment.

Note:

1) The EUT is a portable POS machine with a diagonal of less than 20CM, which is applicable to FCC KDB 941225 D07 regulations. According to KDB regulations, when testing 1 g SAR at 5 mm, it is not necessary to use 10 g SAR.

11. Dielectric Property Measurements & System Check

11.1. Dielectric Property Measurements

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within ± 2°C of the temperature when the tissue parameters are characterized.
The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 – 4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.
Tissue dielectric parameters were measured at the low, middle and high frequency of each operating frequency range of the test device.

Tissue Dielectric Parameters

FCC KDB 865664 D01 v01r04 SAR Measurement 100 MHz to 6 GHz

Target Frequency (MHz)	Head		Body	
	ε_r	σ (S/m)	ε_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 – 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5000	36.2	4.45	49.3	5.07
5100	36.1	4.55	49.1	5.18
5200	36.0	4.66	49.0	5.30
5300	35.9	4.76	48.9	5.42
5400	35.8	4.86	48.7	5.53
5500	35.6	4.96	48.6	5.65
5600	35.5	5.07	48.5	5.77
5700	35.4	5.17	48.3	5.88
5800	35.3	5.27	48.2	6.00

IEEE Std 1528-2013
Refer to Table 3 within the IEEE Std 1528-2013

Dielectric Property Measurements Results:

Liquid	Freq.	Liquid Parameters				Deviation(%)		Limit (%)	Temp. (℃)	Test Date
		Measured		Target						
		ε_r	σ	ε_r	σ	ε_r	σ			
Head 750	700	41.20	0.88	42.20	0.89	-2.37	-1.12	±5	21.5	2023.8.31
	750	41.60	0.90	41.94	0.89	-0.81	1.12			
	800	41.50	0.91	41.68	0.90	-0.43	1.11			
Head 835	805	41.50	0.91	41.66	0.90	-0.38	1.11	±5	21.5	2023.8.31
	835	41.30	0.93	41.50	0.90	-0.48	3.33			
	880	41.60	0.96	41.50	0.96	0.24	0.00			
Head 1800	1700	39.60	1.34	40.16	1.34	-1.39	0.00	±5	21.5	2023.8.31
	1760	39.30	1.36	40.06	1.38	-1.90	-1.45			
	1800	39.50	1.36	40.00	1.40	-1.25	-2.86			
	1840	39.40	1.38	40.00	1.40	-1.50	-1.43			
	1880	39.40	1.38	40.00	1.40	-1.50	-1.43			

Head 2600	2500	38.50	1.81	39.14	1.85	-1.64	-2.16	±5	21.5	2023.8.31
	2540	38.50	1.88	39.09	1.90	-1.51	-1.05			
	2600	38.60	1.92	39.01	1.96	-1.05	-2.04			
Head 835	805	41.70	0.92	41.66	0.90	0.10	2.22	±5	21.6	2023.9.4
	835	41.50	0.94	41.50	0.90	0.00	4.44			
	880	41.80	0.97	41.50	0.96	0.72	1.04			
Head 1800	1700	39.80	1.36	40.16	1.34	-0.90	1.49	±5	21.6	2023.9.4
	1760	39.60	1.38	40.06	1.38	-1.15	0.00			
	1800	39.70	1.38	40.00	1.40	-0.75	-1.43			
	1840	39.70	1.41	40.00	1.40	-0.75	0.71			
	1880	39.60	1.40	40.00	1.40	-1.00	0.00			
Head 2600	2600	38.80	1.96	39.01	1.96	-0.54	0.00	±5	21.6	2023.9.4
	2660	38.60	2.05	38.93	2.03	-0.85	0.99			
	2700	38.60	2.10	38.88	2.07	-0.72	1.45			
Head 835	805	42.00	0.93	41.66	0.90	0.82	3.33	±5	22	2023.9.11
	835	41.70	0.94	41.50	0.90	0.48	4.44			
	880	42.00	0.97	41.50	0.96	1.20	1.04			
Head 1800	1700	40.00	1.38	40.16	1.34	-0.40	2.99	±5	22	2023.9.11
	1760	39.80	1.40	40.06	1.38	-0.65	1.45			
	1800	39.90	1.40	40.00	1.40	-0.25	0.00			
	1840	39.90	1.43	40.00	1.40	-0.25	2.14			
	1880	39.80	1.42	40.00	1.40	-0.50	1.43			
Head 2450	2360	39.20	1.66	39.36	1.72	-0.41	-3.49	±5	21.3	2023.9.14
	2450	39.30	1.87	39.20	1.80	0.26	3.89			
	2540	39.20	1.97	39.09	1.90	0.28	3.68			
Head 5250	5160	36.00	4.52	36.03	4.61	-0.08	-1.95	±5	21.3	2023.9.14
	5250	35.80	4.61	35.93	4.71	-0.36	-2.12			
	5340	35.70	4.72	35.83	4.80	-0.36	-1.67			
Head 2450	2360	39.70	1.78	39.36	1.72	0.86	3.49	±5	22.8	2023.9.18
	2450	39.60	1.85	39.20	1.80	1.02	2.78			
	2540	39.40	1.92	39.09	1.90	0.79	1.05			
Head 5750	5660	35.10	5.10	35.46	5.13	-1.02	-0.58	±5	21.1	2023.9.18
	5750	34.00	5.24	35.36	5.22	-3.85	0.38			
	5840	34.80	5.35	35.27	5.30	-1.33	0.94			
Head 2600	2540	39.00	1.90	39.09	1.90	-0.23	0.00	±5	21.8	2023.9.25
	2600	39.00	1.94	39.01	1.96	-0.03	-1.02			
	2660	38.80	2.04	38.93	2.03	-0.33	0.49			
Head 2450	2360	39.30	1.69	39.36	1.72	-0.15	-1.74	±5	22.9	2023.10.18
	2450	39.00	1.82	39.20	1.80	-0.51	1.11			
	2540	39.00	1.90	39.09	1.90	-0.23	0.00			

11.2. System Check

SAR system verification is required to confirm measurement accuracy, according to the tissue dielectric media, probe calibration points and other system operating parameters required for measuring the SAR of a test device. The system verification must be performed for each frequency band and within the valid range of each probe calibration point required for testing the device. The same SAR probe(s) and tissue-equivalent media combinations used with each specific SAR system for system verification must be used for device testing. When multiple probe calibration points are required to cover substantially large transmission bands, independent system verifications are required for each probe calibration point. A system verification must be performed before each series of SAR measurements using the same probe calibration point and tissue-equivalent medium. Additional system verification should be considered according to the conditions of the tissue-equivalent medium and measured tissue dielectric parameters, typically every three to four days when the liquid parameters are re-measured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

System Performance Check Measurement Conditions:

- The measurements were performed in the flat section of the TWIN SAM or ELI phantom, shell thickness: 2.0 ±0.2 mm (bottom plate) filled with Body or Head simulating liquid of the following parameters.
- The depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm for SAR measurements ≤ 3 GHz and ≥ 10.0 cm for measurements > 3 GHz.
- The DASY system with an E-Field Probe was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10mm (above 1GHZ) and 15mm (below 1GHz) from dipole center to the simulating liquid surface.
- For area scan, standard grid spacing for head measurements is 15 mm in x- and y- dimension(≤2GHz), 12 mm in x- and y-dimension(2-4 GHz) and 10mm in x- and y- dimension(4-6GHz).
- For zoom scan, Δ x_{zoom}, Δ y_{zoom}≤ 2GHz - ≤8mm, 2-4GHz - ≤5 mm and 4-6 GHz-≤4mm; Δ z_{zoom} ≤3GHz - ≤5 mm, 3-4 GHz- ≤4mm and 4-6GHz-≤2mm.
- Distance between probe sensors and phantom surface was set to 3 mm except for 5 GHz band. For 5GHz band, Distance between probe sensors and phantom surface was set to 2.5 mm
- The dipole input power (forward power) was set to 100 mW or 250 mW depend on the certificate of the dipoles.
- The results are normalized to 1 W input power.

System Check Results

The 1-g and 10-g SAR measured with a reference dipole, using the required tissue-equivalent medium at the test frequency, must be within 10% of the manufacturer calibrated dipole SAR target.

T.S. Liquid		Messured Results		Target (Ref. value)	Delta (%)	Limit (%)	Temp. (℃)	Test Date
		Zoom Scan (W/Kg)	Normalize to 1W (W/Kg)					
Head 1800	1-g	9.210	36.84	38.70	-4.81	±10	21.5	2023.8.31
	10-g	4.860	19.44	19.90	-2.31			
Head 2600	1-g	14.700	58.80	55.40	6.14	±10	21.5	2023.8.31
	10-g	6.620	26.48	24.50	8.08			
Head 750	1-g	2.090	8.36	8.50	-1.65	±10	21.9	2023.9.1
	10-g	1.370	5.48	5.61	-2.32			
Head 835	1-g	2.360	9.44	9.64	-2.07	±10	21.9	2023.9.1
	10-g	1.540	6.16	6.26	-1.60			
Head 1800	1-g	9.260	37.04	38.70	-4.29	±10	21.9	2023.9.1
	10-g	4.910	19.64	19.90	-1.31			
Head 2600	1-g	14.200	56.80	55.40	2.53	±10	21.9	2023.9.1
	10-g	6.690	26.76	24.50	9.22			
Head 835	1-g	2.390	9.56	9.64	-0.83	±10	21.6	2023.9.4

	10-g	1.570	6.28	6.26	0.32			
Head 1800	1-g	9.330	37.32	38.70	-3.57	±10	21.6	2023.9.4
	10-g	4.950	19.80	19.90	-0.50			
Head 2600	1-g	14.100	56.40	55.40	1.81	±10	21.6	2023.9.4
	10-g	6.510	26.04	24.50	6.29			
Head 835	1-g	2.320	9.28	9.64	-3.73	±10	21.8	2023.9.5
	10-g	1.560	6.24	6.26	-0.32			
Head 1800	1-g	9.180	36.72	38.70	-5.12	±10	21.8	2023.9.5
	10-g	4.730	18.92	19.90	-4.92			
Head 835	1-g	2.330	9.32	9.64	-3.32	±10	22	2023.9.11
	10-g	1.550	6.20	6.26	-0.96			
Head 1800	1-g	9.250	37.00	38.70	-4.39	±10	22.6	2023.9.12
	10-g	4.820	19.28	19.90	-3.12			
Head 2450	1-g	13.400	53.60	53.20	0.75	±10	21.3	2023.9.14
	10-g	6.270	25.08	24.20	3.64			
Head 5250	1-g	7.800	78.00	77.90	0.13	±10	23	2023.9.15
	10-g	2.270	22.70	22.60	0.44			
Head 5750	1-g	7.720	77.20	78.30	-1.40	±10	21.1	2023.9.18
	10-g	2.220	22.20	22.40	-0.89			
Head 2450	1-g	13.200	52.80	53.20	-0.75	±10	22.8	2023.9.18
	10-g	6.250	25.00	24.20	3.31			
Head 2600	1-g	13.600	54.40	55.40	-1.81	±10	21.8	2023.9.25
	10-g	6.070	24.28	24.50	-0.90			
Head 2450	1-g	13.500	54.00	53.20	1.50	±10	22.9	2023.10.18
	10-g	6.340	25.36	24.20	4.79			

12. Measured and Reported (Scaled) SAR Results

General Notes:

1) As per KDB447498 D01, all SAR measurement results are scaled to the maximum tune-up tolerance limit to demonstrate SAR compliance.
2) As per KDB447498 D01, testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:
   ● ≤ 0.8W/kg for 1-g or 2.0W/kg for 10-g respectively, when the transmission band is ≤ 100MHz.
   ● ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz.
   ● ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz.
   When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel must be used.
3) As per KDB865664 D01 for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/Kg; if the deviation among the repeated measurement is ≤20%, and the measured SAR <1.45W/Kg, only one repeated measurement is required.
4) As per KDB865664 D02, SAR plot is only required for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination; Plots are also required when the measured SAR is > 1.5 W/kg, or > 7.0 W/kg for occupational exposure. The published RF exposure KDB procedures may require additional plots; for example, to support SAR to peak location separation ratio test exclusion and/or volume scan post-processing (Refer to appendix B for detailed SAR plots).
5) Additional SAR tests in simultaneous transmission fixed power reduction scenario are also tested in some frequency bands and required test positions for the SAR worst case, which are only used to ensure simultaneous transmission SAR test exclusion. The standalone SAR compliance still uses the SAR results tested at the maximum output power level.
6) As per KDB 648474 D04, Phones with built-in NFC functions do not require separate SAR testing and can generally be tested according to the SAR measurement procedures normally required for the phone. Influences of the hardware introduced by the built-in NFC functions are inherently considered through testing of the other transmitters that require SAR.

GSM Notes:

1) As per KDB941225 D01, SAR test reduction for GPRS and EDGE modes is determined by the source-based time-averaged output power specified for production units, including tune-up tolerance. The data mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested.
2) As per KDB648474 D04, the device does not support DTM function. Body-worn accessory testing is typically associated with voice operations. Therefore, GSM voice was evaluated for body-worn SAR.

UMTS Notes:

1) As per KDB941225 D01, when the maximum output power and tune-up tolerance specified for production units in a Second mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of Second to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the Second mode.

LTE Notes:

1) The LTE test configurations are determined according to KDB941225 D05. The general test procedures used for SAR testing can be found in Section 8.3.
2) A-MPR was disabled for all SAR test by setting NS_01 on the base station simulator. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames(maximum TTI)

Wi-Fi Notes:

As per KDB248227 D01:

1) When reported SAR for the initial test position is ≤ 0.4W/kg, no additional testing for the remaining test position is required. Otherwise, SAR is evaluated at the subsequent highest peak SAR position until the reported SAR result is ≤ 0.8W/kg or all test position are measured. For all positions/configurations tested using the initial test position and subsequent test positions, when the *reported* SAR is > 0.8 W/kg, SAR is measured for these test

positions/configurations on the subsequent next highest measured output power channel(s) until the *reported* SAR is ≤ 1.2 W/kg or all required channels are tested.

2) The highest SAR measured for the initial test position or initial test configuration should be used to determine SAR test exclusion according to the sum of 1-g SAR and SAR peak to location ratio provisions in KDB 447498. In addition, a test lab may also choose to perform standalone SAR measurements for test positions and 802.11 configurations that are not required by the initial test position or initial test configuration procedures and apply the results to determine simultaneous transmission SAR test exclusion, according to sum of 1-g and SAR peak to location ratio requirements to reduce the number of simultaneous transmission SAR measurements.

12.1. SAR Test Results of GSM 850

Scenario and Distance (Body 5mm)	Test Mode	Channel/ Frequency	Power (dBm)		Measured SAR Value	Power Drift	Scaled (W/Kg)
			Tune-up	Meas.	1-g (W/Kg)		
Front Surface	GPRS 4 Slots	190	28.50	28.30	1.230	-0.01	1.288
Back Surface	GPRS 4 Slots	190	28.50	28.30	0.262	-0.02	0.274
Right Edge	GPRS 4 Slots	190	28.50	28.30	0.356	-0.13	0.373
Bottom Edge	GPRS 4 Slots	190	28.50	28.30	0.574	-8.00	0.601
Front Surface	GPRS 4 Slots	128	28.50	28.09	1.120	-0.03	1.231
Front Surface	GPRS 4 Slots	251	28.50	28.45	1.310	0.01	1.325
Worst Case repeated							
Front Surface	GPRS 4 Slots	251	28.50	28.45	1.310	0.00	1.325

Note:
The SAR testing was set to transmit at maximum power for all tests.

12.2. SAR Test Results of GSM 1900

Scenario and Distance (Body 5mm)	Test Mode	Channel/ Frequency	Power (dBm)		Measured SAR Value	Power Drift	Scaled (W/Kg)
			Tune-up	Meas.	1-g (W/Kg)		
Front Surface	GPRS 4 Slots	661	25.00	24.94	0.379	-0.01	0.384
Back Surface	GPRS 4 Slots	661	25.00	24.94	0.458	0.00	0.464
Right Edge	GPRS 4 Slots	661	25.00	24.94	0.343	-0.03	0.348
Bottom Edge	GPRS 4 Slots	661	25.00	24.94	0.699	-0.02	0.709

Note:
The SAR testing was set to transmit at maximum power for all tests.

12.3. SAR Test Results of WCDMA Band 2

Scenario and Distance (Body 5mm)	Test Mode	Channel/ Frequency	Power (dBm)		Measured SAR Value	Power Drift	Scaled (W/Kg)
			Tune-up	Meas.	1-g (W/Kg)		
Front Surface	RCM 12.2kbps	9400	22.00	21.41	0.433	0.01	0.496
Back Surface	RCM 12.2kbps	9400	22.00	21.41	0.644	0.01	0.738
Right Edge	RCM 12.2kbps	9400	22.00	21.41	0.449	-0.01	0.514
Bottom Edge	RCM 12.2kbps	9400	22.00	21.41	0.772	0.01	0.884
Bottom Edge	RCM 12.2kbps	9262	22.00	21.27	0.815	-0.01	0.964
Bottom Edge	RCM 12.2kbps	9538	22.00	21.04	0.784	0.02	0.978
Worst Case repeated							
Bottom Edge	RCM 12.2kbps	9262	22.00	21.27	0.815	0.00	0.964

Note:
The SAR testing was set to transmit at maximum power for all tests.

12.4. SAR Test Results of WCDMA B4

Scenario and Distance (Body 5mm)	Test Mode	Channel/ Frequency	Power (dBm)		Measured SAR Value	Power Drift	Scaled (W/Kg)
			Tune-up	Meas.	1-g (W/Kg)		
Front Surface	RCM 12.2kbps	1413	22.00	21.45	0.705	-0.07	0.800
Back Surface	RCM 12.2kbps	1413	22.00	21.45	0.816	0.00	0.926
Right Edge	RCM 12.2kbps	1413	22.00	21.45	0.768	-0.03	0.872
Bottom Edge	RCM 12.2kbps	1413	22.00	21.45	0.896	-0.01	1.017
Bottom Edge	RCM 12.2kbps	1312	22.00	21.32	0.795	-0.01	0.930
Bottom Edge	RCM 12.2kbps	1513	22.00	21.55	0.980	0.00	1.087
Worst Case repeated							
Bottom Edge	RCM 12.2kbps	1513	22.00	21.55	0.980	0.00	1.087

Note:
The SAR testing was set to transmit at maximum power for all tests.

12.5. SAR Test Results of WCDMA B5

Scenario and Distance (Body 5mm)	Test Mode	Channel/ Frequency	Power (dBm)		Measured SAR Value	Power Drift	Scaled (W/Kg)
			Tune-up	Meas.	1-g (W/Kg)		
Front Surface	RCM 12.2kbps	4183	22.50	22.11	0.750	0.01	0.820
Back Surface	RCM 12.2kbps	4183	22.50	22.11	0.181	-0.02	0.198
Right Edge	RCM 12.2kbps	4183	22.50	22.11	0.283	-0.05	0.310
Bottom Edge	RCM 12.2kbps	4183	22.50	22.11	0.475	0.00	0.520
Front Surface	RCM 12.2kbps	4132	22.50	21.94	0.598	-0.02	0.680
Front Surface	RCM 12.2kbps	4233	22.50	22.21	0.620	0.00	0.663

Note:
The SAR testing was set to transmit at maximum power for all tests.

12.6. SAR Test Results of LTE B2

Scenario and Distance (Body 5mm)	Test Mode	Channel/ Frequency	Power (dBm)		Measured SAR Value	Power Drift	Scaled (W/Kg)
			Tune-up	Meas.	1-g (W/Kg)		
1RB							
Front Surface	20M QPSK 1RB#49	18700	22.00	21.86	0.384	-0.01	0.397
Back Surface	20M QPSK 1RB#49	18700	22.00	21.86	0.530	-0.01	0.547
Right Edge	20M QPSK 1RB#49	18700	22.00	21.86	0.401	-0.09	0.414
Bottom Edge	20M QPSK 1RB#49	18700	22.00	21.86	0.601	-0.01	0.621
50%RB							
Front Surface	20M QPSK 50RB#0	18700	21.00	20.85	0.381	-0.01	0.394
Back Surface	20M QPSK 50RB#0	18700	21.00	20.85	0.495	-0.02	0.512
Right Edge	20M QPSK 50RB#0	18700	21.00	20.85	0.404	0.00	0.418
Bottom Edge	20M QPSK 50RB#0	18700	21.00	20.85	0.605	0.00	0.626

Note:
The SAR testing was set to transmit at maximum power for all tests.

12.7. SAR Test Results of LTE B4

Scenario and Distance (Body 5mm)	Test Mode	Channel/ Frequency	Power (dBm)		Measured SAR Value	Power Drift	Scaled (W/Kg)
			Tune-up	Meas.	1-g (W/Kg)		
1RB							
Front Surface	20M QPSK 1RB#49	20300	22.50	22.45	0.576	-0.08	0.583
Back Surface	20M QPSK 1RB#49	20300	22.50	22.45	0.682	0.00	0.690
Right Edge	20M QPSK 1RB#49	20300	22.50	22.45	0.669	-0.03	0.677
Bottom Edge	20M QPSK 1RB#49	20300	22.50	22.45	0.958	-0.01	0.969
Bottom Edge	20M QPSK 1RB#49	20050	22.50	22.31	0.947	-0.05	0.989
Bottom Edge	20M QPSK 1RB#49	20175	22.50	22.44	0.948	0.00	0.961
50%RB							
Front Surface	20M QPSK 50RB#0	20300	21.50	21.26	0.583	0.03	0.616
Back Surface	20M QPSK 50RB#0	20300	21.50	21.26	0.685	-0.01	0.724
Right Edge	20M QPSK 50RB#0	20300	21.50	21.26	0.686	0.00	0.725
Bottom Edge	20M QPSK 50RB#0	20300	21.50	21.26	1.010	-0.01	1.067
Bottom Edge	20M QPSK 50RB#50	20050	21.50	21.24	0.952	-0.03	1.011
Bottom Edge	20M QPSK 50RB#0	20175	21.50	21.12	0.965	-0.05	1.053
100%RB							
Bottom Edge	20M QPSK 100RB#0	20300	21.50	21.21	0.881	-0.01	0.942
Worst Case repeated							
Bottom Edge	20M QPSK 50RB#0	20300	21.50	21.26	0.997	-0.01	1.054

Note:
The SAR testing was set to transmit at maximum power for all tests.

12.8. SAR Test Results of LTE B5

Scenario and Distance (Body 5mm)	Test Mode	Channel/ Frequency	Power (dBm)		Measured SAR Value	Power Drift	Scaled (W/Kg)
			Tune-up	Meas.	1-g (W/Kg)		
1RB							
Front Surface	10M QPSK 1RB#24	20600	23.00	22.91	0.766	0.00	0.782
Back Surface	10M QPSK 1RB#24	20600	23.00	22.91	0.204	-0.05	0.208
Right Edge	10M QPSK 1RB#24	20600	23.00	22.91	0.241	-0.08	0.246
Bottom Edge	10M QPSK 1RB#24	20600	23.00	22.91	0.465	0.00	0.475
50%RB							
Front Surface	10M QPSK 25RB#0	20600	22.50	21.99	0.689	0.03	0.775
Back Surface	10M QPSK 25RB#0	20600	22.50	21.99	0.212	0.00	0.238
Right Edge	10M QPSK 25RB#0	20600	22.50	21.99	0.241	-0.01	0.271
Bottom Edge	10M QPSK 25RB#0	20600	22.50	21.99	0.418	-0.02	0.470

Note:
The SAR testing was set to transmit at maximum power for all tests.

12.9. SAR Test Results of LTE B7

Scenario and Distance (Body 5mm)	Test Mode	Channel/ Frequency	Power (dBm)		Measured SAR Value	Power Drift	Scaled (W/Kg)
			Tune-up	Meas.	1-g (W/Kg)		
1RB							
Front Surface	20M QPSK 1RB#49	20850	21.50	21.39	0.167	-0.01	0.171
Back Surface	20M QPSK 1RB#49	20850	21.50	21.39	0.545	-0.02	0.559
Right Edge	20M QPSK 1RB#49	20850	21.50	21.39	0.708	-0.11	0.726
Bottom Edge	20M QPSK 1RB#49	20850	21.50	21.39	0.842	0.01	0.864
Bottom Edge	20M QPSK 1RB#0	21100	21.50	21.24	0.868	-0.08	0.922
Bottom Edge	20M QPSK 1RB#0	21350	21.50	21.25	0.842	0.00	0.892
50%RB							
Front Surface	20M QPSK 50RB#50	20850	20.50	20.39	0.167	0.00	0.171
Back Surface	20M QPSK 50RB#50	20850	20.50	20.39	0.556	-0.09	0.570
Right Edge	20M QPSK 50RB#50	20850	20.50	20.39	0.695	0.00	0.713
Bottom Edge	20M QPSK 50RB#50	20850	20.50	20.39	0.870	0.05	0.892
Bottom Edge	20M QPSK 50RB#25	21100	20.50	20.11	0.900	0.00	0.985
Bottom Edge	20M QPSK 50RB#25	21350	20.50	20.00	0.954	0.04	1.070
100%RB							
Bottom Edge	20M QPSK 100RB#0	20850	20.50	20.39	0.844	-0.02	0.866
Worst Case repeated							
Bottom Edge	20M QPSK 50RB#25	21350	20.50	20.00	0.900	-0.08	1.010

Note:
The SAR testing was set to transmit at maximum power for all tests.

12.10. SAR Test Results of LTE B12

Scenario and Distance (Body 5mm)	Test Mode	Channel/ Frequency	Power (dBm)		Measured SAR Value	Power Drift	Scaled (W/Kg)
			Tune-up	Meas.	1-g (W/Kg)		
1RB							
Front Surface	10M QPSK 1RB#24	23095	23.00	22.67	0.648	-0.01	0.699
Back Surface	10M QPSK 1RB#24	23095	23.00	22.67	0.157	0.00	0.169
Right Edge	10M QPSK 1RB#24	23095	23.00	22.67	0.195	-0.01	0.210
Bottom Edge	10M QPSK 1RB#24	23095	23.00	22.67	0.507	0.02	0.547
50%RB							
Front Surface	10M QPSK 25RB#0	23095	22.00	21.59	0.473	-0.02	0.520
Back Surface	10M QPSK 25RB#0	23095	22.00	21.59	0.120	-0.03	0.132
Right Edge	10M QPSK 25RB#0	23095	22.00	21.59	0.145	0.00	0.159
Bottom Edge	10M QPSK 25RB#0	23095	22.00	21.59	0.400	0.01	0.440

Note:
The SAR testing was set to transmit at maximum power for all tests.

12.11. SAR Test Results of LTE B12

Scenario and Distance (Body 5mm)	Test Mode	Channel/ Frequency	Power (dBm)		Measured SAR Value	Power Drift	Scaled (W/Kg)
			Tune-up	Meas.	1-g (W/Kg)		
1RB							
Front Surface	10M QPSK 1RB#24	23095	23.00	22.67	0.648	-0.01	0.699
Back Surface	10M QPSK 1RB#24	23095	23.00	22.67	0.157	0.00	0.169
Right Edge	10M QPSK 1RB#24	23095	23.00	22.67	0.195	-0.01	0.210
Bottom Edge	10M QPSK 1RB#24	23095	23.00	22.67	0.507	0.02	0.547
50%RB							
Front Surface	10M QPSK 25RB#0	23095	22.00	21.59	0.473	-0.02	0.520
Back Surface	10M QPSK 25RB#0	23095	22.00	21.59	0.120	-0.03	0.132
Right Edge	10M QPSK 25RB#0	23095	22.00	21.59	0.145	0.00	0.159
Bottom Edge	10M QPSK 25RB#0	23095	22.00	21.59	0.400	0.01	0.440

Note:
The SAR testing was set to transmit at maximum power for all tests.

12.12. SAR Test Results of LTE B17

Scenario and Distance (Body 5mm)	Test Mode	Channel/ Frequency	Power (dBm)		Measured SAR Value	Power Drift	Scaled (W/Kg)
			Tune-up	Meas.	1-g (W/Kg)		
1RB							
Front Surface	10M QPSK 1RB#24	23790	23.00	22.62	0.636	0.00	0.694
Back Surface	10M QPSK 1RB#24	23790	23.00	22.62	0.156	0.03	0.170
Right Edge	10M QPSK 1RB#24	23790	23.00	22.62	0.201	-0.07	0.219
Bottom Edge	10M QPSK 1RB#24	23790	23.00	22.62	0.376	-0.08	0.410
50%RB							
Front Surface	10M QPSK 25RB#25	23790	22.00	21.58	0.419	0.00	0.462
Back Surface	10M QPSK 25RB#25	23790	22.00	21.58	0.127	-0.03	0.140
Right Edge	10M QPSK 25RB#25	23790	22.00	21.58	0.172	0.00	0.189
Bottom Edge	10M QPSK 25RB#25	23790	22.00	21.58	0.295	-0.05	0.325

Note:
The SAR testing was set to transmit at maximum power for all tests.

12.13. SAR Test Results of LTE B25

Scenario and Distance (Body 5mm)	Test Mode	Channel/ Frequency	Power (dBm)		Measured SAR Value	Power Drift	Scaled (W/Kg)
			Tune-up	Meas.	1-g (W/Kg)		
1RB							
Front Surface	20M QPSK 1RB#49	26365	22.50	22.04	0.379	-0.02	0.421
Back Surface	20M QPSK 1RB#49	26365	22.50	22.04	0.537	-0.06	0.597
Right Edge	20M QPSK 1RB#49	26365	22.50	22.04	0.337	-0.08	0.375
Bottom Edge	20M QPSK 1RB#49	26365	22.50	22.04	0.683	0.00	0.759
50%RB							
Front Surface	20M QPSK 50RB#0	26140	21.00	20.88	0.337	-0.11	0.346
Back Surface	20M QPSK 50RB#0	26140	21.00	20.88	0.446	0.01	0.458
Right Edge	20M QPSK 50RB#0	26140	21.00	20.88	0.278	0.00	0.286
Bottom Edge	20M QPSK 50RB#0	26140	21.00	20.88	0.550	-0.15	0.565

Note:
The SAR testing was set to transmit at maximum power for all tests.

12.14. SAR Test Results of LTE B26

Scenario and Distance (Body 5mm)	Test Mode	Channel/ Frequency	Power (dBm)		Measured SAR Value	Power Drift	Scaled (W/Kg)
			Tune-up	Meas.	1-g (W/Kg)		
1RB							
Front Surface	15M QPSK 1RB#38	26965	23.00	22.85	0.954	0.00	0.988
Back Surface	15M QPSK 1RB#38	26965	23.00	22.85	0.223	-0.12	0.231
Right Edge	15M QPSK 1RB#38	26965	23.00	22.85	0.285	0.06	0.295
Bottom Edge	15M QPSK 1RB#38	26965	23.00	22.85	0.582	-0.01	0.602
Front Surface	15M QPSK 1RB#74	26765	23.00	22.59	0.784	-0.03	0.862
Front Surface	15M QPSK 1RB#74	26865	23.00	22.84	0.767	0.00	0.796
50%RB							
Front Surface	15M QPSK 36RB#0	26965	22.50	22.03	0.661	-0.15	0.737
Back Surface	15M QPSK 36RB#0	26965	22.50	20.88	0.181	0.00	0.263
Right Edge	15M QPSK 36RB#0	26965	22.50	20.88	0.220	-0.13	0.319
Bottom Edge	15M QPSK 36RB#0	26965	22.50	20.88	0.451	0.00	0.655
100%RB							
Bottom Edge	15M QPSK 75RB#0	26965	22.50	22.05	0.559	-0.03	0.620
Worst Case repeated							
Front Surface	15M QPSK 1RB#38	26965	23.00	22.85	0.933	0.00	0.966

Note:
The SAR testing was set to transmit at maximum power for all tests.

12.15. SAR Test Results of LTE B38

Scenario and Distance (Body 5mm)	Test Mode	Channel/ Frequency	Power (dBm)		Measured SAR Value	Power Drift	Scaled (W/Kg)
			Tune-up	Meas.	1-g (W/Kg)		
1RB							
Front Surface	20M QPSK 1RB#49	31850	22.00	21.78	0.177	-0.05	0.186
Back Surface	20M QPSK 1RB#49	31850	22.00	21.78	0.437	-0.01	0.460
Right Edge	20M QPSK 1RB#49	31850	22.00	21.78	0.341	-0.03	0.359
Bottom Edge	20M QPSK 1RB#49	31850	22.00	21.78	0.588	0.00	0.619
50%RB							
Front Surface	20M QPSK 50RB#25	31850	22.00	21.70	0.135	0.00	0.145
Back Surface	20M QPSK 50RB#25	31850	22.00	21.70	0.340	-0.05	0.364
Right Edge	20M QPSK 50RB#25	31850	22.00	21.70	0.271	-0.09	0.290
Bottom Edge	20M QPSK 50RB#25	31850	22.00	21.70	0.456	0.00	0.489

Note:
The SAR testing was set to transmit at maximum power for all tests.

12.16. SAR Test Results of LTE B41

Scenario and Distance (Body 5mm)	Test Mode	Channel/ Frequency	Power (dBm)		Measured SAR Value	Power Drift	Scaled (W/Kg)
			Tune-up	Meas.	1-g (W/Kg)		
1RB							
Front Surface	20M QPSK 1RB#49	41140	22.00	21.99	0.115	-0.01	0.115
Back Surface	20M QPSK 1RB#49	41140	22.00	21.99	0.310	-0.02	0.311
Right Edge	20M QPSK 1RB#49	41140	22.00	21.99	0.212	-0.01	0.212
Bottom Edge	20M QPSK 1RB#49	41140	22.00	21.99	0.616	0.00	0.617
50%RB							
Front Surface	20M QPSK 50RB#50	31850	22.00	20.85	0.103	-0.02	0.134
Back Surface	20M QPSK 50RB#50	31850	22.00	20.85	0.245	-0.01	0.319
Right Edge	20M QPSK 50RB#50	31850	22.00	20.85	0.184	0.00	0.240
Bottom Edge	20M QPSK 50RB#50	31850	22.00	20.85	0.562	-0.03	0.732

Note:
The SAR testing was set to transmit at maximum power for all tests.

12.17. SAR Test Results of LTE B66

Scenario and Distance (Body 5mm)	Test Mode	Channel/ Frequency	Power (dBm)		Measured SAR Value	Power Drift	Scaled (W/Kg)
			Tune-up	Meas.	1-g (W/Kg)		
1RB							
Front Surface	20M QPSK 1RB#49	132322	22.50	22.32	0.679	-0.01	0.708
Back Surface	20M QPSK 1RB#49	132322	22.50	22.32	0.859	0.01	0.895
Right Edge	20M QPSK 1RB#49	132322	22.50	22.32	0.637	-0.01	0.664
Bottom Edge	20M QPSK 1RB#49	132322	22.50	22.32	1.080	0.02	1.126
Bottom Edge	20M QPSK 1RB#49	132072	22.50	22.21	0.961	0.00	1.027
Bottom Edge	20M QPSK 1RB#49	132572	22.50	22.02	1.070	-0.01	1.195
50%RB							
Front Surface	20M QPSK 50RB#0	132322	21.50	21.30	0.569	0.00	0.596
Back Surface	20M QPSK 50RB#0	132322	21.50	21.30	0.680	0.00	0.712
Right Edge	20M QPSK 50RB#0	132322	21.50	21.30	0.514	0.02	0.538
Bottom Edge	20M QPSK 50RB#0	132322	21.50	21.30	0.866	-0.02	0.907
Bottom Edge	20M QPSK 50RB#50	132072	21.50	21.22	0.778	0.00	0.830
Bottom Edge	20M QPSK 50RB#0	132572	21.50	21.05	0.857	0.00	0.951
100%RB							
Bottom Edge	20M QPSK 100RB#0	132322	21.50	21.21	0.843	0.01	0.901
Worst Case repeated							
Bottom Edge	20M QPSK 1RB#49	132322	22.50	22.32	1.070	0.00	1.115

Note:
The SAR testing was set to transmit at maximum power for all tests.

12.18. SAR Test Results of 2.4GHz Wi-Fi

Scenario and Distance (Body 5mm)	Test Mode	Channel/ Frequency	Power (dBm)		SAR Value	Power Drift	Duty Factor (%)	Scaled (W/Kg)
			Tune-up	Meas.	1-g (W/Kg)			
Front Surface	11b	11	13.0	12.28	0.034	-0.03	99.55	0.040
Back Surface	11b	11	13.0	12.28	0.026	0.00	99.55	0.031
Left Edge	11b	11	13.0	12.28	0.320	-0.08	99.55	0.379
Front Surface	11g	1	16.0	16.0	0.117	-0.02	96.94	0.121
Back Surface	11g	1	16.0	16.0	0.094	0.00	96.94	0.097
Left Edge	11g	1	16.0	16.0	0.694	0.09	96.94	0.716

Note:

1) The SAR testing was set to transmit at maximum power for all tests.

OFDM mode SAR evaluation exclusion analysis

Mode	Tune-up (dBm)	Tune-up (mW)	Highest Reported SAR (W/Kg)	Adjusted SAR (W/Kg)	SAR Test
802.11g	16	39.81	0.716	\	\
802.11n20	15.5	35.48	\	0.638	Excluded
802.11n40	12	15.85	\	0.285	Excluded

Note:

1) The highest reported SAR for OFDM adjusted by the ratio of OFDM 802.11n to OFDM specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, so SAR evaluation for 802.11n is not required.

12.19. SAR Test Results of 5GHz Wi-Fi

Scenario and Distance (Body 5mm)	Test Mode	Channel/ Frequency	Power (dBm)		SAR Value	Power Drift	Duty Factor (%)	Scaled (W/Kg)
			Tune-up	Meas.	1-g (W/Kg)			
5.3GHz								
Front Surface	11a	48	12.5	12.48	0.068	-0.03	97.08	0.070
Back Surface	11a	48	12.5	12.48	0.045	0.00	97.08	0.047
Left Edge	11a	48	12.5	12.48	1.020	-0.01	97.08	1.056
Left Edge	11a	36	12.5	12.47	1.190	-0.03	97.08	1.234
Left Edge	11a	40	12.5	12.43	0.995	-0.05	97.08	1.042
Left Edge	11a	44	12.5	12.40	1.120	-0.06	97.08	1.181
Left Edge	11n20	36	11.5	10.58	0.913	-0.01	96.80	1.166
Left Edge	11n20	40	11.5	10.70	0.905	-0.01	96.80	1.124
Worst Case repeated								
Left Edge	11a	36	12.5	12.47	1.160	-0.03	97.08	1.203
5.8GHz								
Front Surface	11a	149	12.0	11.98	0.101	-0.02	99.57	0.102
Back Surface	11a	149	12.0	11.98	0.071	-0.06	99.57	0.072
Left Edge	11a	149	12.0	11.98	1.090	-0.06	99.57	1.100
Left Edge	11a	153	12.0	11.93	1.030	-0.02	99.57	1.051
Left Edge	11a	157	12.0	11.58	0.998	-0.01	99.57	1.104
Left Edge	11a	161	12.0	11.95	0.987	0.00	99.57	1.003
Left Edge	11a	165	12.0	11.60	1.050	-0.02	99.57	1.156
Worst Case repeated								
Left Edge	11a	149	12.0	11.98	1.080	0.00	99.57	1.090

Note:

1) When the reported SAR of the initial test configuration is ＞0.8W/kg, SAR measurement is required for subsequent nest highest measured output power channel(s) in the initial test configuration until reported SAR is ≤1.2 W/kg or all required channels are tested.
2) The SAR testing was set to transmit at maximum power for all tests.

Subsequent test configuration SAR evaluation exclusion analysis for U-NII-I band

Mode	Tune-up (dBm)	Tune-up (mW)	Highest Reported SAR (W/Kg)	Adjusted SAR (W/Kg)	SAR Test
802.11a	12.0	15.85	1.234	\	\
802.11n 40M	10.5	11.22	\	0.874	Excluded
802.11ac 20M	11.0	12.59	\	0.980	Excluded
802.11ac 40M	10.5	11.22	\	0.874	Excluded
802.11ac 80M	10.0	10.00	\	0.779	Excluded

Note:

1) The 802.11a mode is selected as Initial Test Configuration for SAR test according to the specified maximum output power. As the highest reported SAR for the initial test configuration is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR test for the other 802.11 modes is not required.

Subsequent test configuration SAR evaluation exclusion analysis for U-NII-3 band

Mode	Tune-up (dBm)	Tune-up (mW)	Highest Reported SAR (W/Kg)	Adjusted SAR (W/Kg)	SAR Test
802.11a-20	12.0	15.85	1.156	\	\
802.11n 20M	11.0	12.59	\	0.918	Excluded
802.11n 40M	11.0	12.59	\	0.918	Excluded
802.11ac 20M	11.0	12.59	\	0.918	Excluded
802.11ac 40M	11.0	12.59	\	0.918	Excluded
802.11ac 80M	10.0	10.00	\	0.729	Excluded

Note:

1) The 802.11a mode is selected as Initial Test Configuration for SAR test according to the specified maximum output power. As the highest reported SAR for the initial test configuration is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR test for the other 802.11 modes is not required.

12.20. SAR Test Results of Bluetooth

Scenario and Distance (Body 5mm)	Test Mode	Channel/ Frequency	Power (dBm)		SAR Value	Power Drift	Duty Factor (%)	Scaled (W/Kg)
			Tune-up	Meas.	1-g (W/Kg)			
Front Surface	BT DH5	78	11.5	11.09	0.013	-0.03	77.07	0.019
Back Surface	BT DH5	78	11.5	11.09	0.012	0.00	77.07	0.017
Left Edge	BT DH5	78	11.5	11.09	0.116	-0.08	77.07	0.165

Note:
The SAR testing was set to transmit at maximum power for all tests.

13. Simultaneous Transmission SAR Analysis

According to FCC OET KDB447498 D01, when the sum of 1g SAR for all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit, SAR test exclusion applies to that simultaneous transmission configuration.

13.1. Simultaneous Transmission calculation

NO.	Combination	Scenario
		Body
1	GSM+BT+NFC	√
2	GSM+2.4G WIFI+NFC	√
3	GSM+5G WIFI+NFC	√
4	WCDMA+BT+NFC	√
5	WCDMA+2.4G WIFI+NFC	√
6	WCDMA+5G WIFI+NFC	√
7	LTE+BT+NFC	√
8	LTE+2.4G WIFI+NFC	√
9	LTE+5G WIFI+NFC	√

Note:
1) "√" indicates exist, "×" indicates inexistence.
2) The NFC SAR test evaluation can be waived, so the SAR measurement of the NFC transmitter does not need to be synchronized with the WWAN/WLAN/BT, and therefore the SAR result for 13.56 MHz NFC is considered to be 0 W/kg.

13.2. Highest Reported SAR

GSM Highest Reported SAR (1-g) (W/kg) For Body	
Test Position	GSM_{MAX}
Back Surface	1.325
Front Surface	0.464
Left Edge	/
Right Edge	0.373
Top Edge	/
Bottom Edge	0.709

WCDMA Highest Reported SAR (1-g) (W/kg) For Body	
Test Position	$WCDMA_{MAX}$
Back Surface	0.820
Front Surface	0.926
Left Edge	/
Right Edge	0.872
Top Edge	/
Bottom Edge	1.087

LTE Highest Reported SAR (1-g) (W/kg) For Body	
Test Position	LTE_{MAX}
Back Surface	0.988
Front Surface	0.895
Left Edge	/
Right Edge	0.726
Top Edge	/
Bottom Edge	1.195

BT Highest Reported SAR (1-g) (W/kg) For Body	
Test Position	BT_{MAX}
Back Surface	0.019
Front Surface	0.017
Left Edge	0.165
Right Edge	/
Top Edge	/
Bottom Edge	/

2.4G Wi-Fi Highest Reported SAR (1-g) (W/kg) For Body	
Test Position	2.4G $Wi\text{-}Fi_{MAX}$
Back Surface	0.121
Front Surface	0.097
Left Edge	0.716
Right Edge	/
Top Edge	/
Bottom Edge	/

5G Wi-Fi Highest Reported SAR (1-g) (W/kg) For Body	
Test Position	5G $Wi\text{-}Fi_{MAX}$
Back Surface	0.102
Front Surface	0.072
Left Edge	1.234
Right Edge	/
Top Edge	/
Bottom Edge	/

13.3. Simultaneous Transmission calculation

KDB 447498 D01 General RF Exposure Guidance provides two procedures for determining simultaneous transmission SAR test exclusion: Sum of SAR and SAR to Peak Location Ratio (SPLSR)

Sum of SAR

To qualify for simultaneous transmission SAR test exclusion based upon Sum of SAR the sum of the reported standalone SARs for all simultaneously transmitting antennas shall be below the applicable standalone SAR limit. If the sum of the SARs is above the applicable limit then simultaneous transmission SAR test exclusion may still apply if the requirements of the SAR to Peak Location Ratio (SPLSR) evaluation are met.

SAR to Peak Location Ratio (SPLSR)

KDB 447498 D01 General RF Exposure Guidance explains how to calculate the SAR to Peak Location Ratio (SPLSR) between pairs of simultaneously transmitting antennas:

SPLSR = (SAR1 + SAR2)1.5 /Ri

Where:

***SAR*$_1$** is the highest reported or estimated SAR for the first of a pair of simultaneous transmitting antennas, in a specific test operating mode and exposure condition

***SAR*$_2$** is the highest reported or estimated SAR for the second of a pair of simultaneous transmitting antennas, in the same test operating mode and exposure condition as the first

Ri is the separation distance between the pair of simultaneous transmitting antennas. When the SAR is measured, for both antennas in the pair, it is determined by the actual x, y and z coordinates in the 1-g SAR for each SAR peak location, based on the extrapolated and interpolated result in the zoom scan measurement, using the formula of $\mathbf{[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]}$

In order for a pair of simultaneous transmitting antennas with the sum of 1-g SAR > 1.6 W/kg to qualify for exemption from Simultaneous Transmission SAR measurements, it has to satisfy the condition of:

(SAR1 + SAR2)1.5 /Ri ≤ 0.04

When an individual antenna transmits at on two bands simultaneously, the sum of the highest *reported* SAR for the frequency bands should be used to determine ***SAR*$_1$**.or ***SAR*$_2$**. When SPLSR is necessary, the smallest distance between the peak SAR locations for the antenna pair with respect to the peaks from each antenna should be used.

The antennas in all antenna pairs that do not qualify for simultaneous transmission SAR test exclusion must be tested for SAR compliance, according to the enlarged zoom scan and volume scan post-processing procedures in KDB Publication 865664 D01

Position	Simultaneous Tx Antenna Combination		∑SAR 1g (W/kg)	Limit (W/kg)
	GSM_{MAX}	BT_{MAX}		
Front surface	1.325	0.019	1.344	1.6
Back surface	0.464	0.017	0.481	
Left Edge	/	0.165	0.165	
Right Edge	0.373	/	0.373	
Top Edge	/	/	/	
Bottom Edge	0.709	/	0.709	

Position	Simultaneous Tx Antenna Combination		∑SAR 1g (W/kg)	Limit (W/kg)
	GSM_{MAX}	2.4G $Wi\text{-}Fi_{MAX}$		
Front surface	1.325	0.121	1.446	1.6
Back surface	0.464	0.097	0.561	
Left Edge	/	0.716	0.716	
Right Edge	0.373	/	0.373	
Top Edge	/	/	/	
Bottom Edge	0.709	/	0.709	

Position	Simultaneous Tx Antenna Combination		∑SAR 1g (W/kg)	Limit (W/kg)
	GSM_{MAX}	5G $Wi\text{-}Fi_{MAX}$		
Front surface	1.325	0.102	1.427	1.6
Back surface	0.464	0.072	0.536	
Left Edge	/	1.234	1.234	
Right Edge	0.373	/	0.373	
Top Edge	/	/	/	
Bottom Edge	0.709	/	0.709	

Position	Simultaneous Tx Antenna Combination		∑SAR 1g (W/kg)	Limit (W/kg)
	$WCDMA_{MAX}$	BT_{MAX}		
Front surface	0.820	0.019	0.839	1.6
Back surface	0.926	0.017	0.943	
Left Edge	/	0.165	0.165	
Right Edge	0.872	/	0.872	
Top Edge	/	/	/	
Bottom Edge	1.087	/	1.087	

Position	Simultaneous Tx Antenna Combination		∑SAR 1g (W/kg)	Limit (W/kg)
	$WCDMA_{MAX}$	2.4G $Wi\text{-}Fi_{MAX}$		
Front surface	0.820	0.121	0.941	1.6
Back surface	0.926	0.097	1.023	
Left Edge	/	0.716	0.716	
Right Edge	0.872	/	0.872	
Top Edge	/	/	/	
Bottom Edge	1.087	/	1.087	

Position	Simultaneous Tx Antenna Combination		∑SAR 1g (W/kg)	Limit (W/kg)
	$WCDMA_{MAX}$	5G $Wi\text{-}Fi_{MAX}$		
Front surface	0.820	0.102	0.922	1.6
Back surface	0.926	0.072	0.998	
Left Edge	/	1.234	1.234	
Right Edge	0.872	/	0.872	
Top Edge	/	/	/	
Bottom Edge	1.087	/	1.087	

Position	Simultaneous Tx Antenna Combination		∑SAR 1g (W/kg)	Limit (W/kg)
	LTE_{MAX}	BT_{MAX}		
Front surface	0.988	0.019	1.007	1.6
Back surface	0.895	0.017	0.912	
Left Edge	/	0.165	0.165	
Right Edge	0.726	/	0.726	
Top Edge	/	/	/	
Bottom Edge	1.195	/	1.195	

Position	Simultaneous Tx Antenna Combination		∑SAR 1g (W/kg)	Limit (W/kg)
	LTE_{MAX}	2.4G $Wi\text{-}Fi_{MAX}$		
Front surface	0.988	0.121	1.109	1.6
Back surface	0.895	0.097	0.992	
Left Edge	/	0.716	0.716	
Right Edge	0.726	/	0.726	
Top Edge	/	/	/	
Bottom Edge	1.195	/	1.195	

Position	Simultaneous Tx Antenna Combination		∑SAR 1g (W/kg)	Limit (W/kg)
	LTE_{MAX}	5G $Wi\text{-}Fi_{MAX}$		
Front surface	0.988	0.102	1.090	1.6
Back surface	0.895	0.072	0.967	
Left Edge	/	1.234	1.234	
Right Edge	0.726	/	0.726	
Top Edge	/	/	/	
Bottom Edge	1.195	/	1.195	

Appendixes

Refer to separated files for the following appendixes.

4790950508-SAR-1_APP A Conducted Power

4790950508-SAR-1_App B Photo

4790950508-SAR-1_App C System Check Plots

4790950508-SAR-1_App D Highest Test Plots

4790950508-SAR-1_App E Cal. Certificates

---------End of Report---------