9.2 General Measurement Procedure

The area and zoom scan resolutions specified in the table below must be applied to the SAR measurements and fully documented in SAR reports to qualify for TCB approval. Probe boundary effect error compensation is required for measurements with the probe tip closer than half a probe tip diameter to the phantom surface. Both the probe tip diameter and sensor offset distance must satisfy measurement protocols; to ensure probe boundary effect errors are minimized and the higher fields closest to the phantom surface can be correctly measured and extrapolated to the phantom surface for computing 1-g SAR. Tolerances of the post-processing algorithms must be verified by the test laboratory for the scan resolutions used in the SAR measurements, according to the reference distribution functions specified in IEEE Std 1528-2003. The results should be documented as part of the system validation records and may be requested to support test results when all the measurement parameters in the following table are not satisfied.

<table>
<tr><td colspan="3"></td><td>≤ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td colspan="3">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>½·δ·ln(2) ± 0.5 mm</td></tr>
<tr><td colspan="3">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td colspan="3" rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">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.</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>≤ 2 GHz: ≤ 8 mm
2 – 3 GHz: ≤ 5 mm*</td><td>3 – 4 GHz: ≤ 5 mm*
4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm
4 – 5 GHz: ≤ 3 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm
4 – 5 GHz: ≤ 2.5 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">≤ 1.5·$\Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>≥ 30 mm</td><td>3 – 4 GHz: ≥ 28 mm
4 – 5 GHz: ≥ 25 mm
5 – 6 GHz: ≥ 22 mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.
* When zoom scan is required and the <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

9.3 WCDMA Measurement Procedures for SAR

The following procedures are applicable to WCDMA handsets operating under 3GPP Release99, Release 5 and Release 6. The default test configuration is to measure SAR with an established radio link between the DUT and a communication test set using a 12.2kbps RMC (reference measurement channel) configured in Test Loop Mode 1. SAR is selectively confirmed for other physical channel configurations (DPCCH & $DPDCH_n$), HSDPA and HSPA (HSUPA/HSDPA) modes according to output power, exposure conditions and device operating capabilities. Both uplink and downlink should be configured with the same RMC or AMR, when required. SAR for Release 5 HSDPA and Release 6 HSPA are measured using the applicable FRC (fixed reference channel) and E-DCH reference channel configurations. Maximum output power is verified according to applicable versions of 3GPP TS 34.121 and SAR must be measured according to these maximum output conditions. When Maximum Power Reduction (MPR) is not implemented according to Cubic Metric (CM) requirements for Release 6 HSPA, the following procedures do not apply.

For Release 5 HSDPA Data Devices:

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs}	CM/dB
1	2/15	15/15	64	2/15	4/15	0.0
2	12/15	15/15	64	12/15	24/25	1.0
3	15/15	8/15	64	15/8	30/15	1.5
4	15/15	4/15	64	15/4	30/15	1.5

For Release 6 HSPA Data Devices

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs}	β_{ec}	β_{ed}	β_{ed} (SF)	β_{ed} (codes)	CM (dB)	MPR (dB)	AG Index	E-TFCI
1	11/15	15/15	64	11/15	22/15	209/225	1039/225	4	1	1.5	1.5	20	75
2	6/15	15/15	64	6/15	12/15	12/15	12/15	4	1	1.5	1.5	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed1}:47/15 β_{ed2}:47/15	4	2	1.5	1.5	15	92
4	2/15	15/15	64	2/15	4/15	4/15	56/75	4	1	1.5	1.5	17	71
5	15/15	15/15	64	15/15	24/15	30/15	134/15	4	1	1.5	1.5	21	81

Rel.8 DC-HSDPA (Cat 24)

SAR test exclusion for Rel.8 DC-HSDPA must satisfy the SAR test exclusion requirements of Rel.5 HSDPA. SAR test exclusion for DC-HSDPA devices is determined by power measurements according to the H-Set 12, Fixed Reference Channel (FRC) configuration in Table C.8.1.12 of 3GPP TS 34.121-1. A primary and a secondary serving HS-DSCH Cell are required to perform the power measurement and for the results to qualify for SAR test exclusion.

9.4 SAR Measurement for LTE

SAR tests for LTE are performed with a base station simulator, Rohde & Rchwarz CMW500. Closed loop power control was used so the UE transmits with maximum output power during SAR testing. All powers were measured with the CMW 500.
It is performed for conducted power and SAR based on the KDB941225 D05.
SAR is evaluated separately according to the following procedures for the different test positions in each exposure condition – head, body, body-worn accessories and other use conditions. The procedures in the following subsections are applied separately to test each LTE frequency band.

1) 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 among 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.
2) QPSK with 50% RB allocation
   The procedures required for 1 RB allocation in 1) are applied to measure the SAR for QPSK with 50% RB allocation.
3) 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 1) and 2) 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.

9.5 Bluetooth & Wi-Fi Measurement Procedures for SAR

Normal network operating configurations are not suitable for measuring the SAR of 802.11 transmitters in general. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure that the results are consistent and reliable.
Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in a test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters. The test frequencies should correspond to actual channel frequencies defined for domestic use. SAR for devices with switched diversity should be measured with only one antenna transmitting at a time during each SAR measurement, according to a fixed modulation and data rate. The same data pattern should be used for all measurements.

9.6 Power Drift

To control the output power stability during the SAR test, DASY4 system calculates the power drift by measuring the E-field at the same location at the beginning and at the end of the measurement for each test position. These drift values can be found in section 14 labeled as: (Power Drift [dB]). This ensures that the power drift during one measurement is within 5%.

10 Area Scan Based 1-g SAR

10.1 Requirement of KDB

According to the KDB447498 D01 v05, when the implementation is based the specific polynomial fit
algorithm as presented at the 29th Bioelectromagnetics Society meeting (2007) and the estimated 1-g SAR is ≤ 1.2 W/kg, a zoom scan measurement is not required provided it is also not needed for any other purpose; for example, if the peak SAR location required for simultaneous transmission SAR test exclusion can be determined accurately by the SAR system or manually to discriminate between distinctive peaks and scattered noisy SAR distributions from area scans.

There must not be any warning or alert messages due to various measurement concerns identified by the SAR system; for example, noise in measurements, peaks too close to scan boundary, peaks are too sharp, spatial resolution and uncertainty issues etc. The SAR system verification must also demonstrate that the area scan estimated 1-g SAR is within 3% of the zoom scan 1-g SAR (See Annex B). When all the SAR results for each exposure condition in a frequency band and wireless mode are based on estimated 1-g SAR, the 1-g SAR for the highest SAR configuration must be determined by a zoom scan.

10.2 Fast SAR Algorithms

The approach is based on the area scan measurement applying a frequency dependent attenuation parameter. This attenuation parameter was empirically determined by analyzing a large number of phones. The MOTOROLA FAST SAR was developed and validated by the MOTOROLA Research Group in Ft. Lauderdale.

In the initial study, an approximation algorithm based on Linear fit was developed. The accuracy of the algorithm has been demonstrated across a broad frequency range (136-2450 MHz) and for both 1- and 10-g averaged SAR using a sample of 264 SAR measurements from 55 wireless handsets. For the sample size studied, the root-mean-squared errors of the algorithm are 1.2% and 5.8% for 1- and 10-g averaged SAR, respectively. The paper describing the algorithm in detail is expected to be published in August 2004 within the Special Issue of Transactions on MTT.

In the second step, the same research group optimized the fitting algorithm to an Polynomial fit whereby the frequency validity was extended to cover the range 30-6000MHz. Details of this study can be found in the BEMS 2007 Proceedings.
Both algorithms are implemented in DASY software.

11 Conducted Output Power

This device uses a proximity sensor for SAR compliance. The proximity sensor is activated when the device is used in close proximity to the user. The proximity sensors trigger power reduction for all bands WLAN and Bluetooth. There is no power reduction mechanism for BT modes for SAR purposes.

11.1 GSM Measurement result

During the process of testing, the EUT was controlled via Agilent Digital Radio Communication tester (E5515C) to ensure the maximum power transmission and proper modulation. This result contains conducted output power for the EUT. In all cases, the measured peak output power should be greater and within 5% than EMI measurement.

Note：the #1 is normal power– Proximity sensor not active，
the #2 is low power– Proximity sensor active.

Table 11-1 GSM850 #1

GSM850 #1								
		Measured Power (dBm)			Caculation	Average Power （dBm）		
Config	Tune-up	CH251 848.8 MHz	CH190 836.6 MHz	CH128 824.2 MHz		CH251 848.8 MHz	CH190 836.6 MHz	CH128 824.2 MHz
GSM Speech	33.00	32.01	31.92	31.76				
GPRS 1 Txslot	33.00	31.98	31.88	31.73	-9.03	22.95	22.85	22.70
GPRS 2 Txslots	32.00	31.35	31.27	31.13	-6.02	25.33	25.25	25.11
GPRS 3 Txslots	31.00	29.79	29.68	29.53	-4.26	25.53	25.42	25.27
GPRS 4 Txslots	30.00	28.91	28.74	28.52	-3.01	25.90	25.73	25.51
EGPRS GMSK 1 Txslot	33.00	32.07	31.97	31.82	-9.03	23.04	22.94	22.79
EGPRS GMSK 2 Txslots	32.00	31.45	31.35	31.20	-6.02	25.43	25.33	25.18
EGPRS GMSK 3 Txslots	31.00	29.88	29.77	29.60	-4.26	25.62	25.51	25.34
EGPRS GMSK 4 Txslots	30.00	28.97	28.76	28.52	-3.01	25.96	25.75	25.51
EGPRS 8PSK 1 Txslot	27.50	26.03	25.65	25.55	-9.03	17.00	16.62	16.52
EGPRS 8PSK 2 Txslots	26.50	25.04	24.78	24.65	-6.02	19.02	18.76	18.63
EGPRS 8PSK 3 Txslots	24.50	23.10	22.76	22.64	-4.26	18.84	18.50	18.38
EGPRS 8PSK 4 Txslots	23.50	22.17	21.89	21.75	-3.01	19.16	18.88	18.74

Table 11-2 GSM850 #2

GSM850 #2								
		Measured Power (dBm)			Caculation	Average Power （dBm）		
Config	Tune-up	CH251 848.8 MHz	CH190 836.6 MHz	CH128 824.2 MHz		CH251 848.8 MHz	CH190 836.6 MHz	CH128 824.2 MHz
GSM Speech	28.00	27.36	27.21	27.01				
GPRS 1 Txslot	28.00	27.37	27.22	27.03	-9.03	18.34	18.19	18.00
GPRS 2 Txslots	25.00	24.34	24.18	23.94	-6.02	18.32	18.16	17.92
GPRS 3 Txslots	23.00	22.57	22.38	22.19	-4.26	18.31	18.12	17.93
GPRS 4 Txslots	22.00	21.46	21.28	21.03	-3.01	18.45	18.27	18.02
EGPRS GMSK 1 Txslot	28.00	27.37	27.23	27.04	-9.03	18.34	18.20	18.01
EGPRS GMSK 2 Txslots	25.00	24.35	24.18	23.93	-6.02	18.33	18.16	17.91
EGPRS GMSK 3 Txslots	23.00	22.57	22.39	22.18	-4.26	18.31	18.13	17.92
EGPRS GMSK 4 Txslots	22.00	21.43	21.33	21.01	-3.01	18.42	18.32	18.00
EGPRS 8PSK 1 Txslot	22.00	21.17	20.85	20.76	-9.03	12.14	11.82	11.73
EGPRS 8PSK 2 Txslots	19.00	18.04	17.65	17.57	-6.02	12.02	11.63	11.55
EGPRS 8PSK 3 Txslots	17.00	16.11	15.80	15.68	-4.26	11.85	11.54	11.42
EGPRS 8PSK 4 Txslots	15.00	14.90	14.46	14.35	-3.01	11.89	11.45	11.34

Table 11-3 PCS1900 #1

PCS1900 #1								
		Measured Power (dBm)			Caculation	Average Power （dBm）		
Config	Tune-up	CH810 1909.8 MHz	CH661 1880 MHz	CH512 1850.2 MHz		CH810 1909.8 MHz	CH661 1880 MHz	CH512 1850.2 MHz
GSM Speech	31.00	29.13	29.11	29.12				
GPRS 1 Txslot	31.00	29.13	29.11	29.11	-9.03	20.10	20.08	20.08
GPRS 2 Txslots	30.00	28.54	28.50	28.49	-6.02	22.52	22.48	22.47
GPRS 3 Txslots	28.00	27.05	26.99	26.97	-4.26	22.79	22.73	22.71
GPRS 4 Txslots	27.00	26.01	25.91	25.86	-3.01	23.00	22.90	22.85
EGPRS GMSK 1 Txslot	31.00	29.07	29.04	29.03	-9.03	20.04	20.01	20.00
EGPRS GMSK 2 Txslots	30.00	28.47	28.44	28.44	-6.02	22.45	22.42	22.42
EGPRS GMSK 3 Txslots	28.00	27.00	26.93	26.93	-4.26	22.74	22.67	22.67
EGPRS GMSK 4 Txslots	27.00	25.95	25.86	25.81	-3.01	22.94	22.85	22.80
EGPRS 8PSK 1 Txslot	26.50	25.80	25.72	25.73	-9.03	16.77	16.69	16.70
EGPRS 8PSK 2 Txslots	25.50	25.02	24.88	24.89	-6.02	19.00	18.86	18.87
EGPRS 8PSK 3 Txslots	23.50	23.34	23.08	23.20	-4.26	19.08	18.82	18.94
EGPRS 8PSK 4 Txslots	22.50	22.25	22.13	22.13	-3.01	19.24	19.12	19.12

Table 11-4 PCS1900 #2

PCS1900 #2								
		Measured Power (dBm)			Caculation	Average Power （dBm）		
Config	Tune-up	CH810 1909.8 MHz	CH661 1880 MHz	CH512 1850.2 MHz		CH810 1909.8 MHz	CH661 1880 MHz	CH512 1850.2 MHz
GSM Speech	25.00	24.53	24.38	24.27				
GPRS 1 Txslot	25.00	24.54	24.38	24.27	-9.03	15.51	15.35	15.24
GPRS 2 Txslots	22.00	21.55	21.40	21.38	-6.02	15.53	15.38	15.36
GPRS 3 Txslots	20.00	19.83	19.67	19.65	-4.26	15.57	15.41	15.39
GPRS 4 Txslots	19.00	18.49	18.35	18.32	-3.01	15.48	15.34	15.31
EGPRS GMSK 1 Txslot	25.00	24.54	24.39	24.28	-9.03	15.51	15.36	15.25
EGPRS GMSK 2 Txslots	22.00	21.56	21.40	21.39	-6.02	15.54	15.38	15.37
EGPRS GMSK 3 Txslots	20.00	19.82	19.67	19.66	-4.26	15.56	15.41	15.40
EGPRS GMSK 4 Txslots	19.00	18.50	18.34	18.32	-3.01	15.49	15.33	15.31
EGPRS 8PSK 1 Txslot	22.00	21.36	21.25	21.25	-9.03	12.33	12.22	12.22
EGPRS 8PSK 2 Txslots	19.00	18.41	18.25	18.29	-6.02	12.39	12.23	12.27
EGPRS 8PSK 3 Txslots	17.00	16.58	16.49	16.57	-4.26	12.32	12.23	12.31
EGPRS 8PSK 4 Txslots	16.00	15.21	15.12	15.22	-3.01	12.20	12.11	12.21

NOTES:

Division Factors

To average the power, the division factor is as follows:

1TX-slot = 1 transmit time slot out of 8 time slots=> conducted power divided by (8/1) => -9.03dB

2TX-slots = 2 transmit time slots out of 8 time slots=> conducted power divided by (8/2) => -6.02dB

3TX-slots = 3 transmit time slots out of 8 time slots=> conducted power divided by (8/3) => -4.26dB

4TX-slots = 4 transmit time slots out of 8 time slots=> conducted power divided by (8/4) => -3.01dB

According to the conducted power as above, the body measurements are performed with 4Txslots for 850MHz and 1900MHz in normal power. And 4Txslots for 850MHz and 3Txslots for 1900MHz in lower power.

11.2 WCDMA Measurement result

Table 11-5 WCDMA1900-BII #1

WCDMA1900-BII #1					
			Measured Power (dBm)		
Item		Tune-up	CH9538 1907.6 MHz	CH9400 1880 MHz	CH9262 1852.4 MHz
WCDMA	RMC	23.00	22.50	22.66	22.64
HSUPA	subtest1	21.00	20.46	20.12	20.01
	subtest2	21.00	19.96	20.03	19.93
	subtest3	21.00	20.98	21.00	20.95
	subtest4	21.00	19.45	19.58	19.41
	subtest5	22.00	21.94	22.00	21.90
HSPA+	\	22.00	21.58	21.54	21.51
DC-HSDPA	subtest1	23.00	22.01	22.02	22.02
	subtest2	23.00	21.97	21.98	22.01
	subtest3	23.00	21.46	21.48	21.49
	subtest4	23.00	21.49	21.52	21.51

Table 11-6 WCDMA1900-BII #2

WCDMA1900-BII #2					
			Measured Power (dBm)		
Item		Tune-up	CH9538 1907.6 MHz	CH9400 1880 MHz	CH9262 1852.4 MHz
WCDMA	RMC	17.50	16.99	17.09	17.07
HSUPA	subtest1	17.00	15.94	15.44	15.38
	subtest2	17.00	15.41	15.42	15.38
	subtest3	17.00	16.44	16.46	16.38
	subtest4	16.00	14.87	14.93	14.84
	subtest5	18.00	17.42	17.43	17.35
HSPA+	\	18.00	17.04	17.05	17.01
DC-HSDPA	subtest1	18.00	17.52	17.54	17.55
	subtest2	18.00	17.35	17.51	17.51
	subtest3	18.00	16.96	16.97	16.97
	subtest4	18.00	16.95	16.98	16.98

Table 11-7 WCDMA850-BV #1

WCDMA850-BV #1					
			Measured Power (dBm)		
Item		Tune-up	CH4233 846.6 MHz	CH4182 835.4 MHz	CH4132 826.4 MHz
WCDMA	RMC	23.00	22.91	22.97	22.99
HSUPA	subtest1	21.00	19.41	19.92	19.96
	subtest2	21.00	19.94	19.94	19.93
	subtest3	21.00	20.92	20.96	20.96
	subtest4	21.00	19.38	19.42	19.41
	subtest5	22.00	21.90	21.95	21.95
HSPA+	\	22.00	21.58	21.53	21.52
DC-HSDPA	subtest1	23.00	22.05	21.92	21.98
	subtest2	23.00	22.06	21.94	21.95
	subtest3	23.00	21.54	21.45	21.44
	subtest4	23.00	21.52	21.46	21.48

Table 11-8 WCDMA850-BV #2

WCDMA850-BV #2					
			Measured Power (dBm)		
Item		Tune-up	CH4233 846.6 MHz	CH4182 835.4 MHz	CH4132 826.4 MHz
WCDMA	RMC	18.00	17.41	17.52	17.54
HSUPA	subtest1	17.00	15.78	15.34	15.32
	subtest2	17.00	15.31	15.34	15.31
	subtest3	17.00	16.30	16.32	16.31
	subtest4	16.00	14.77	14.79	14.75
	subtest5	18.00	17.28	17.35	17.29
HSPA+	\	18.00	16.96	16.96	16.94
DC-HSDPA	subtest1	18.00	17.47	17.38	17.37
	subtest2	18.00	17.43	17.37	17.38
	subtest3	18.00	16.84	16.85	16.85
	subtest4	18.00	16.88	16.86	16.88

11.3 LTE Measurement result

Table 11-9 LTE2500-FDD7 #1

LTE2500-FDD7 #1							
				Measured Power (dBm) & MPR			
				QPSK		16QAM	
BandWidth	RB No./Start	Channel	Tune-up	Measured Power	MPR	Measured Power	MPR
5MHz	1H	21425	24	22.23	0	21.09	1
		21100	24	22.35	0	21.21	1
		20775	24	22.47	0	21.32	1
	1M	21425	24	22.37	0	21.19	1
		21100	24	22.44	0	21.28	1
		20775	24	22.58	0	21.41	1
	1L	21425	24	22.37	0	21.21	1
		21100	24	22.39	0	21.25	1
		20775	24	22.60	0	21.42	1
	12H	21425	24	21.31	1	20.34	2
		21100	24	21.44	1	20.43	2
		20775	24	21.69	1	20.65	2
	12M	21425	24	21.35	1	20.36	2
		21100	24	21.45	1	20.44	2
		20775	24	21.71	1	20.70	2
	12L	21425	24	21.37	1	20.40	2
		21100	24	21.43	1	20.43	2
		20775	24	21.72	1	20.69	2
	25	21425	24	21.27	1	20.23	2
		21100	24	21.38	1	20.31	2
		20775	24	21.64	1	20.54	2
10MHz	1H	21400	24	22.38	0	21.66	1
		21100	24	22.48	0	21.36	1
		20800	24	22.58	0	21.98	1
	1M	21400	24	22.48	0	21.79	1
		21100	24	22.51	0	21.42	1
		20800	24	22.71	0	22.07	1
	1L	21400	24	22.51	0	21.92	1
		21100	24	22.44	0	21.36	1
		20800	24	22.78	0	22.12	1
	25H	21400	24	21.41	1	20.39	2
		21100	24	21.38	1	20.42	2
		20800	24	21.59	1	20.63	2
	25M	21400	24	21.36	1	20.49	2
		21100	24	21.39	1	20.46	2
		20800	24	21.65	1	20.67	2
	25L	21400	24	21.50	1	20.43	2
		21100	24	21.36	1	20.43	2
		20800	24	21.67	1	20.71	2
	50	21400	24	21.25	1	20.40	2
		21100	24	21.38	1	20.38	2
		20800	24	21.63	1	20.61	2
15MHz	1H	21375	24	22.47	0	21.71	1
		21100	24	22.55	0	21.75	1
		20825	24	22.34	0	21.87	1
	1M	21375	24	22.57	0	21.96	1
		21100	24	22.60	0	21.80	1
		20825	24	22.62	0	21.63	1
	1L	21375	24	22.64	0	22.04	1
		21100	24	22.50	0	21.76	1
		20825	24	22.78	0	22.11	1
	36H	21375	24	21.62	1	20.47	2
		21100	24	21.63	1	20.49	2
		20825	24	21.66	1	20.54	2
	36M	21375	24	21.59	1	20.53	2
		21100	24	21.63	1	20.50	2
		20825	24	21.75	1	20.61	2
	36L	21375	24	21.67	1	20.60	2
		21100	24	21.57	1	20.46	2
		20825	24	21.80	1	20.66	2
	75	21375	24	21.60	1	20.55	2
		21100	24	21.62	1	20.52	2
		20825	24	21.74	1	20.62	2

20MHz	1H	21350	24	22.50	0	21.62	1
		21100	24	22.57	0	21.93	1
		20850	24	22.45	0	21.67	1
	1M	21350	24	22.64	0	21.81	1
		21100	24	22.57	0	**21.98**	1
		20850	24	22.60	0	21.79	1
	1L	21350	24	22.69	0	**21.88**	1
		21100	24	22.46	0	21.92	1
		20850	24	22.74	0	**21.91**	1
	50H	21350	24	21.43	1	20.42	2
		21100	24	21.52	1	20.46	2
		20850	24	21.46	1	20.41	2
	50M	21350	24	21.48	1	20.50	2
		21100	24	21.46	1	20.41	2
		20850	24	21.50	1	20.44	2
	50L	21350	24	21.55	1	20.55	2
		21100	24	21.44	1	20.39	2
		20850	24	21.60	1	20.54	2
	100	21350	24	21.51	1	20.52	2
		21100	24	21.48	1	20.45	2
		20850	24	21.53	1	20.48	2

Table 11-10 LTE2500-FDD7 #2

LTE2500-FDD7 #2							
				Measured Power (dBm) & MPR			
				QPSK		16QAM	
BandWidth	RB No./Start	Channel	Tune-up	Measured Power	MPR	Measured Power	MPR
5MHz	1H	21425	18	16.86	0	16.76	0
		21100	18	16.76	0	16.86	0
		20775	18	16.79	0	16.71	0
	1M	21425	18	16.96	0	16.85	0
		21100	18	16.82	0	16.89	0
		20775	18	16.89	0	16.78	0
	1L	21425	18	16.98	0	16.88	0
		21100	18	16.74	0	16.83	0
		20775	18	16.89	0	16.77	0
	12H	21425	18	16.96	0	16.98	0
		21100	18	16.85	0	16.89	0
		20775	18	16.86	0	16.90	0
	12M	21425	18	16.97	0	17.00	0
		21100	18	16.86	0	16.88	0
		20775	18	16.88	0	16.92	0
	12L	21425	18	16.97	0	17.01	0
		21100	18	16.79	0	16.84	0
		20775	18	16.88	0	16.92	0
	25	21425	18	16.90	0	16.83	0
		21100	18	16.79	0	16.73	0
		20775	18	16.81	0	16.75	0
10MHz	1H	21400	18	16.88	0	17.42	0
		21100	18	16.83	0	16.84	0
		20800	18	16.75	0	17.33	0
	1M	21400	18	16.96	0	17.54	0
		21100	18	16.84	0	16.86	0
		20800	18	16.81	0	17.38	0
	1L	21400	18	17.04	0	17.61	0
		21100	18	16.74	0	16.76	0
		20800	18	16.83	0	17.39	0
	25H	21400	18	16.91	0	16.98	0
		21100	18	16.81	0	16.89	0
		20800	18	16.81	0	16.88	0
	25M	21400	18	16.94	0	17.02	0
		21100	18	16.79	0	16.87	0
		20800	18	16.81	0	16.90	0
	25L	21400	18	16.98	0	17.06	0
		21100	18	16.75	0	16.82	0
		20800	18	16.82	0	16.89	0
	50	21400	18	16.94	0	16.96	0
		21100	18	16.77	0	16.80	0
		20800	18	16.81	0	16.83	0
15MHz	1H	21375	18	16.86	0	17.41	0
		21100	18	16.85	0	17.23	0
		20825	18	16.61	0	17.21	0
	1M	21375	18	17.00	0	17.57	0
		21100	18	16.84	0	17.23	0
		20825	18	16.71	0	17.28	0
	1L	21375	18	17.05	0	17.63	0
		21100	18	16.76	0	17.16	0
		20825	18	16.78	0	17.35	0
	36H	21375	18	17.05	0	17.01	0
		21100	18	16.87	0	16.84	0
		20825	18	16.89	0	16.85	0
	36M	21375	18	17.08	0	17.05	0
		21100	18	16.88	0	16.85	0
		20825	18	16.75	0	16.73	0
	36L	21375	18	17.14	0	17.12	0
		21100	18	16.83	0	16.80	0
		20825	18	16.79	0	16.75	0
	75	21375	18	17.12	0	17.09	0
		21100	18	16.91	0	16.89	0
		20825	18	16.76	0	16.74	0

20MHz	1H	21350	18	17.07	0	17.34	0
		21100	18	17.00	0	17.54	0
		20850	18	16.72	0	17.01	0
	1M	21350	18	17.15	0	17.44	0
		21100	18	16.88	0	17.43	0
		20850	18	16.76	0	17.06	0
	1L	21350	18	17.18	0	**17.47**	0
		21100	18	16.76	0	17.33	0
		20850	18	16.87	0	**17.15**	0
	50H	21350	18	17.05	0	17.02	0
		21100	18	16.92	0	16.89	0
		20850	18	16.68	0	16.66	0
	50M	21350	18	17.08	0	17.05	0
		21100	18	16.86	0	16.83	0
		20850	18	16.72	0	16.68	0
	50L	21350	18	17.11	0	17.09	0
		21100	18	16.80	0	16.77	0
		20850	18	16.78	0	16.76	0
	100	21350	18	17.08	0	17.08	0
		21100	18	16.85	0	16.84	0
		20850	18	16.74	0	16.74	0

11.4 Wi-Fi and BT Measurement result

The output power of BT antenna is as following:

Table 11-11 Bluetooth Power

Bluetooth Power				
Mode	Channel	Frequence	Tune-up	Measured
GFSK	78	2480 MHz	5	4.01
	39	2441 MHz	5	4.71
	0	2402 MHz	5	4.59
EDR2M-4_DQPSK	78	2480 MHz	4	2.93
	39	2441 MHz	4	3.64
	0	2402 MHz	4	3.52
EDR3M-8DPSK	78	2480 MHz	4	3.11
	39	2441 MHz	4	3.8
	0	2402 MHz	4	3.63

The average conducted power for Wi-Fi is as following:

Table 11-12 WLAN2450 #1

WLAN2450 #1						
Band	Mode	Channel	Frequence	Data Rate	Tune-up	Measured
WLAN 2.4G 20M	802.11b	11	2462 MHz	1Mbps	16.20	15.74
		6	2437 MHz		16.20	16.12
		1	2412 MHz		16.20	15.94
		11	2462 MHz	2Mbps	/	/
		6	2437 MHz		16.20	16.10
		1	2412 MHz		/	/
		11	2462 MHz	5.5Mbps	/	/
		6	2437 MHz		16.20	16.08
		1	2412 MHz		/	/
		11	2462 MHz	11Mbps	/	/
		6	2437 MHz		16.20	15.71
		1	2412 MHz		/	/
	802.11g	11	2462 MHz	6Mbps	16.20	15.17
		6	2437 MHz		16.20	15.49
		1	2412 MHz		13.00	12.79
		11	2462 MHz	9Mbps	/	/
		6	2437 MHz		16.20	15.42
		1	2412 MHz		/	/
		11	2462 MHz	12Mbps	16.20	15.28
		6	2437 MHz		16.20	15.55
		1	2412 MHz		13.00	12.82
		11	2462 MHz	18Mbps	/	/
		6	2437 MHz		16.20	15.46
		1	2412 MHz		/	/
		11	2462 MHz	24Mbps	/	/
		6	2437 MHz		16.20	15.17
		1	2412 MHz		/	/
		11	2462 MHz	36Mbps	/	/
		6	2437 MHz		16.20	14.58
		1	2412 MHz		/	/
		11	2462 MHz	48Mbps	/	/
		6	2437 MHz		16.20	14.85
		1	2412 MHz		/	/
		11	2462 MHz	54Mbps	/	/
		6	2437 MHz		16.20	14.52
		1	2412 MHz		/	/
	802.11n 20M	11	2462 MHz	MCS0	16.20	15.12
		6	2437 MHz		16.20	15.46
		1	2412 MHz		13.00	12.79
		11	2462 MHz	MCS1	/	/
		6	2437 MHz		16.20	15.34
		1	2412 MHz		/	/
		11	2462 MHz	MCS2	/	/
		6	2437 MHz		16.20	15.27
		1	2412 MHz		/	/
		11	2462 MHz	MCS3	/	/
		6	2437 MHz		16.20	14.74
		1	2412 MHz		/	/
		11	2462 MHz	MCS4	/	/
		6	2437 MHz		16.20	15.03
		1	2412 MHz		/	/
		11	2462 MHz	MCS5	/	/
		6	2437 MHz		16.20	14.60
		1	2412 MHz		/	/
		11	2462 MHz	MCS6	/	/
		6	2437 MHz		16.20	14.88
		1	2412 MHz		/	/
		11	2462 MHz	MCS7	/	/
		6	2437 MHz		16.20	14.83
		1	2412 MHz		/	/

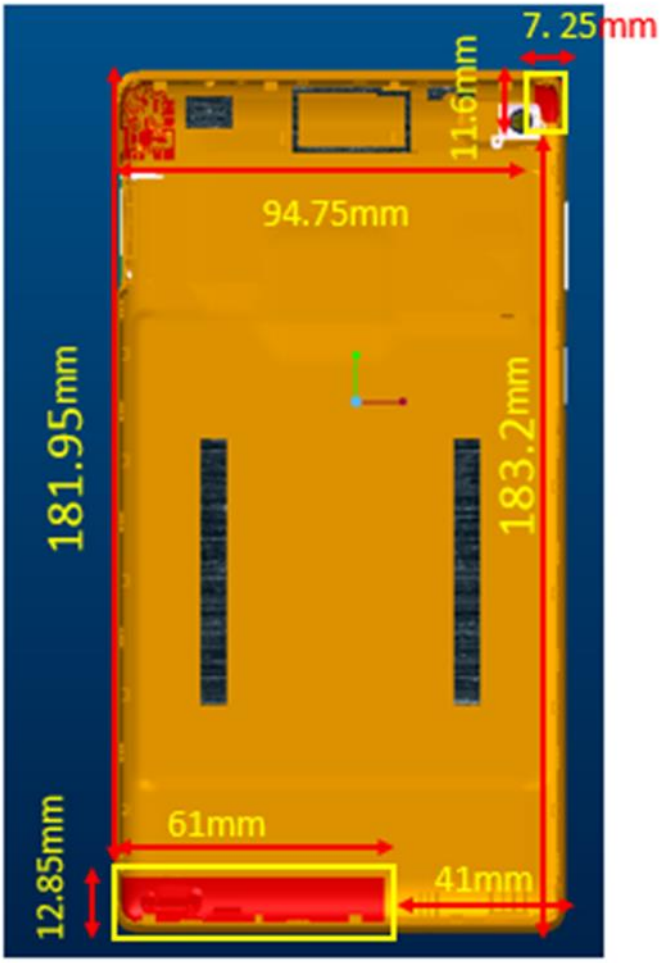
WLAN 2.4G 40M	802.11n 40M	11	2462 MHz	MCS0	15.00	14.42
		6	2437 MHz		15.00	14.40
		1	2412 MHz		15.00	14.58
		11	2462 MHz	MCS1	/	/
		6	2437 MHz		/	/
		1	2412 MHz		15.00	13.94
		11	2462 MHz	MCS2	/	/
		6	2437 MHz		/	/
		1	2412 MHz		15.00	13.80
		11	2462 MHz	MCS3	/	/
		6	2437 MHz		/	/
		1	2412 MHz		15.00	14.08
		11	2462 MHz	MCS4	/	/
		6	2437 MHz		/	/
		1	2412 MHz		15.00	13.87
		11	2462 MHz	MCS5	/	/
		6	2437 MHz		/	/
		1	2412 MHz		13.00	12.01
		11	2462 MHz	MCS6	/	/
		6	2437 MHz		/	/
		1	2412 MHz		13.00	11.69
		11	2462 MHz	MCS7	/	/
		6	2437 MHz		/	/
		1	2412 MHz		13.00	11.57

12 Simultaneous TX SAR Considerations

12.1 Introduction

The following procedures adopted from “FCC SAR Considerations for Cell Phones with Multiple Transmitters” are applicable to handsets with built-in unlicensed transmitters such as 802.11 a/b/g and Bluetooth devices which may simultaneously transmit with the licensed transmitter.
For this device, the BT and Wi-Fi can transmit simultaneous with other transmitters.

12.2 Transmit Antenna Separation Distances



Picture 12.1 Antenna Locations

12.3 SAR Measurement Positions

According to the KDB941225 D06 Hot Spot SAR v01, the edges with less than 2.5 cm distance to the antennas need to be tested for SAR.

SAR measurement positions						
Mode	Front	Rear	Left edge	Right edge	Top edge	Bottom edge
Main antenna	No	Yes	Yes	No	No	Yes
WLAN	No	Yes	Yes	No	Yes	No

12.4 Standalone SAR Test Exclusion Considerations

Standalone 1-g head or body SAR evaluation by measurement or numerical simulation is not required when the corresponding SAR Exclusion Threshold condition, listed below, is satisfied.
The 1-g SAR test exclusion threshold for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR, where

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

Table 12.1: Standalone SAR test exclusion considerations

Band/Mode	F(GHz)	Position	SAR test exclusion threshold (mW)	RF output power		SAR test exclusion
				dBm	mW	
Bluetooth	2.441	Head	9.60	5	3.16	Yes
		Body	19.20	5	3.16	Yes
2.4GHz WLAN 802.11 b	2.45	Head	9.58	16.2	41.69	No
		Body	19.17	16.2	41.69	No

13 Evaluation of Simultaneous

Table 13.1: The sum of reported SAR values for main antenna and WiFi

	Position	Main antenna	WiFi	Sum
Highest reported SAR value for Head	Right hand, Touch cheek	0.10	0.75	**0.85**
Highest reported SAR value for Body	Rear 0mm	0.64	0.92	**1.56**

Table 13.2: The sum of reported SAR values for main antenna and BT

	Position	Main antenna	BT	Sum
Maximum reported SAR value for Head	Left hand, Touch cheek	0.15	0.13	**0.28**
Maximum reported SAR value for Body	Rear 0mm	0.64	0.07	**0.71**

[1] - Estimated SAR for Bluetooth (see the table 13.3)

Table 13.3: Estimated SAR for Bluetooth

Mode/Band	F (GHz)	Position	Distance (mm)	Upper limit of power *		Estimated$_{1g}$ (W/kg)
				dBm	mW	
Bluetooth	2.441	Head	5	5	3.16	0.13
Bluetooth	2.441	Body	10	5	3.16	0.07

* - Maximum possible output power declared by manufacturer

When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:
(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]·[√f(GHz)/x] W/kg for test separation distances ≤ 50 mm;
where x = 7.5 for 1-g SAR.
When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion

Conclusion:
According to the above tables, the sum of reported SAR values is<1.6W/kg. So the simultaneous transmission SAR with volume scans is not required.

14 SAR Test Result

It is determined by user manual for the distance between the EUT and the phantom bottom.
The distance is 0/19 mm and just applied to the condition of body worn accessory.
It is performed for all SAR measurements with area scan based 1-g SAR estimation (Fast SAR). A zoom scan measurement is added when the estimated 1-g SAR is the highest measured SAR in each exposure configuration, wireless mode and frequency band combination or more than 1.2W/kg.
The calculated SAR is obtained by the following formula:

$$\text{Reported SAR} = \text{Measured SAR} \times 10^{(P_{Target}-P_{Measured})/10}$$

Where P_{Target} is the power of manufacturing upper limit;
$P_{Measured}$ is the measured power in chapter 11.

14.1 SAR results for Fast SAR

Table 14-1 GSM850 #1 Head

GSM850 #1 Head									
Ambient Temperature:			22.8			Liquid Temperature:			22.4
Mode	Device orientation	SAR measurement	Measured SAR [W/kg]			Reported SAR [W/kg]			
			CH251 848.8 MHz	CH190 836.6 MHz	CH128 824.2 MHz	CH251 848.8 MHz	CH190 836.6 MHz	CH128 824.2 MHz	
GSM	Tune-up		33.00	33.00	33.00	Scaling factor*			
	Slot Average Power [dBm]		32.01	31.92	31.76	1.26	1.28	1.33	
	Left Cheek	1g SAR		0.041			0.05		
		10g SAR		0.028			0.04		
		Deviation		-0.05			-0.05		
	Left Tilt	1g SAR		0.024			0.03		
		10g SAR		0.016			0.02		
		Deviation		0.02			0.02		
	Right Cheek	1g SAR	0.076	0.052	0.041	0.10	0.07	0.05	
		10g SAR	0.057	0.036	0.028	0.07	0.05	0.04	
		Deviation	0.18	-0.02	-0.08	0.18	-0.02	-0.08	
	Right Tilt	1g SAR		0.03			0.04		
		10g SAR		0.019			0.02		
		Deviation		-0.09			-0.09		
GSM SKU8	*Right Cheek*	1g SAR	0.043			0.05			
		10g SAR	0.029			0.04			
		Deviation	-0.06			-0.06			

Table 14-2 GSM850 #1 Body

GSM850 #1 Body									
Ambient Temperature:	22.8					Liquid Temperature:	22.4		
Mode	Device orientation	SAR measurement	Measured SAR [W/kg]			Reported SAR [W/kg]			
			CH251 848.8 MHz	CH190 836.6 MHz	CH128 824.2 MHz	CH251 848.8 MHz	CH190 836.6 MHz	CH128 824.2 MHz	
GPRS 4 Txslots	Tune-up		30.00	30.00	30.00	Scaling factor*			
	Slot Average Power [dBm]		28.91	28.74	28.52	1.29	1.34	1.41	
	Left edge 19mm	1g SAR		0.1			0.13		
		10g SAR		0.031			0.04		
		Deviation		0.04			0.04		
	Rear 19mm	1g SAR		0.127			0.17		
		10g SAR		0.088			0.12		
		Deviation		0.11			0.11		
	Bottom edge 19mm	1g SAR		0.112			0.15		
		10g SAR		0.054			0.07		
		Deviation		0.06			0.06		

Table 14-3 GSM850 #2 Body

GSM850 #2 Body									
Ambient Temperature:	22.8					Liquid Temperature:	22.4		
Mode	Device orientation	SAR measurement	Measured SAR [W/kg]			Reported SAR [W/kg]			
			CH251 848.8 MHz	CH190 836.6 MHz	CH128 824.2 MHz	CH251 848.8 MHz	CH190 836.6 MHz	CH128 824.2 MHz	
GPRS 4 Txslots	Tune-up		22.00	22.00	22.00	Scaling factor*			
	Slot Average Power [dBm]		21.46	21.28	21.03	1.13	1.18	1.25	
	Rear 0mm	1g SAR	0.35	0.306	0.262	0.40	0.36	0.33	
		10g SAR	0.185	0.158	0.141	0.21	0.19	0.18	
		Deviation	0.16	0.05	0.04	0.16	0.05	0.04	
	Bottom edge 0mm	1g SAR		0.156			0.18		
		10g SAR		0.082			0.10		
		Deviation		0.14			0.14		
	Left edge 0mm	1g SAR		0.026			0.03		
		10g SAR		0.015			0.02		
		Deviation		0.12			0.12		
EGPRS GMSK 4 Txslots	Tune-up		22.00	22.00	22.00	Scaling factor*			
	Slot Average Power [dBm]		21.43	21.33	21.01	1.14	1.17	1.26	
	Rear 0mm	1g SAR	0.341			0.39			
		10g SAR	0.178			0.20			
		Deviation	0.03			0.03			
GPRS 4 Txslots SKU8	*Rear 0mm*	1g SAR	0.338			0.38			
		10g SAR	0.174			0.20			
		Deviation	0.05			0.05			

Table 14-4 PCS1900 #1 Head

PCS1900 #1 Head									
Ambient Temperature:			22.8			Liquid Temperature:			22.4
Mode	Device orientation	SAR measurement	Measured SAR [W/kg]			Reported SAR [W/kg]			
			CH810 1909.8	CH661 1880 MHz	CH512 1850.2	CH810 1909.8	CH661 1880 MHz	CH512 1850.2	
GSM	Tune-up		31.00	31.00	31.00	Scaling factor*			
	Slot Average Power [dBm]		29.13	29.11	29.12	1.54	1.54	1.54	
	Left Cheek	1g SAR	0.098	0.072	0.069	0.15	0.11	0.11	
		10g SAR	0.063	0.043	0.042	0.10	0.07	0.06	
		Deviation	0.06	0.14	0.02	0.06	0.14	0.02	
	Left Tilt	1g SAR		0.056			0.09		
		10g SAR		0.031			0.05		
		Deviation		-0.09			-0.09		
	Right Cheek	1g SAR		0.065			0.10		
		10g SAR		0.039			0.06		
		Deviation		0.13			0.13		
	Right Tilt	1g SAR		0.057			0.09		
		10g SAR		0.033			0.05		
		Deviation		0.05			0.05		
GSM SKU8	*Left Cheek*	1g SAR	0.077			0.12			
		10g SAR	0.046			0.07			
		Deviation	-0.07			-0.07			

Table 14-5 PCS1900 #1 Body

PCS1900 #1 Body									
Ambient Temperature:		22.8				Liquid Temperature:			22.4
Mode	Device orientation	SAR measurement	Measured SAR [W/kg]			Reported SAR [W/kg]			
			CH810 1909.8	CH661 1880 MHz	CH512 1850.2	CH810 1909.8	CH661 1880 MHz	CH512 1850.2	
GPRS 4 Txslots	Tune-up		27.00	27.00	27.00	Scaling factor*			
	Slot Average Power [dBm]		26.01	25.91	25.86	1.26	1.28	1.30	
	Left edge 19mm	1g SAR		0.056			0.07		
		10g SAR		0.035			0.04		
		Deviation		0.05			0.05		
	Rear 19mm	1g SAR		0.142			0.18		
		10g SAR		0.088			0.11		
		Deviation		0.16			0.16		
	Bottom edge 19mm	1g SAR		0.159			0.20		
		10g SAR		0.098			0.13		
		Deviation		0.04			0.04		