FCC SAR Test Report

APPLICANT	:	ASUSTeK COMPUTER INC.
EQUIPMENT	:	ASUS Phone
BRAND NAME	:	ASUS
MODEL NAME	:	ASUS_Z00AD
FCC ID	:	MSQZ00AD
STANDARD	:	FCC 47 CFR Part 2 (2.1093) ANSI/IEEE C95.1-1992 IEEE 1528-2003

We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures and had been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by: Eric Huang / Deputy Manager

Approved by: Jones Tsai / Manager

Testing Laboratory
1190

SPORTON INTERNATIONAL INC.
No.52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Taoyuan City, Taiwan (R.O.C.)

Table of Contents

1. Statement of Compliance **4**
2. Administration Data **5**
3. Guidance Standard **5**
4. Equipment Under Test (EUT) **6**
4.1 General Information 6
4.2 Maximum Tune-up Limit 7
4.3 General LTE SAR Test and Reporting Considerations 8
5. RF Exposure Limits **9**
5.1 Uncontrolled Environment 9
5.2 Controlled Environment 9
6. Specific Absorption Rate (SAR) **10**
6.1 Introduction 10
6.2 SAR Definition 10
7. System Description and Setup **11**
8. Measurement Procedures **12**
8.1 Spatial Peak SAR Evaluation 12
8.2 Power Reference Measurement 13
8.3 Area Scan 13
8.4 Zoom Scan 14
8.5 Volume Scan Procedures 14
8.6 Power Drift Monitoring 14
9. Test Equipment List **15**
10. System Verification **16**
10.1 Tissue Verification 16
10.2 System Performance Check Results 18
11. RF Exposure Positions **19**
11.1 Ear and handset reference point 19
11.2 Definition of the cheek position 20
11.3 Definition of the tilt position 21
11.4 Body Worn Accessory 22
11.5 Wireless Router 22
12. Conducted RF Output Power (Unit: dBm) **23**
13. Antenna Location **40**
14. SAR Test Results **41**
14.1 Head SAR 42
14.2 Hotspot SAR 43
14.3 Body Worn Accessory SAR 44
14.4 Repeated SAR Measurement 44
15. Simultaneous Transmission Analysis **45**
15.1 Head Exposure Conditions 46
15.2 Hotspot Exposure Conditions 48
15.3 Body-Worn Accessory Exposure Conditions 49
16. Uncertainty Assessment **50**
17. References **53**
Appendix A. Plots of System Performance Check
Appendix B. Plots of High SAR Measurement
Appendix C. DASY Calibration Certificate
Appendix D. Test Setup Photos

Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA520232-06	Rev. 01	Variant report to include verification of worst case found in the original report FCC ID: MSQZ00AD, Sporton Report No.: FA520232 performed testing.	Jul. 27, 2015

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **ASUSTeK COMPUTER INC., ASUS Phone, ASUS_Z00AD**, are as follows.

Equipment Class	Frequency Band	Highest SAR Summary			Highest Simultaneous Transmission 1g SAR (W/kg)
		Head (Separation 0mm) 1g SAR (W/kg)	Body-worn (Separation 10mm) 1g SAR (W/kg)	Wireless Router (Separation 10mm) 1g SAR (W/kg)	
PCE	GSM850	0.30	0.47	0.47	1.52
	GSM1900	**1.12**	0.30	0.30	
	WCDMA Band V	0.25	0.41	0.41	
	WCDMA Band IV	0.39	0.48	0.48	
	WCDMA Band II	0.39	0.51	**0.70**	
	LTE Band 17	0.02	0.09	0.09	
	LTE Band 5	0.17	0.48	0.37	
	LTE Band 4	0.21	**0.58**	0.58	
	LTE Band 2	0.32	0.28	0.66	
	LTE Band 7	0.40	0.36	0.36	
DTS	2.4GHz WLAN	0.03	0.05	0.05	1.52
NII	5.2GHz WLAN	0.38	0.19		1.57
	5.8GHz WLAN	0.22	0.12	0.12	
Date of Testing:		2015/07/06-2015/07/16			

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2003.

2. Administration Data

Testing Laboratory	
Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No.52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978

Applicant	
Company Name	ASUSTeK COMPUTER INC.
Address	4F, No. 150, LI-TE RD., PEITOU, TAIPEI, TAIWAN

Manufacturer	
Company Name	QM (Shanghai) Technology Co., Ltd.
Address	Building 7, No. 1-8, Alley 18, Sanzhuang Road, Songjiang Export Zone, Shanghai 201613, P.R. China

3. Guidance Standard

The Specific Absorption Rate (SAR) testing specification, method, and procedure for this device is in accordance with the following standards:

- FCC 47 CFR Part 2 (2.1093)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2003
- FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r03
- FCC KDB 865664 D02 SAR Reporting v01r01
- FCC KDB 447498 D01 General RF Exposure Guidance v05r02
- FCC KDB 648474 D04 SAR Evaluation Considerations for Wireless Handsets v01r02
- FCC KDB 248227 D01 802.11 Wi-Fi SAR v02r01
- FCC KDB 941225 D01 3G SAR Procedures v03
- FCC KDB 941225 D05 SAR for LTE Devices v02r03
- FCC KDB 941225 D06 Hotspot Mode SAR v02

4. Equipment Under Test (EUT)

4.1 General Information

Product Feature & Specification	
Equipment Name	ASUS Phone
Brand Name	ASUS
Model Name	ASUS_Z00AD
FCC ID	MSQZ00AD
S / N	Sample for 2G 3G SAR testing: F1AZFG191049 Sample for LTE SAR testing: F1AZFG142782 Sample for WLAN SAR testing: F1AZFG201607
Wireless Technology and Frequency Range	GSM850: 824.2 MHz ~ 848.8 MHz GSM1900: 1850.2 MHz ~ 1909.8 MHz WCDMA Band V: 826.4 MHz ~ 846.6 MHz WCDMA Band IV: 1712.4 MHz ~ 1752.6 MHz WCDMA Band II: 1852.4 MHz ~ 1907.6 MHz LTE Band 17: 706.5 MHz ~ 713.5 MHz LTE Band 5: 824.7 MHz ~ 848.3 MHz LTE Band 4: 1710.7 MHz ~ 1754.3 MHz LTE Band 2: 1850.7 MHz ~ 1909.3 MHz LTE Band 7: 2502.5 MHz ~ 2567.5 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz NFC : 13.56 MHz
Mode	• GSM/GPRS/EGPRS • RMC/AMR 12.2Kbps • HSDPA • HSUPA • DC-HSDPA • LTE: QPSK, 16QAM • 802.11a/b/g/n/ac HT20/HT40/VHT20/VHT40/VHT80 • Bluetooth v3.0+EDR，Bluetooth v4.0-LE • NFC:ASK
GSM / (E)GPRS Dual Transfer mode	Class A – EUT can support Packet Switched and Circuit Switched Network simultaneously.
EUT Stage	Production Unit

Remark:

1. This supports dual SIM dual active, the SIM1 supports full band and the SIM2 GSM850 / 1900 Voice call only, the WWAN radio can simultaneous transmission at the same time when in Head and Body-worn exposure position.

4.2 Maximum Tune-up Limit

Mode / Band		Burst Average Power (dBm)	
		GSM 850	GSM 1900
GSM (GMSK, 1 Tx slot)		33.50	30.50
GPRS (GMSK, 1 Tx slot)		33.50	30.50
GPRS (GMSK, 2 Tx slots)		30.50	28.00
EDGE (8PSK, 1 Tx slot)		28.00	28.00
EDGE (8PSK, 2 Tx slots)		25.00	25.00
DTM 5 (2Tx slots)	GSM (GMSK, 1 Tx slot)	30.50	28.00
	GPRS (GMSK, 1 Tx slot)	30.50	28.00
DTM 9 (2Tx slots)	GSM (GMSK, 1 Tx slot)	30.50	28.00
	GPRS (GMSK, 1 Tx slot)	30.50	28.00
DTM 5 (2Tx slots)	GSM (GMSK, 1 Tx slot)	30.50	28.00
	EDGE (8PSK, 1 Tx slot)	25.00	25.00
DTM 9 (2Tx slots)	GSM (GMSK, 1 Tx slot)	30.50	28.00
	EDGE (8PSK, 1 Tx slot)	25.00	25.00

Mode / Band		Average Power (dBm)
WCDMA	Band V	23.50
	Band IV	24.50
	Band II	24.00
LTE	Band 2	23.50
	Band 4	24.50
	Band 5	23.50
	Band 7	22.00
	Band 17	23.50
2.4GHz WLAN	802.11b	13.00
	802.11g	11.50
	802.11n-HT20	11.50
5GHz WLAN	802.11a	12.00
	802.11n-HT20 / HT40	10.50
	802.11n-VHT20 / VHT40 / VHT80	10.50
Bluetooth v3.0+EDR	1Mbps	7.50
	2Mbps	4.00
	3Mbps	4.00
Bluetooth v4.0+LE		4.00

4.3 General LTE SAR Test and Reporting Considerations

Summarized necessary items addressed in KDB 941225 D05 v02r03	
FCC ID	MSQZ00AD
Equipment Name	ASUS Phone
Operating Frequency Range of each LTE transmission band	LTE Band 17: 706.5 MHz ~ 713.5 MHz LTE Band 5: 824.7 MHz ~ 848.3 MHz LTE Band 4: 1710.7 MHz ~ 1754.3 MHz LTE Band 2: 1850.7 MHz ~ 1909.3 MHz LTE Band 7: 2502.5 MHz ~ 2567.5 MHz
Channel Bandwidth	LTE Band 17: 5MHz, 10MHz LTE Band 5: 1.4MHz, 3MHz, 5MHz, 10MHz LTE Band 4: 1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz LTE Band 2: 1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz LTE Band 7: 5MHz, 10MHz, 15MHz, 20MHz
uplink modulations used	QPSK, and 16QAM
LTE Voice / Data requirements	Data only
LTE MPR permanently built-in by design	Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3

Modulation	Channel bandwidth / Transmission bandwidth (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

LTE A-MPR	In the base station simulator configuration, Network Setting value is set to NS_01 to disable A-MPR during SAR testing and the LTE SAR tests was transmitting on all TTI frames (Maximum TTI)
Spectrum plots for RB configuration	A properly configured base station simulator was used for the SAR and power measurement; therefore, spectrum plots for each RB allocation and offset configuration are not included in the SAR report.

Transmission (H, M, L) channel numbers and frequencies in each LTE band

LTE Band 17

	Bandwidth 5 MHz		Bandwidth 10 MHz	
	Channel #	Freq.(MHz)	Channel #	Freq. (MHz)
L	23755	706.5	23780	709
M	23790	710	23790	710
H	23825	713.5	23800	711

LTE Band 5

	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	20407	824.7	20415	825.5	20425	826.5	20450	829
M	20525	836.5	20525	836.5	20525	836.5	20525	836.5
H	20643	848.3	20635	847.5	20625	846.5	20600	844

LTE Band 4

	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	19957	1710.7	19965	1711.5	19975	1712.5	20000	1715	20025	1717.5	20050	1720
M	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5
H	20393	1754.3	20385	1753.5	20375	1752.5	20350	1750	20325	1747.5	20300	1745

LTE Band 2

	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	18607	1850.7	18615	1851.5	18625	1852.5	18650	1855	18675	1857.5	18700	1860
M	18900	1880	18900	1880	18900	1880	18900	1880	18900	1880	18900	1880
H	19193	1909.3	19185	1908.5	19175	1907.5	19150	1905	19125	1902.5	19100	1900

LTE Band 7

	Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	20775	2502.5	20800	2505	20825	2507.5	20850	2510
M	21100	2535	21100	2535	21100	2535	21100	2535
H	21425	2567.5	21400	2565	21375	2562.5	21350	2560

5. RF Exposure Limits

5.1 Uncontrolled Environment

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

5.2 Controlled Environment

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. The exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Limits for Occupational/Controlled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.4	8.0	20.0

Limits for General Population/Uncontrolled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.08	1.6	4.0

1. Whole-Body SAR is averaged over the entire body, partial-body SAR is averaged over any 1gram of tissue defined as a tissue volume in the shape of a cube. SAR for hands, wrists, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

6. Specific Absorption Rate (SAR)

6.1 Introduction

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

6.2 SAR Definition

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). The equation description is as below:

$$\mathbf{SAR} = \frac{\mathbf{d}}{\mathbf{dt}}\left(\frac{\mathbf{dW}}{\mathbf{dm}}\right) = \frac{\mathbf{d}}{\mathbf{dt}}\left(\frac{\mathbf{dW}}{\boldsymbol{\rho}\mathbf{dv}}\right)$$

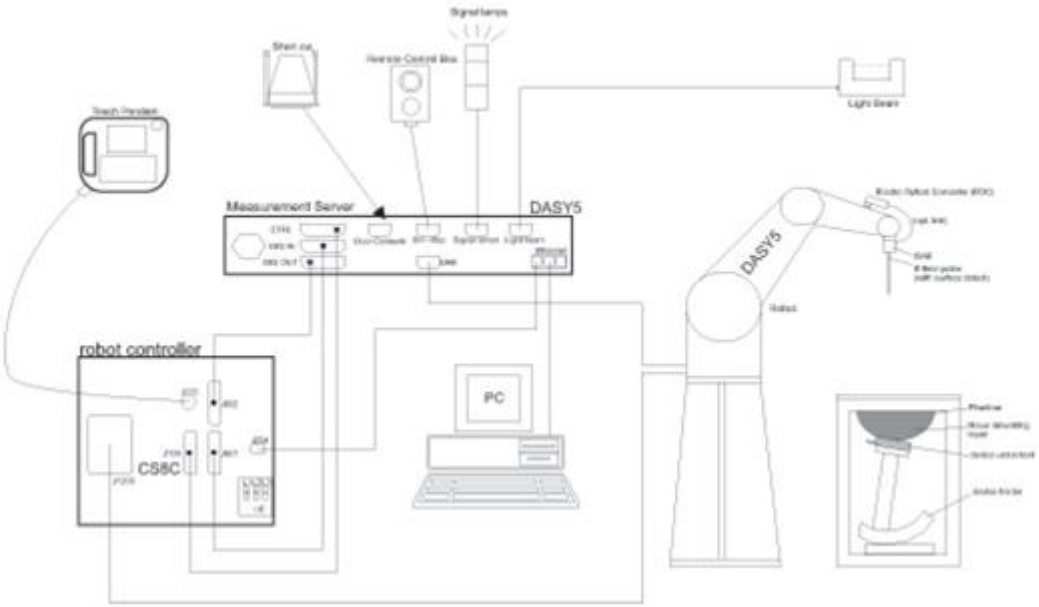
SAR is expressed in units of Watts per kilogram (W/kg)

$$\mathbf{SAR} = \frac{\boldsymbol{\sigma}|\mathbf{E}|^{\mathbf{2}}}{\boldsymbol{\rho}}$$

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical field strength.

7. System Description and Setup

The DASY 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 WinXP or Win7 and the DASY5 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.

8. Measurement Procedures

The measurement procedures are as follows:

<Conducted power measurement>

(a) For WWAN power measurement, use base station simulator to configure EUT WWAN transmission in conducted connection with RF cable, at maximum power in each supported wireless interface and frequency band.
(b) Read the WWAN RF power level from the base station simulator.
(c) For WLAN/BT power measurement, use engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power in each supported wireless interface and frequency band
(d) Connect EUT RF port through RF cable to the power meter, and measure WLAN/BT output power

<SAR measurement>

(a) Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power, in the highest power channel.
(b) Place the EUT in the positions as Appendix D demonstrates.
(c) Set scan area, grid size and other setting on the DASY software.
(d) Measure SAR results for the highest power channel on each testing position.
(e) Find out the largest SAR result on these testing positions of each band
(f) Measure SAR results for other channels in worst SAR testing position if the reported SAR of highest power channel is larger than 0.8 W/kg

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

(a) Power reference measurement
(b) Area scan
(c) Zoom scan
(d) Power drift measurement

8.1 Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

(a) Extraction of the measured data (grid and values) from the Zoom Scan
(b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
(c) Generation of a high-resolution mesh within the measured volume
(d) Interpolation of all measured values form the measurement grid to the high-resolution grid
(e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
(f) Calculation of the averaged SAR within masses of 1g and 10g

8.2 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. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

8.3 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 found in the scanned area, within a range of the global maximum. The range (in dB0 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 FCC KDB 865664 D01v01r03 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 ± 1 mm	½·δ·ln(2) ± 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.	

8.4 Zoom Scan

Zoom scans are used assess the peak spatial SAR values within a cubic averaging volume containing 1 gram and 10 gram of simulated tissue. The zoom scan measures points (refer to table below) within a cube shoes 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 gram and 10 gram and displays these values next to the job's label.

Zoom scan parameters extracted from FCC KDB 865664 D01v01r03 SAR measurement 100 MHz to 6 GHz.

			≤ 3 GHz	> 3 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	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm

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 *reported* 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.

8.5 Volume Scan Procedures

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

8.6 Power Drift Monitoring

All SAR testing is under the EUT install full charged battery and transmit maximum output power. In DASY measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of EUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drifts more than 5%, the SAR will be retested.

9. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	750MHz System Validation Kit	D750V3	1012	May. 28, 2015	May. 27, 2016
SPEAG	835MHz System Validation Kit	D835V2	499	Mar. 20, 2015	Mar. 19, 2016
SPEAG	1750MHz System Validation Kit	D1750V2	1068	Nov. 14, 2014	Nov. 13, 2015
SPEAG	1900MHz System Validation Kit	D1900V2	5d041	Mar. 24, 2015	Mar. 23, 2016
SPEAG	2450MHz System Validation Kit	D2450V2	736	Aug. 21, 2014	Aug. 20, 2015
SPEAG	2600MHz System Validation Kit	D2600V2	1008	Aug. 21, 2014	Aug. 20, 2015
SPEAG	5GHz System Validation Kit	D5GHzV2	1006	Sep. 25, 2014	Sep. 24, 2015
SPEAG	Data Acquisition Electronics	DAE4	778	Aug. 21, 2014	Aug. 20, 2015
SPEAG	Data Acquisition Electronics	DAE3	577	Oct. 06, 2014	Oct. 05, 2015
SPEAG	Data Acquisition Electronics	DAE4	1279	Jul. 23, 2014	Jul. 22, 2015
SPEAG	Data Acquisition Electronics	DAE3	495	May. 22, 2015	May. 21, 2016
SPEAG	Dosimetric E-Field Probe	ES3DV3	3270	Sep. 26, 2014	Sep. 25, 2015
SPEAG	Dosimetric E-Field Probe	EX3DV4	3931	Sep. 25, 2014	Sep. 24, 2015
SPEAG	Dosimetric E-Field Probe	EX3DV4	3925	May. 27, 2015	May. 26, 2016
Wisewind	Thermometer	HTC-1	TM281	Oct. 21, 2014	Oct. 20, 2015
H.M.IRIS	Thermometer	TH-08	TM658	Oct. 21, 2014	Oct. 20, 2015
Wisewind	Thermometer	ETP-101	TM225	Oct. 21, 2014	Oct. 20, 2015
Anritsu	Radio Communication Analyzer	MT8820C	6201074414	Feb. 06, 2015	Feb. 05, 2016
Agilent	Wireless Communication Test Set	E5515C	MY50266977	May. 14, 2015	May. 13, 2016
SPEAG	Device Holder	N/A	N/A	N/A	N/A
Agilent	Signal Generator	N5181A	MY50145381	Dec. 11, 2014	Dec. 10, 2015
Agilent	ENA Network Analyzer	E5071C	MY46316648	Feb. 11, 2015	Feb. 10, 2016
SPEAG	Dielectric Probe Kit	DAK-3.5	1138	Nov. 18, 2014	Nov. 17, 2015
Anritsu	Power Meter	ML2495A	1349001	Dec. 03, 2014	Dec. 02, 2015
Anritsu	Power Sensor	MA2411B	1306099	Dec. 03, 2014	Dec. 02, 2015
Anritsu	Spectrum Analyzer	MS2830A	6201396378	Jun. 17, 2015	Jun. 16, 2016
Agilent	Dual Directional Coupler	778D	50422	Note 1	
Woken	Attenuator 1	WK0602-XX	N/A	Note 1	
PE	Attenuator 2	PE7005-10	N/A	Note 1	
PE	Attenuator 3	PE7005- 3	N/A	Note 1	
AR	Power Amplifier	5S1G4M2	0328767	Note 1	
Mini-Circuits	Power Amplifier	ZVE-3W	162601250	Note 1	

General Note:

1. Prior to system verification and validation, the path loss from the signal generator to the system check source and the power meter, which includes the amplifier, cable, attenuator and directional coupler, was measured by the network analyzer. The reading of the power meter was offset by the path loss difference between the path to the power meter and the path to the system check source to monitor the actual power level fed to the system check source.

10. System Verification

10.1 Tissue Verification

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (εr)
For Head								
750	41.1	57.0	0.2	1.4	0.2	0	0.89	41.9
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
900	40.3	57.9	0.2	1.4	0.2	0	0.97	41.5
1800, 1900, 2000	55.2	0	0	0.3	0	44.5	1.40	40.0
2450	55.0	0	0	0	0	45.0	1.80	39.2
2600	54.8	0	0	0.1	0	45.1	1.96	39.0
For Body								
750	51.7	47.2	0	0.9	0.1	0	0.96	55.5
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
900	50.8	48.2	0	0.9	0.1	0	1.05	55.0
1800, 1900, 2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2450	68.6	0	0	0	0	31.4	1.95	52.7
2600	68.1	0	0	0.1	0	31.8	2.16	52.5

Simulating Liquid for 5GHz, Manufactured by SPEAG

Ingredients	(% by weight)
Water	64~78%
Mineral oil	11~18%
Emulsifiers	9~15%
Additives and Salt	2~3%

<Tissue Dielectric Parameter Check Results>

Frequency (MHz)	Tissue Type	Liquid Temp. (℃)	Conductivity (σ)	Permittivity (ε_r)	Conductivity Target (σ)	Permittivity Target (ε_r)	Delta (σ) (%)	Delta (ε_r) (%)	Limit (%)	Date
750	HSL	22.6	0.894	42.744	0.89	41.90	0.45	2.01	±5	2015/7/7
750	MSL	22.3	0.963	54.245	0.96	55.50	0.31	-2.26	±5	2015/7/6
835	HSL	22.7	0.896	41.887	0.90	41.50	-0.44	0.93	±5	2015/7/7
835	MSL	22.3	0.984	54.433	0.97	55.20	1.44	-1.39	±5	2015/7/6
835	MSL	22.5	0.980	54.556	0.97	55.20	1.03	-1.17	±5	2015/7/16
1750	HSL	22.5	1.408	39.639	1.37	40.10	2.77	-1.15	±5	2015/7/7
1750	MSL	22.4	1.478	53.486	1.49	53.40	-0.81	0.16	±5	2015/7/6
1900	HSL	22.4	1.439	40.777	1.40	40.00	2.79	1.94	±5	2015/7/7
1900	MSL	22.4	1.545	54.205	1.52	53.30	1.64	1.70	±5	2015/7/6
1900	MSL	22.5	1.547	53.165	1.52	53.30	1.78	-0.25	±5	2015/7/16
2450	HSL	22.6	1.851	38.221	1.80	39.20	2.83	-2.50	±5	2015/7/8
2450	HSL	22.3	1.867	37.778	1.80	39.20	3.72	-3.63	±5	2015/7/16
2450	MSL	22.4	1.992	52.040	1.95	52.70	2.15	-1.25	±5	2015/7/8
2600	HSL	22.6	2.040	37.289	1.96	39.00	4.08	-4.39	±5	2015/7/8
2600	MSL	22.4	2.179	54.006	2.16	52.50	0.88	2.87	±5	2015/7/8
5200	HSL	22.6	4.791	35.422	4.66	36.00	2.81	-1.61	±5	2015/7/9
5200	MSL	22.4	5.131	47.488	5.30	49.00	-3.19	-3.09	±5	2015/7/9
5800	HSL	22.6	5.390	34.350	5.27	35.30	2.28	-2.69	±5	2015/7/9
5800	MSL	22.4	5.981	46.515	6.00	48.20	-0.32	-3.50	±5	2015/7/9

10.2 System Performance Check Results

Comparing to the original SAR value provided by SPEAG, the verification data should be within its specification of 10 %. Below table shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance check can meet the variation criterion and the plots can be referred to Appendix A of this report.

Date	Frequency (MHz)	Tissue Type	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured 1g SAR (W/kg)	Targeted 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Deviation (%)
2015/7/7	750	HSL	250	D750V3-1012	EX3DV4 - SN3931	DAE4 Sn1279	2.05	8.22	8.20	-0.24
2015/7/6	750	MSL	250	D750V3-1012	EX3DV4 - SN3931	DAE4 Sn1279	2.01	8.61	8.04	-6.62
2015/7/7	835	HSL	250	D835V2-499	EX3DV4 - SN3931	DAE4 Sn1279	2.20	9.20	8.80	-4.35
2015/7/6	835	MSL	250	D835V2-499	EX3DV4 - SN3931	DAE4 Sn1279	2.49	9.30	9.96	7.10
2015/7/16	835	MSL	250	D835V2-499	EX3DV4 - SN3931	DAE3 Sn577	2.47	9.30	9.88	6.24
2015/7/7	1750	HSL	250	D1750V2-1068	EX3DV4 - SN3931	DAE4 Sn1279	9.74	36.80	38.96	5.87
2015/7/6	1750	MSL	250	D1750V2-1068	EX3DV4 - SN3931	DAE4 Sn1279	9.04	38.00	36.16	-4.84
2015/7/7	1900	HSL	250	D1900V2-5d041	EX3DV4 - SN3931	DAE4 Sn1279	9.88	40.00	39.52	-1.20
2015/7/6	1900	MSL	250	D1900V2-5d041	EX3DV4 - SN3931	DAE4 Sn1279	9.54	39.80	38.16	-4.12
2015/7/16	1900	MSL	250	D1900V2-5d041	EX3DV4 - SN3931	DAE3 Sn577	9.48	39.80	37.92	-4.72
2015/7/8	2450	HSL	250	D2450V2-736	EX3DV4 - SN3925	DAE3 Sn495	13.80	51.80	55.20	6.56
2015/7/16	2450	HSL	250	D2450V2-736	ES3DV3 - SN3270	DAE4 Sn778	14.10	51.80	56.40	8.88
2015/7/8	2450	MSL	250	D2450V2-736	EX3DV4 - SN3925	DAE3 Sn495	12.40	50.60	49.60	-1.98
2015/7/8	2600	HSL	250	D2600V2-1008	EX3DV4 - SN3925	DAE3 Sn495	14.10	57.10	56.40	-1.23
2015/7/8	2600	MSL	250	D2600V2-1008	EX3DV4 - SN3925	DAE3 Sn495	13.50	55.30	54.00	-2.35
2015/7/9	5200	HSL	100	D5GHzV2-1006	EX3DV4 - SN3925	DAE3 Sn495	8.45	81.10	84.50	4.19
2015/7/9	5200	MSL	100	D5GHzV2-1006	EX3DV4 - SN3925	DAE3 Sn495	7.39	77.50	73.90	-4.65
2015/7/9	5800	HSL	100	D5GHzV2-1006	EX3DV4 - SN3925	DAE3 Sn495	7.77	82.90	77.70	-6.27
2015/7/9	5800	MSL	100	D5GHzV2-1006	EX3DV4 - SN3925	DAE3 Sn495	7.94	78.40	79.40	1.28

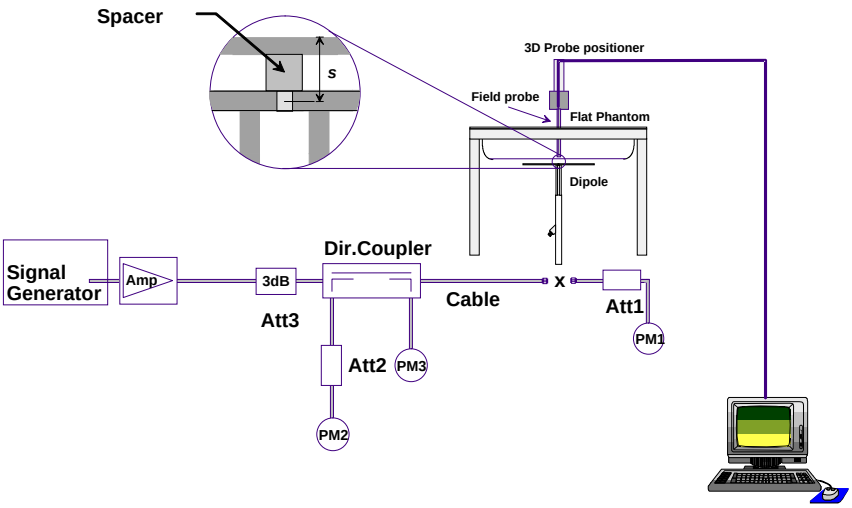


Fig 8.3.1 System Performance Check Setup

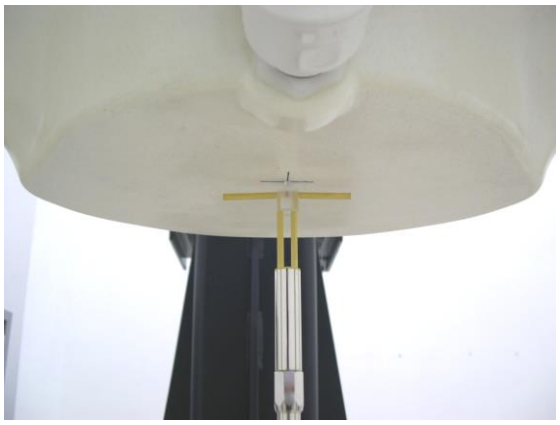


Fig 8.3.2 Setup Photo

11. RF Exposure Positions

11.1 Ear and handset reference point

Figure 9.1.1 shows the front, back, and side views of the SAM phantom. The center-of-mouth reference point is labeled “M,” the left ear reference point (ERP) is marked “LE,” and the right ERP is marked “RE.” Each ERP is 15 mm along the B-M (back-mouth) line behind the entrance-to-ear-canal (EEC) point, as shown in Figure 9.1.2 The Reference Plane is defined as passing through the two ear reference points and point M. The line N-F (neck-front), also called the reference pivoting line, is normal to the Reference Plane and perpendicular to both a line passing through RE and LE and the B-M line (see Figure 9.1.3). Both N-F and B-M lines should be marked on the exterior of the phantom shell to facilitate handset positioning. Posterior to the N-F line the ear shape is a flat surface with 6 mm thickness at each ERP, and forward of the N-F line the ear is truncated, as illustrated in Figure 9.1.2. The ear truncation is introduced to preclude the ear lobe from interfering with handset tilt, which could lead to unstable positioning at the cheek.

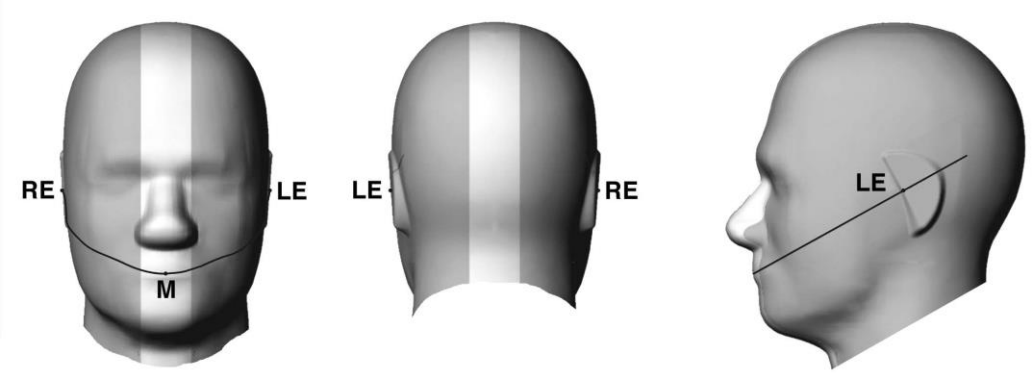


Fig 9.1.1 Front, back, and side views of SAM twin phantom

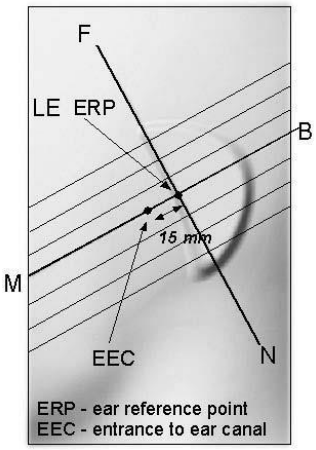


Fig 9.1.2 Close-up side view of phantom showing the ear region.

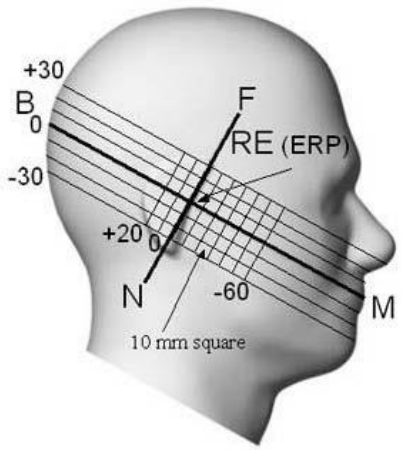


Fig 9.1.3 Side view of the phantom showing relevant markings and seven cross-sectional plane locations

11.2 Definition of the cheek position

1. Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece (flip cover), open the cover. If the handset can transmit with the cover closed, both configurations must be tested.
2. Define two imaginary lines on the handset—the vertical centerline and the horizontal line. The vertical centerline passes through two points on the front side of the handset—the midpoint of the width wt of the handset at the level of the acoustic output (point A in Figure 9.2.1 and Figure 9.2.2), and the midpoint of the width wb of the bottom of the handset (point B). The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output (see Figure 9.2.1). The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output; however, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily parallel to the front face of the handset (see Figure 9.2.2), especially for clamshell handsets, handsets with flip covers, and other irregularly-shaped handsets.
3. Position the handset close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 9.2.3), such that the plane defined by the vertical centerline and the horizontal line of the handset is approximately parallel to the sagittal plane of the phantom.
4. Translate the handset towards the phantom along the line passing through RE and LE until handset point A touches the pinna at the ERP.
5. While maintaining the handset in this plane, rotate it around the LE-RE line until the vertical centerline is in the plane normal to the plane containing B-M and N-F lines, i.e., the Reference Plane.
6. Rotate the handset around the vertical centerline until the handset (horizontal line) is parallel to the N-F line.
7. While maintaining the vertical centerline in the Reference Plane, keeping point A on the line passing through RE and LE, and maintaining the handset contact with the pinna, rotate the handset about the N-F line until any point on the handset is in contact with a phantom point below the pinna on the cheek. See Figure 9.2.3. The actual rotation angles should be documented in the test report.

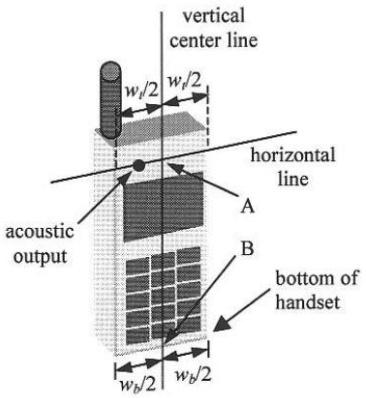


Fig 9.2.1 Handset vertical and horizontal reference lines—"fixed case

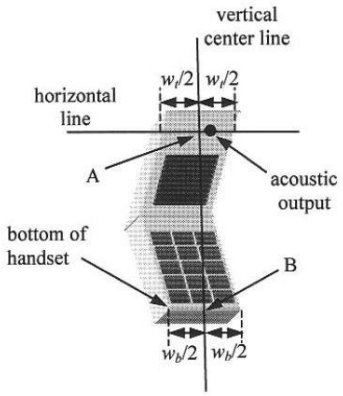


Fig 9.2.2 Handset vertical and horizontal reference lines—"clam-shell case"

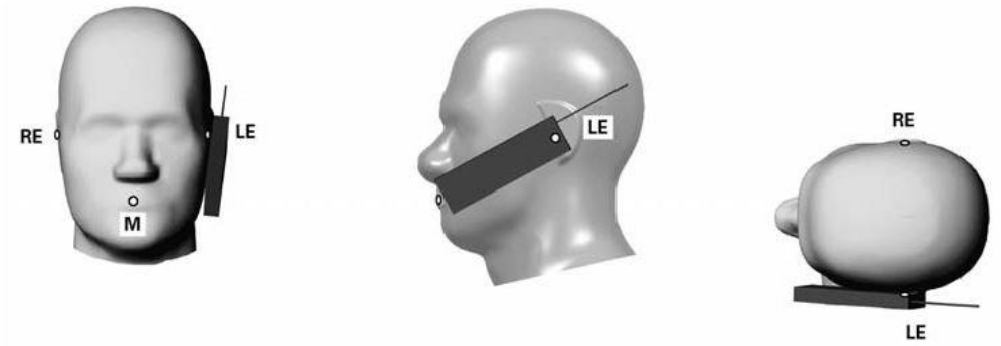


Fig 9.2.3 cheek or touch position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which establish the Reference Plane for handset positioning, are indicated.

11.3 Definition of the tilt position

1. Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece (flip cover), open the cover. If the handset can transmit with the cover closed, both configurations must be tested.
2. While maintaining the orientation of the handset, move the handset away from the pinna along the line passing through RE and LE far enough to allow a rotation of the handset away from the cheek by 15°.
3. Rotate the handset around the horizontal line by 15°.
4. While maintaining the orientation of the handset, move the handset towards the phantom on the line passing through RE and LE until any part of the handset touches the ear. The tilt position is obtained when the contact point is on the pinna. See Figure 9.3.1. If contact occurs at any location other than the pinna, e.g., the antenna at the back of the phantom head, the angle of the handset should be reduced. In this case, the tilt position is obtained if any point on the handset is in contact with the pinna and a second point

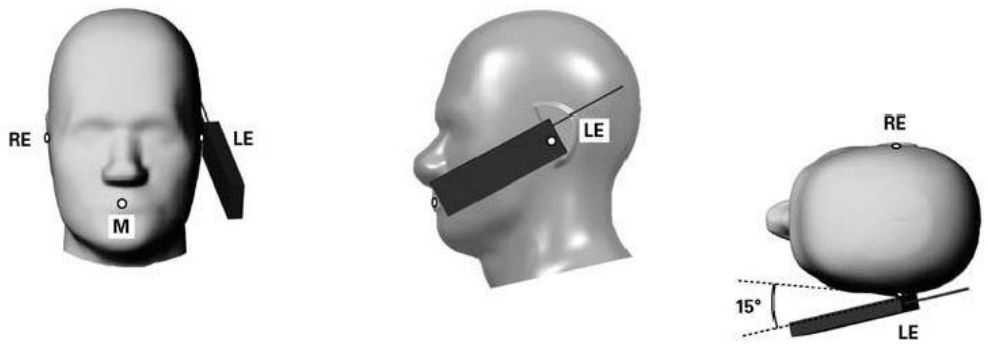


Fig 9.3.1 Tilt position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which define the Reference Plane for handset positioning, are indicated.

11.4 Body Worn Accessory

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 9.4). Per KDB 648474 D04v01r02, body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB 447498 D01v05r02 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for body-worn accessory, measured without a headset connected to the handset is < 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a handset attached to the handset.

Accessories for body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are test with the device with each accessory. If multiple accessories share an identical metallic component (i.e. the same metallic belt-chip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

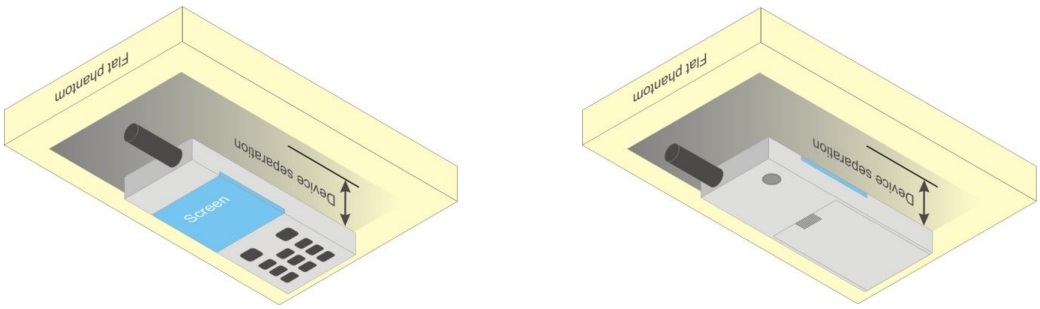


Fig 9.4 Body Worn Position

11.5 Wireless Router

Some battery-operated handsets have the capability to transmit and receive user through simultaneous transmission of WIFI simultaneously with a separate licensed transmitter. The FCC has provided guidance in FCC HDB Publication 941225 D06 v02 where SAR test considerations for handsets (L x W ≥ 9 cm x 5 cm) are based on a composite test separation distance of 10mm from the front, back and edges of the device containing transmitting antennas within 2.5cm of their edges, determined form general mixed use conditions for this type of devices. Since the hotspot SAR results may overlap with the body-worn accessory SAR requirements, the more conservative configurations can be considered, thus excluding some body-worn accessory SAR tests.

When the user enables the personal wireless router functions for the handset, actual operations include simultaneous transmission of both the WIFI transmitter and another licensed transmitter. Both transmitters often do not transmit at the same transmitting frequency and thus cannot be evaluated for SAR under actual use conditions due to the limitations of the SAR assessment probes. Therefore, SAR must be evaluated for each frequency transmission and mode separately and spatially summed with the WIFI transmitter according to FCC KDB Publication 447498 D01v05r02 publication procedures. The “Portable Hotspot” feature on the handset was NOT activated during SAR assessments, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal at a time.

12. Conducted RF Output Power (Unit: dBm)

<GSM Conducted Power>

<SIM1>

Band GSM850		Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
TX Channel		128	189	251		128	189	251	
Frequency (MHz)		824.2	836.4	848.8		824.2	836.4	848.8	
GSM (GMSK, 1 Tx slot)		32.74	32.75	32.74	33.50	23.74	23.75	23.74	24.50
GPRS (GMSK, 1 Tx slot)		32.72	32.73	32.73	33.50	23.72	23.73	23.73	24.50
GPRS (GMSK, 2 Tx slots)		29.71	29.73	29.77	30.50	23.71	23.73	23.77	24.50
EDGE (8PSK, 1 Tx slot)		27.64	27.49	27.37	28.00	18.64	18.49	18.37	19.00
EDGE (8PSK, 2 Tx slots)		24.54	24.41	24.29	25.00	18.54	18.41	18.29	19.00
DTM 5 (2Tx slots)	GSM (GMSK, 1 Tx slot)	29.68	29.71	29.75	30.50	23.59	23.62	23.65	24.48
	GPRS (GMSK, 1 Tx slot)	29.53	29.56	29.59	30.50				
DTM 9 (2Tx slots)	GSM (GMSK, 1 Tx slot)	29.67	29.69	29.73	30.50	23.57	23.60	23.63	24.48
	GPRS (GMSK, 1 Tx slot)	29.51	29.54	29.57	30.50				
DTM 5 (2Tx slots)	GSM (GMSK, 1 Tx slot)	29.52	29.56	29.60	30.50	21.67	21.67	21.69	22.55
	EDGE (8PSK, 1 Tx slot)	24.46	24.35	24.28	25.00				
DTM 9 (2Tx slots)	GSM (GMSK, 1 Tx slot)	29.50	29.55	29.58	30.50	21.65	21.66	21.67	22.55
	EDGE (8PSK, 1 Tx slot)	24.44	24.34	24.26	25.00				

Band GSM1900		Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
TX Channel		512	661	810		512	661	810	
Frequency (MHz)		1850.2	1880	1909.8		1850.2	1880	1909.8	
GSM (GMSK, 1 Tx slot)		30.28	30.26	30.18	30.50	21.28	21.26	21.18	21.50
GPRS (GMSK, 1 Tx slot)		30.27	30.25	30.17	30.50	21.27	21.25	21.17	21.50
GPRS (GMSK, 2 Tx slots)		27.30	27.23	27.17	28.00	21.30	21.23	21.17	22.00
EDGE (8PSK, 1 Tx slot)		26.85	26.95	27.00	28.00	17.85	17.95	18.00	19.00
EDGE (8PSK, 2 Tx slots)		23.85	23.92	23.96	25.00	17.85	17.92	17.96	19.00
DTM 5 (2Tx slots)	GSM (GMSK, 1 Tx slot)	27.34	27.28	27.11	28.00	21.25	21.21	21.07	21.98
	GPRS (GMSK, 1 Tx slot)	27.21	27.18	27.07	28.00				
DTM 9 (2Tx slots)	GSM (GMSK, 1 Tx slot)	27.31	27.24	27.10	28.00	21.24	21.18	21.06	21.98
	GPRS (GMSK, 1 Tx slot)	27.21	27.17	27.06	28.00				
DTM 5 (2Tx slots)	GSM (GMSK, 1 Tx slot)	27.24	27.18	27.06	28.00	19.84	19.81	19.74	20.73
	EDGE (8PSK, 1 Tx slot)	23.82	23.87	23.91	25.00				
DTM 9 (2Tx slots)	GSM (GMSK, 1 Tx slot)	27.29	27.22	27.08	28.00	19.82	19.80	19.72	20.73
	EDGE (8PSK, 1 Tx slot)	23.66	23.74	23.78	25.00				

<SIM2>

Band GSM850	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
TX Channel	128	189	251		128	189	251	
Frequency (MHz)	824.2	836.4	848.8		824.2	836.4	848.8	
GSM (GMSK, 1 Tx slot)	32.94	32.93	32.91	33.50	23.94	23.93	23.91	24.50

Band GSM1900	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
TX Channel	512	661	810		512	661	810	
Frequency (MHz)	1850.2	1880	1909.8		1850.2	1880	1909.8	
GSM (GMSK, 1 Tx slot)	27.86	27.90	27.92	28.00	18.86	18.90	18.92	19.00

<WCDMA Conducted Power>

1. The following tests were conducted according to the test requirements outlines in 3GPP TS 34.121 specification.
2. The procedures in KDB 941225 D01 are applied for 3GPP Rel. 6 HSPA to configure the device in the required sub-test mode(s) to determine SAR test exclusion.
3. For DC-HSDPA, the device was configured according to the H-Set 12, Fixed Reference Channel (FRC) configuration in Table C.8.1.12 of 3GPP TS 34.121-1, with the primary and the secondary serving HS-DSCH Cell enabled during the power measurement.

A summary of these settings are illustrated below:

HSDPA Setup Configuration:

a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting:
   i. Set Gain Factors (β_c and β_d) and parameters were set according to each
   ii. Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
   iii. Set RMC 12.2Kbps + HSDPA mode.
   iv. Set Cell Power = -86 dBm
   v. Set HS-DSCH Configuration Type to FRC (H-set 1, QPSK)
   vi. Select HSDPA Uplink Parameters
   vii. Set Delta ACK, Delta NACK and Delta CQI = 8
   viii. Set Ack-Nack Repetition Factor to 3
   ix. Set CQI Feedback Cycle (k) to 4 ms
   x. Set CQI Repetition Factor to 2
   xi. Power Ctrl Mode = All Up bits
d. The transmitted maximum output power was recorded.

Table C.10.1.4: β values for transmitter characteristics tests with HS-DPCCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1, Note 2)	CM (dB) (Note 3)	MPR (dB) (Note 3)
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 (Note 4)	15/15 (Note 4)	64	12/15 (Note 4)	24/15	1.0	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} = 30/15 with β_{hs} = 30/15 * β_c.

Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, Δ_{ACK} and Δ_{NACK} = 30/15 with β_{hs} = 30/15 * β_c, and Δ_{CQI} = 24/15 with β_{hs} = 24/15 * β_c.

Note 3: 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 4: 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.

Setup Configuration

HSUPA Setup Configuration:

a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting * :
   i. Call Configs = 5.2B, 5.9B, 5.10B, and 5.13.2B with QPSK
   ii. Set the Gain Factors (β_c and β_d) and parameters (AG Index) were set according to each specific sub-test in the following table, C11.1.3, quoted from the TS 34.121
   iii. Set Cell Power = -86 dBm
   iv. Set Channel Type = 12.2k + HSPA
   v. Set UE Target Power
   vi. Power Ctrl Mode= Alternating bits
   vii. Set and observe the E-TFCI
   viii. Confirm that E-TFCI is equal to the target E-TFCI of 75 for sub-test 1, and other subtest's E-TFCI
d. The transmitted maximum output power was recorded.

Table C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1)	β_{ec}	β_{ed} (Note 5) (Note 6)	β_{ed} (SF)	β_{ed} (Codes)	CM (dB) (Note 2)	MPR (dB) (Note 2)	AG Index (Note 6)	E-TFCI
1	11/15 (Note 3)	15/15 (Note 3)	64	11/15 (Note 3)	22/15	209/225	1309/225	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_{ed}1: 47/15 β_{ed}2: 47/15	4 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 (Note 4)	15/15 (Note 4)	64	15/15 (Note 4)	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_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, 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 β_c = 10/15 and β_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 β_c = 14/15 and β_d = 15/15.

Note 5: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.

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

Setup Configuration

DC-HSDPA 3GPP release 8 Setup Configuration:

a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration below
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting:
   i. Set RMC 12.2Kbps + HSDPA mode.
   ii. Set Cell Power = -25 dBm
   iii. Set HS-DSCH Configuration Type to FRC (H-set 12, QPSK)
   iv. Select HSDPA Uplink Parameters
   v. Set Gain Factors (β_c and β_d) and parameters were set according to each Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
      a). Subtest 1: β_c/β_d=2/15
      b). Subtest 2: β_c/β_d=12/15
      c). Subtest 3: β_c/β_d=15/8
      d). Subtest 4: β_c/β_d=15/4
   vi. Set Delta ACK, Delta NACK and Delta CQI = 8
   vii. Set Ack-Nack Repetition Factor to 3
   viii. Set CQI Feedback Cycle (k) to 4 ms
   ix. Set CQI Repetition Factor to 2
   x. Power Ctrl Mode = All Up bits
d. The transmitted maximum output power was recorded.

The following tests were conducted according to the test requirements outlines in 3GPP TS 34.121 specification.
A summary of these settings are illustrated below:

C.8.1.12 Fixed Reference Channel Definition H-Set 12

Table C.8.1.12: Fixed Reference Channel H-Set 12

Parameter	Unit	Value
Nominal Avg. Inf. Bit Rate	kbps	60
Inter-TTI Distance	TTI's	1
Number of HARQ Processes	Processes	6
Information Bit Payload (N_{INF})	Bits	120
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	960
Total Available SML's in UE	SML's	19200
Number of SML's per HARQ Proc.	SML's	3200
Coding Rate		0.15
Number of Physical Channel Codes	Codes	1
Modulation		QPSK
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.		
Note 2: Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used.		

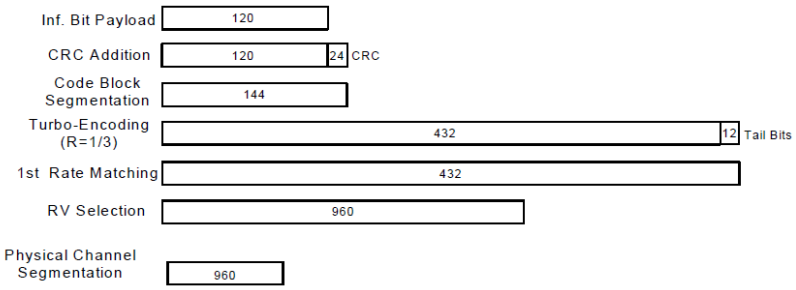


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

Setup Configuration

<WCDMA Conducted Power>

Band			WCDMA V			WCDMA II			WCDMA IV		
TX Channel			4132	4182	4233	9262	9400	9538	1312	1413	1513
Rx Channel			4357	4407	4458	9662	9800	9938	1537	1638	1738
Frequency (MHz)			826.4	836.4	846.6	1852.4	1880	1907.6	1712.4	1732.6	1752.6
3GPP MPR (dB)	3GPP Rel 99	AMR 12.2Kbps	23.28	23.22	23.38	23.84	23.86	23.75	24.19	24.16	24.37
	3GPP Rel 99	RMC 12.2Kbps	23.29	23.24	23.40	23.86	23.89	23.76	24.20	24.19	24.39
0	3GPP Rel 6	HSDPA Subtest-1	23.24	23.29	23.36	23.84	23.86	23.75	24.23	24.20	24.36
0	3GPP Rel 6	HSDPA Subtest-2	23.29	23.23	23.33	23.82	23.84	23.74	24.25	24.24	24.32
0.5	3GPP Rel 6	HSDPA Subtest-3	22.81	22.76	22.93	23.40	23.38	23.37	23.19	23.27	23.41
0.5	3GPP Rel 6	HSDPA Subtest-4	22.60	22.51	22.72	23.16	23.18	23.13	23.08	23.01	23.19
0	3GPP Rel 8	DC-HSDPA Subtest-1	23.11	23.18	23.24	23.72	23.75	23.66	24.22	24.19	24.38
0	3GPP Rel 8	DC-HSDPA Subtest-2	23.20	23.10	23.19	23.69	23.73	23.63	24.24	24.23	24.36
0.5	3GPP Rel 8	DC-HSDPA Subtest-3	22.69	22.68	22.84	23.31	23.25	23.24	23.18	23.26	23.40
0.5	3GPP Rel 8	DC-HSDPA Subtest-4	22.48	22.42	22.59	23.07	23.06	23.01	23.07	23.00	23.18
0	3GPP Rel 6	HSUPA Subtest-1	22.84	22.80	22.91	23.45	23.43	23.32	23.21	23.26	23.34
2	3GPP Rel 6	HSUPA Subtest-2	21.05	21.01	21.15	21.63	21.66	21.58	21.58	21.55	21.63
1	3GPP Rel 6	HSUPA Subtest-3	22.11	22.02	22.16	22.63	22.65	22.54	22.56	22.49	22.59
2	3GPP Rel 6	HSUPA Subtest-4	21.29	21.26	21.40	21.75	21.82	21.81	21.65	21.69	21.78
0	3GPP Rel 6	HSUPA Subtest-5	23.26	23.21	23.29	23.79	23.85	23.71	23.05	23.01	23.08

<LTE Conducted Power>

<LTE Band 17>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune up Limit (dBm)	MPR (dB)
Channel				23780	23790	23800		
Frequency (MHz)				709	710	711		
10	QPSK	1	0	22.40	22.39	22.44	23.5	0
10	QPSK	1	24	22.23	22.24	22.26		
10	QPSK	1	49	22.26	22.38	22.41		
10	QPSK	25	0	21.32	21.30	21.39	22.5	1
10	QPSK	25	12	21.25	21.27	21.29		
10	QPSK	25	24	21.27	21.32	21.38		
10	QPSK	50	0	21.35	21.35	21.36		
10	16QAM	1	0	21.76	21.68	21.71	22.5	1
10	16QAM	1	24	21.44	21.38	21.41		
10	16QAM	1	49	21.58	21.66	21.68		
10	16QAM	25	0	20.45	20.35	20.37	21.5	2
10	16QAM	25	12	20.26	20.27	20.32		
10	16QAM	25	24	20.33	20.33	20.38		
10	16QAM	50	0	20.41	20.36	20.38		
Channel				23755	23790	23825	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				706.5	710	713.5		
5	QPSK	1	0	22.39	22.31	22.35	23.5	0
5	QPSK	1	12	21.99	21.83	21.96		
5	QPSK	1	24	22.21	22.23	22.27		
5	QPSK	12	0	21.10	21.08	21.06	22.5	1
5	QPSK	12	6	20.92	20.91	20.99		
5	QPSK	12	11	21.29	20.89	21.08		
5	QPSK	25	0	21.10	20.93	21.09		
5	16QAM	1	0	21.72	21.41	21.53	22.5	1
5	16QAM	1	12	21.25	20.93	21.20		
5	16QAM	1	24	21.39	21.34	21.49		
5	16QAM	12	0	20.39	20.07	20.08	21.5	2
5	16QAM	12	6	20.20	19.90	20.01		
5	16QAM	12	11	20.20	19.93	20.11		
5	16QAM	25	0	20.18	20.13	20.12		

<LTE Band 5>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune up Limit (dBm)	MPR (dB)
Channel				20450	20525	20600		
Frequency (MHz)				829	836.5	844		
10	QPSK	1	0	22.32	22.36	22.35	23.5	0
10	QPSK	1	24	22.29	22.35	22.28		
10	QPSK	1	49	22.31	22.24	21.99		
10	QPSK	25	0	21.34	21.40	21.38	22.5	1
10	QPSK	25	12	21.36	21.37	21.34		
10	QPSK	25	24	21.39	21.38	21.28		
10	QPSK	50	0	21.36	21.41	21.34		
10	16QAM	1	0	21.61	21.71	21.66	22.5	1
10	16QAM	1	24	21.52	21.70	21.54		
10	16QAM	1	49	21.57	21.52	21.35		
10	16QAM	25	0	20.39	20.48	20.45	21.5	2
10	16QAM	25	12	20.43	20.49	20.37		
10	16QAM	25	24	20.46	20.49	20.33		
10	16QAM	50	0	20.44	20.51	20.38		
Channel				20425	20525	20625	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				826.5	836.5	846.5		
5	QPSK	1	0	22.30	22.35	22.25	23.5	0
5	QPSK	1	12	21.90	22.01	21.88		
5	QPSK	1	24	22.26	22.34	22.04		
5	QPSK	12	0	21.09	21.26	21.15	22.5	1
5	QPSK	12	6	20.96	21.13	20.98		
5	QPSK	12	11	21.02	21.18	20.97		
5	QPSK	25	0	21.07	21.20	21.04		
5	16QAM	1	0	21.56	21.76	21.53	22.5	1
5	16QAM	1	12	21.19	21.39	21.20		
5	16QAM	1	24	21.55	21.64	21.32		
5	16QAM	12	0	20.16	20.38	20.22	21.5	2
5	16QAM	12	6	20.02	20.22	20.05		
5	16QAM	12	11	20.08	20.26	20.05		
5	16QAM	25	0	20.13	20.28	20.11		
Channel				20415	20525	20635	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				825.5	836.5	847.5		
3	QPSK	1	0	22.19	22.24	22.11	23.5	0
3	QPSK	1	7	22.10	22.23	22.05		
3	QPSK	1	14	22.11	22.22	21.93		
3	QPSK	8	0	21.16	21.33	21.18	22.5	1
3	QPSK	8	4	21.16	21.32	21.12		
3	QPSK	8	7	21.17	21.31	21.09		
3	QPSK	15	0	21.16	21.33	21.12		
3	16QAM	1	0	21.37	21.66	21.40	22.5	1
3	16QAM	1	7	21.36	21.57	21.38		
3	16QAM	1	14	21.36	21.51	21.18		
3	16QAM	8	0	20.24	20.45	20.27	21.5	2
3	16QAM	8	4	20.23	20.40	20.21		
3	16QAM	8	7	20.26	20.42	20.17		
3	16QAM	15	0	20.23	20.43	20.22		

Channel				20407	20525	20643	Tune up Limit (dBm)	Target MPR (dB)
Frequency (MHz)				824.7	836.5	848.3		
1.4	QPSK	1	0	22.15	22.25	22.19	23.5	0
1.4	QPSK	1	2	22.08	22.18	21.99		
1.4	QPSK	1	5	22.11	22.19	21.98		
1.4	QPSK	3	0	22.08	22.24	22.12		
1.4	QPSK	3	1	22.03	22.13	22.08		
1.4	QPSK	3	2	22.09	22.08	22.03		
1.4	QPSK	6	0	21.13	21.29	21.07	22.5	1
1.4	16QAM	1	0	21.43	21.71	21.47	22.5	1
1.4	16QAM	1	2	21.30	21.68	21.41		
1.4	16QAM	1	5	21.36	21.69	21.27		
1.4	16QAM	3	0	21.16	21.38	21.20		
1.4	16QAM	3	1	21.31	21.43	21.14		
1.4	16QAM	3	2	21.29	21.44	21.15		
1.4	16QAM	6	0	20.28	20.45	20.22	21.5	2

<LTE Band 4>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune up Limit (dBm)	MPR (dB)
Channel				20050	20175	20300		
Frequency (MHz)				1720	1732.5	1745		
20	QPSK	1	0	23.98	23.87	23.64	24.5	0
20	QPSK	1	49	23.65	23.48	23.26		
20	QPSK	1	99	23.46	23.38	23.29		
20	QPSK	50	0	22.88	22.71	22.49	23.5	1
20	QPSK	50	24	22.68	22.51	22.32		
20	QPSK	50	49	22.53	22.36	22.25		
20	QPSK	100	0	22.68	22.52	22.36		
20	16QAM	1	0	22.99	22.95	22.70	23.5	1
20	16QAM	1	49	22.90	22.73	22.51		
20	16QAM	1	99	22.39	22.24	22.17		
20	16QAM	50	0	21.78	21.62	21.40	22.5	2
20	16QAM	50	24	21.60	21.43	21.22		
20	16QAM	50	49	21.45	21.28	21.14		
20	16QAM	100	0	21.59	21.41	21.24		
Channel				20025	20175	20325	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1717.5	1732.5	1747.5		
15	QPSK	1	0	23.95	23.84	23.81	24.5	0
15	QPSK	1	37	23.51	23.34	23.12		
15	QPSK	1	74	23.93	23.64	23.77		
15	QPSK	36	0	22.93	22.68	22.55	23.5	1
15	QPSK	36	18	22.59	22.35	22.22		
15	QPSK	36	37	22.72	22.42	22.40		
15	QPSK	75	0	22.80	22.52	22.44		
15	16QAM	1	0	23.48	23.46	23.33	23.5	1
15	16QAM	1	37	22.74	22.57	22.36		
15	16QAM	1	74	23.28	22.94	22.97		
15	16QAM	36	0	21.86	21.64	21.46	22.5	2
15	16QAM	36	18	21.50	21.29	21.11		
15	16QAM	36	37	21.62	21.34	21.26		
15	16QAM	75	0	21.72	21.43	21.37		
Channel				20000	20175	20350	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1715	1732.5	1750		
10	QPSK	1	0	23.94	23.76	23.47	24.5	0
10	QPSK	1	24	23.83	23.60	23.38		
10	QPSK	1	49	23.68	23.37	23.29		
10	QPSK	25	0	22.94	22.64	22.44	23.5	1
10	QPSK	25	12	22.87	22.55	22.39		
10	QPSK	25	24	22.80	22.48	22.36		
10	QPSK	50	0	22.87	22.56	22.42		
10	16QAM	1	0	23.15	22.96	22.72	23.5	1
10	16QAM	1	24	23.10	22.82	22.65		
10	16QAM	1	49	22.89	22.62	22.54		
10	16QAM	25	0	21.83	21.58	21.40	22.5	2
10	16QAM	25	12	21.76	21.48	21.35		
10	16QAM	25	24	21.72	21.41	21.33		
10	16QAM	50	0	21.80	21.49	21.37		

Channel				19975	20175	20375	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1712.5	1732.5	1752.5		
5	QPSK	1	0	23.91	23.83	23.59	24.5	0
5	QPSK	1	12	23.66	23.39	23.27		
5	QPSK	1	24	23.90	23.71	23.55		
5	QPSK	12	0	22.92	22.66	22.46	23.5	1
5	QPSK	12	6	22.72	22.48	22.30		
5	QPSK	12	11	22.76	22.51	22.36		
5	QPSK	25	0	22.81	22.59	22.40		
5	16QAM	1	0	23.29	23.15	22.87	23.5	1
5	16QAM	1	12	22.94	22.73	22.48		
5	16QAM	1	24	23.22	22.93	22.79		
5	16QAM	12	0	21.86	21.58	21.41	22.5	2
5	16QAM	12	6	21.69	21.39	21.23		
5	16QAM	12	11	21.72	21.41	21.26		
5	16QAM	25	0	21.77	21.49	21.34		
Channel				19965	20175	20385	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1711.5	1732.5	1753.5		
3	QPSK	1	0	23.85	23.60	23.42	24.5	0
3	QPSK	1	7	23.82	23.55	23.42		
3	QPSK	1	14	23.81	23.53	23.36		
3	QPSK	8	0	22.90	22.62	22.42	23.5	1
3	QPSK	8	4	22.85	22.58	22.38		
3	QPSK	8	7	22.86	22.56	22.42		
3	QPSK	15	0	22.85	22.57	22.43		
3	16QAM	1	0	23.08	22.84	22.61	23.5	1
3	16QAM	1	7	23.10	22.83	22.64		
3	16QAM	1	14	23.06	22.73	22.61		
3	16QAM	8	0	21.86	21.56	21.43	22.5	2
3	16QAM	8	4	21.84	21.52	21.40		
3	16QAM	8	7	21.83	21.52	21.41		
3	16QAM	15	0	21.83	21.55	21.39		
Channel				19957	20175	20393	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1710.7	1732.5	1754.3		
1.4	QPSK	1	0	23.20	23.65	23.49	24.5	0
1.4	QPSK	1	2	23.19	23.63	23.45		
1.4	QPSK	1	5	23.54	23.61	23.45		
1.4	QPSK	3	0	23.25	23.62	23.47		
1.4	QPSK	3	1	23.10	23.60	23.46		
1.4	QPSK	3	2	23.20	23.60	23.47		
1.4	QPSK	6	0	22.13	22.56	22.41	23.5	1
1.4	16QAM	1	0	22.75	22.88	22.69	23.5	1
1.4	16QAM	1	2	22.77	22.85	22.67		
1.4	16QAM	1	5	22.53	22.82	22.67		
1.4	16QAM	3	0	22.18	22.63	22.48		
1.4	16QAM	3	1	22.37	22.61	22.47		
1.4	16QAM	3	2	22.41	22.59	22.46		
1.4	16QAM	6	0	21.66	21.56	21.46	22.5	2

<LTE Band 2>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune up Limit (dBm)	MPR (dB)
Channel				18700	18900	19100		
Frequency (MHz)				1860	1880	1900		
20	QPSK	1	0	23.04	22.82	22.81	23.5	0
20	QPSK	1	49	22.57	22.41	22.43		
20	QPSK	1	99	22.41	22.44	22.41		
20	QPSK	50	0	21.67	21.58	21.63	22.5	1
20	QPSK	50	24	21.51	21.42	21.47		
20	QPSK	50	49	21.47	21.44	21.44		
20	QPSK	100	0	21.52	21.50	21.46		
20	16QAM	1	0	21.98	21.73	21.76	22.5	1
20	16QAM	1	49	21.47	21.54	21.65		
20	16QAM	1	99	21.50	21.46	21.44		
20	16QAM	50	0	20.97	20.89	20.94	21.5	2
20	16QAM	50	24	20.70	20.72	20.82		
20	16QAM	50	49	20.64	20.74	20.82		
20	16QAM	100	0	20.79	20.78	20.86		
Channel				18675	18900	19125	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1857.5	1880	1902.5		
15	QPSK	1	0	22.87	22.91	22.88	23.5	0
15	QPSK	1	37	22.38	22.44	22.30		
15	QPSK	1	74	22.55	22.70	22.72		
15	QPSK	36	0	21.54	21.47	21.62	22.5	1
15	QPSK	36	18	21.25	21.22	21.35		
15	QPSK	36	37	21.32	21.36	21.56		
15	QPSK	75	0	21.42	21.38	21.57		
15	16QAM	1	0	22.29	22.09	22.33	22.5	1
15	16QAM	1	37	21.36	21.40	21.43		
15	16QAM	1	74	21.73	21.92	22.09		
15	16QAM	36	0	20.87	20.76	20.94	21.5	2
15	16QAM	36	18	20.57	20.52	20.65		
15	16QAM	36	37	20.59	20.66	20.85		
15	16QAM	75	0	20.71	20.69	20.88		
Channel				18650	18900	19150	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1855	1880	1905		
10	QPSK	1	0	22.76	22.47	22.60	23.5	0
10	QPSK	1	24	22.50	22.43	22.58		
10	QPSK	1	49	22.41	22.47	22.46		
10	QPSK	25	0	21.60	21.53	21.67	22.5	1
10	QPSK	25	12	21.51	21.46	21.62		
10	QPSK	25	24	21.46	21.47	21.61		
10	QPSK	50	0	21.53	21.51	21.62		
10	16QAM	1	0	21.93	21.81	21.84	22.5	1
10	16QAM	1	24	21.74	21.70	21.84		
10	16QAM	1	49	21.51	21.64	21.70		
10	16QAM	25	0	20.93	20.80	20.95	21.5	2
10	16QAM	25	12	20.81	20.75	20.91		
10	16QAM	25	24	20.76	20.74	20.90		
10	16QAM	50	0	20.85	20.77	20.93		

Channel				18625	18900	19175	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1852.5	1880	1907.5		
5	QPSK	1	0	22.82	22.82	22.83	23.5	0
5	QPSK	1	12	22.37	22.37	22.49		
5	QPSK	1	24	22.66	22.66	22.75		
5	QPSK	12	0	21.64	21.64	21.69	22.5	1
5	QPSK	12	6	21.44	21.44	21.53		
5	QPSK	12	11	21.46	21.46	21.58		
5	QPSK	25	0	21.54	21.54	21.62		
5	16QAM	1	0	22.09	22.09	22.08	22.5	1
5	16QAM	1	12	21.65	21.65	21.68		
5	16QAM	1	24	21.89	21.89	21.91		
5	16QAM	12	0	20.95	20.95	20.99	21.5	2
5	16QAM	12	6	20.77	20.77	20.82		
5	16QAM	12	11	20.78	20.78	20.85		
5	16QAM	25	0	20.86	20.86	20.91		
Channel				18615	18900	19185	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1851.5	1880	1908.5		
3	QPSK	1	0	22.58	22.44	22.61	23.5	0
3	QPSK	1	7	22.50	22.43	22.60		
3	QPSK	1	14	22.47	22.42	22.54		
3	QPSK	8	0	21.60	21.48	21.66	22.5	1
3	QPSK	8	4	21.55	21.42	21.62		
3	QPSK	8	7	21.54	21.44	21.63		
3	QPSK	15	0	21.56	21.46	21.64		
3	16QAM	1	0	21.82	21.65	21.81	22.5	1
3	16QAM	1	7	21.76	21.63	21.77		
3	16QAM	1	14	21.68	21.61	21.71		
3	16QAM	8	0	20.93	20.77	20.97	21.5	2
3	16QAM	8	4	20.87	20.76	20.91		
3	16QAM	8	7	20.88	20.76	20.94		
3	16QAM	15	0	20.90	20.78	20.94		
Channel				18607	18900	19193	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1850.7	1880	1909.3		
1.4	QPSK	1	0	22.61	22.51	22.67	23.5	0
1.4	QPSK	1	2	22.59	22.48	22.65		
1.4	QPSK	1	5	22.58	22.49	22.64		
1.4	QPSK	3	0	22.62	22.50	22.67		
1.4	QPSK	3	1	22.61	22.50	22.67		
1.4	QPSK	3	2	22.62	22.50	22.67		
1.4	QPSK	6	0	21.57	21.45	21.61	22.5	1
1.4	16QAM	1	0	21.88	21.75	21.86	22.5	1
1.4	16QAM	1	2	21.84	21.73	21.83		
1.4	16QAM	1	5	21.84	21.74	21.83		
1.4	16QAM	3	0	21.60	21.48	21.65		
1.4	16QAM	3	1	21.59	21.48	21.65		
1.4	16QAM	3	2	21.57	21.46	21.63		
1.4	16QAM	6	0	20.96	20.84	21.01	21.5	2

<LTE Band 7>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune up Limit (dBm)	MPR (dB)
Channel				20850	21100	21350		
Frequency (MHz)				2510	2535	2560		
20	QPSK	1	0	20.54	20.79	20.82	22	0
20	QPSK	1	49	20.51	20.72	20.74		
20	QPSK	1	99	20.24	20.35	20.42		
20	QPSK	50	0	19.56	19.67	19.68	21	1
20	QPSK	50	24	19.50	19.65	19.59		
20	QPSK	50	49	19.44	19.57	19.58		
20	QPSK	100	0	19.51	19.61	19.64		
20	16QAM	1	0	19.80	19.92	19.87	21	1
20	16QAM	1	49	19.76	19.86	19.84		
20	16QAM	1	99	19.38	19.47	19.60		
20	16QAM	50	0	18.65	18.73	18.78	20	2
20	16QAM	50	24	18.57	18.71	18.67		
20	16QAM	50	49	18.52	18.65	18.63		
20	16QAM	100	0	18.53	18.69	18.68		
Channel				20825	21100	21375	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				2507.5	2535	2562.5		
15	QPSK	1	0	20.51	20.76	20.75	22	0
15	QPSK	1	37	20.30	20.16	20.10		
15	QPSK	1	74	20.41	20.60	20.61		
15	QPSK	36	0	19.10	19.31	19.27	21	1
15	QPSK	36	18	19.00	19.09	19.05		
15	QPSK	36	37	19.01	19.23	19.18		
15	QPSK	75	0	19.04	19.26	19.20		
15	16QAM	1	0	19.82	19.93	19.83	21	1
15	16QAM	1	37	19.17	19.39	19.26		
15	16QAM	1	74	19.57	19.82	19.76		
15	16QAM	36	0	18.20	18.38	18.31	20	2
15	16QAM	36	18	18.10	18.14	18.07		
15	16QAM	36	37	18.09	18.30	18.21		
15	16QAM	75	0	18.10	18.30	18.23		
Channel				20800	21100	21400	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				2505	2535	2565		
10	QPSK	1	0	20.61	20.77	20.77	22	0
10	QPSK	1	24	20.59	20.76	20.72		
10	QPSK	1	49	20.37	20.58	20.59		
10	QPSK	25	0	19.39	19.62	19.57	21	1
10	QPSK	25	12	19.36	19.60	19.54		
10	QPSK	25	24	19.33	19.56	19.52		
10	QPSK	50	0	19.38	19.58	19.53		
10	16QAM	1	0	19.80	19.99	19.90	21	1
10	16QAM	1	24	19.77	19.98	19.89		
10	16QAM	1	49	19.58	19.78	19.79		
10	16QAM	25	0	18.49	18.70	18.67	20	2
10	16QAM	25	12	18.47	18.68	18.65		
10	16QAM	25	24	18.45	18.65	18.65		
10	16QAM	50	0	18.48	18.67	18.66		

Channel				20775	21100	21425	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				2502.5	2535	2567.5		
5	QPSK	1	0	20.52	20.72	20.80	22	0
5	QPSK	1	12	20.38	20.62	20.61		
5	QPSK	1	24	20.47	20.71	20.71		
5	QPSK	12	0	19.24	19.47	19.44	21	1
5	QPSK	12	6	19.07	19.31	19.30		
5	QPSK	12	11	19.10	19.35	19.34		
5	QPSK	25	0	19.13	19.40	19.38		
5	16QAM	1	0	19.69	19.93	19.87	21	1
5	16QAM	1	12	19.56	19.81	19.76		
5	16QAM	1	24	19.65	19.87	19.85		
5	16QAM	12	0	18.35	18.55	18.52	20	2
5	16QAM	12	6	18.20	18.40	18.37		
5	16QAM	12	11	18.24	18.43	18.40		
5	16QAM	25	0	18.28	18.48	18.48		

<WLAN Conducted Power>

<2.4GHz WLAN>

WLAN 2.4GHz 802.11b Average Power (dBm)					
Power vs. Channel			Power vs. Data Rate		
Channel	Frequency (MHz)	Data Rate 1Mbps	2Mbps	5.5Mbps	11Mbps
CH 1	2412	12.59	12.16	12.11	11.68
CH 6	2437	12.52			
CH 11	2462	12.06			

WLAN 2.4GHz 802.11g Average Power (dBm)									
Power vs. Channel			Power vs. Data Rate						
Channel	Frequency (MHz)	Data Rate 6Mbps	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
CH 1	2412	10.91	10.92	10.85	10.87	10.11	10.01	10.23	10.32
CH 6	2437	10.93							
CH 11	2462	10.90							

WLAN 2.4GHz 802.11n-HT20 Average Power (dBm)									
Power vs. Channel			Power vs. MCS Index						
Channel	Frequency (MHz)	MCS Index MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
CH 1	2412	10.59	10.69	10.77	8.39	8.62	8.46	8.46	8.43
CH 6	2437	10.79							
CH 11	2462	10.77							

<5GHz WLAN>

WLAN 5GHz 802.11a Average Power (dBm)									
Power vs. Channel			Power vs. Data Rate						
Channel	Frequency (MHz)	Data Rate 6Mbps	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
CH 36	5180	11.50	11.45	11.44	11.49	10.77	10.76	10.91	10.96
CH 40	5200	11.37							
CH 44	5220	11.43							
CH 48	5240	11.33							
CH 149	5745	11.95	11.95	11.95	11.85	10.48	10.27	10.59	10.50
CH 153	5765	11.79							
CH 157	5785	11.99							
CH 161	5805	11.84							
CH 165	5825	11.90							

WLAN 5GHz 802.11n-HT20 Average Power (dBm)									
Power vs. Channel			Power vs. MCS Index						
Channel	Frequency (MHz)	Data Rate 6Mbps	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
CH 36	5180	9.99	9.49	9.77	9.06	9.08	9.14	9.12	9.13
CH 40	5200	9.44							
CH 44	5220	9.24							
CH 48	5240	9.21							
CH 149	5745	9.58	9.64	9.58	6.67	6.61	6.78	6.77	6.63
CH 153	5765	9.38							
CH 157	5785	9.46							
CH 161	5805	9.41							
CH 165	5825	9.66							

WLAN 5GHz 802.11n-HT40 Average Power (dBm)									
Power vs. Channel			Power vs. MCS Index						
Channel	Frequency (MHz)	MCS Index MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
CH 38	5190	9.96	9.91	9.85	9.87	9.95	9.93	9.90	9.93
CH 46	5230	9.76							
CH 151	5755	9.97	9.93	9.88	7.39	6.95	6.95	6.88	6.91
CH 159	5795	9.93							

WLAN 5GHz 802.11ac-VHT20 Average Power (dBm)										
Power vs. Channel			Power vs. MCS Index							
Channel	Frequency (MHz)	MCS Index MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	MCS8
CH 36	5180	9.44	9.42	9.17	9.38	9.40	9.42	9.28	9.36	9.39
CH 40	5200	9.26								
CH 44	5220	9.28								
CH 48	5240	9.40								
CH 149	5745	9.50	9.60	9.58	6.49	6.52	6.66	6.69	6.72	6.78
CH 153	5765	9.43								
CH 157	5785	9.37								
CH 161	5805	9.29								
CH 165	5825	9.65								

WLAN 5GHz 802.11ac-VHT40 Average Power (dBm)											
Power vs. Channel			Power vs. MCS Index								
Channel	Frequency (MHz)	MCS Index MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	MCS8	MCS9
CH 38	5190	9.46	9.28	9.36	9.44	9.48	9.48	9.49	9.46	9.50	9.46
CH 46	5230	9.53									
CH 151	5755	9.91	9.86	9.89	7.92	7.91	7.78	8.03	8.03	7.98	8.22
CH 159	5795	9.44									

WLAN 5GHz 802.11ac-VHT80 Average Power (dBm)											
Power vs. Channel			Power vs. MCS Index								
Channel	Frequency (MHz)	MCS Index MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	MCS8	MCS9
CH 42	5210	9.54	9.50	9.42	9.52	9.53	9.51	9.49	9.51	9.52	9.51
CH 155	5775	9.93	9.79	9.83	9.09	9.10	9.17	9.13	8.83	9.11	9.14

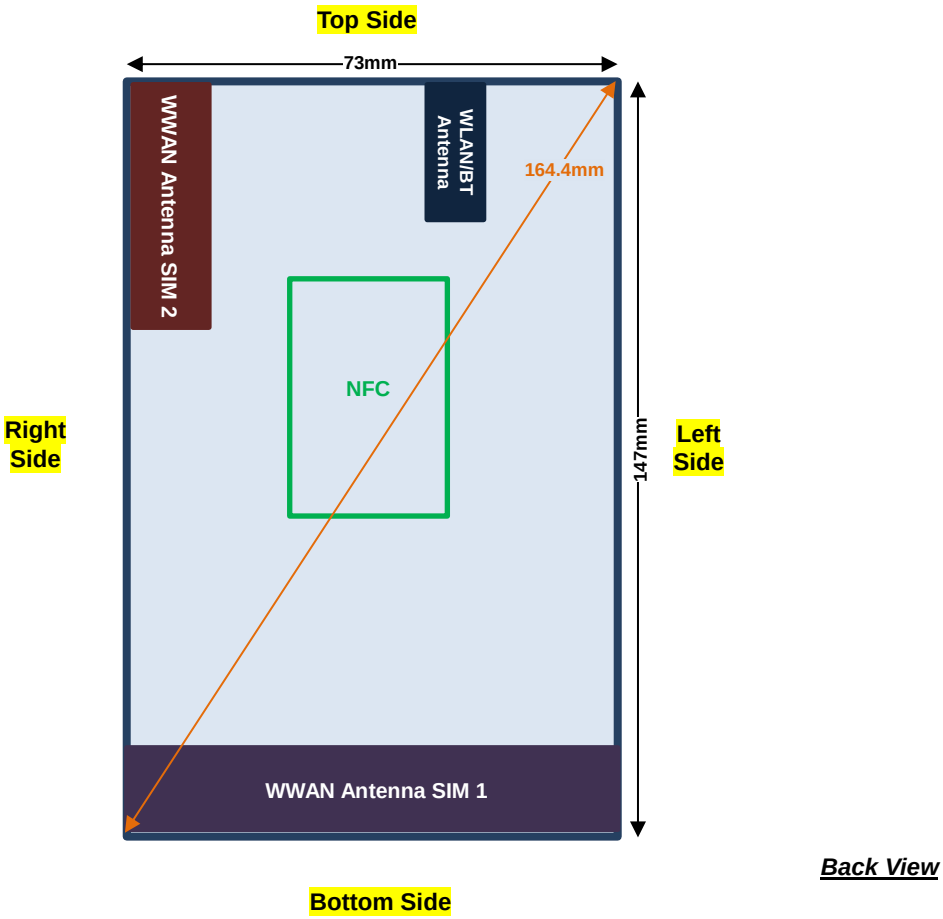
<Bluetooth Power>

Mode	Channel	Frequency (MHz)	Average power (dBm)		
			1Mbps	2Mbps	3Mbps
v3.0 with EDR	CH 00	2402	5.58	3.58	3.60
	CH 39	2441	7.05	3.20	3.21
	CH 78	2480	4.78	1.32	1.33

Mode	Channel	Frequency (MHz)	Average power (dBm)
			GFSK
v4.0 with LE	CH 00	2402	2.82
	CH 19	2440	3.46
	CH 39	2480	1.96

13. Antenna Location

<Mobile Phone>



Distance of the Antenna to the EUT surface/edge						
Antennas	Back	Front	Top Side	Bottom Side	Right Side	Left Side
WWAN Antenna SIM1	≤ 25mm	≤ 25mm	> 25mm	≤ 25mm	≤ 25mm	≤ 25mm
BT&WLAN	≤ 25mm	≤ 25mm	≤ 25mm	> 25mm	> 25mm	≤ 25mm
Positions for SAR tests; Hotspot mode						
Antennas	Back	Front	Top Side	Bottom Side	Right Side	Left Side
WWAN Antenna SIM1	Yes	Yes	No	Yes	Yes	Yes
BT&WLAN	Yes	Yes	Yes	No	No	Yes

General Note:

1. Referring to KDB 941225 D06 v02, when the overall device length and width are ≥ 9cm*5cm, the test distance is 10 mm. SAR must be measured for all sides and surfaces with a transmitting antenna located within 25mm from that surface or edge
2. The SIM2 supports GSM Voice only.

14. SAR Test Results

General Note:

1. Per KDB 447498 D01v05r02, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
   a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
   b. For SAR testing of WLAN signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)"
   c. For WWAN/Bluetooth: Reported SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor
   d. For WLAN: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor * Tune-up scaling factor
2. Per KDB 447498 D01v05r02, for each exposure position, 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:
   - ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
   - ≤ 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
3. Per KDB 648474 D04v01r02, when the reported SAR for a body-worn accessory measured without a headset connected to the handset is ≤ 1.2 W/kg, SAR testing with a headset connected to the handset is not required.
4. Per KDB 648474 D04v01r02, for smart phones with a display diagonal dimension > 15.0 cm or an overall diagonal dimension > 16.0 cm, when hotspot mode applies, 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR > 1.2 W/kg.
5. Additional Bluetooth Head SAR was used perform simultaneously transmission analysis.
6. During SAR testing the WLAN transmission was verified using a spectrum analyzer.

14.1 Head SAR

<GSM SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	SIM	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
01	GSM850	GPRS (2 Tx slots)	Right Cheek	0mm	SIM1	251	848.8	29.77	30.50	1.183	0.04	0.257	0.304
	GSM850	GSM Voice	Left Cheek	0mm	SIM2	251	848.8	32.91	33.50	1.146	0.15	0.146	0.167
	GSM1900	GPRS (2 Tx slots)	Left Cheek	0mm	SIM1	512	1850.2	27.30	28.00	1.175	0.19	0.185	0.217
02	GSM1900	GSM Voice	Left Cheek	0mm	SIM2	810	1909.8	27.92	28.00	1.019	-0.1	1.100	1.120
	GSM1900	GSM Voice	Left Cheek	0mm	SIM2	512	1850.2	27.86	28.00	1.033	-0.1	0.976	1.008
	GSM1900	GSM Voice	Left Cheek	0mm	SIM2	661	1880	27.90	28.00	1.023	-0.1	0.991	1.014

<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	SIM	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
03	WCDMA V	RMC 12.2Kbps	Right Cheek	0mm	SIM1	4233	846.6	23.40	23.50	1.023	0.04	0.245	0.251
04	WCDMA IV	RMC 12.2Kbps	Left Cheek	0mm	SIM1	1513	1752.6	24.39	24.50	1.026	0.11	0.382	0.392
05	WCDMA II	RMC 12.2Kbps	Left Cheek	0mm	SIM1	9262	1852.4	23.86	24.00	1.033	0.13	0.381	0.393

<LTE SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	SIM	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
06	LTE Band 17	10M	QPSK	1RB	0Offset	Right Cheek	0mm	SIM1	23800	711	22.44	23.50	1.276	0.17	0.019	0.024
07	LTE Band 5	10M	QPSK	1RB	0Offset	Right Cheek	0mm	SIM1	20600	844	22.35	23.50	1.303	0.03	0.131	0.171
08	LTE Band 4	20M	QPSK	1RB	0Offset	Right Cheek	0mm	SIM1	20300	1745	23.64	24.50	1.219	-0.07	0.173	0.211
09	LTE Band 2	20M	QPSK	1RB	0Offset	Left Cheek	0mm	SIM1	18700	1860	23.04	23.50	1.112	0.16	0.291	0.324
10	LTE Band 7	20M	QPSK	1RB	0offset	Left Cheek	0mm	SIM1	20850	2510	20.64	22.00	1.368	0.17	0.294	0.402

<WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
11	WLAN2.4GHz	802.11b 1Mbps	Right Tilted	0mm	6	2437	12.52	13.00	1.117	98.85	1.012	-0.11	0.022	0.025
12	WLAN5GHz	802.11a 6Mbps	Right Cheek	0mm	36	5180	11.50	12.00	1.122	92.86	1.077	0	0.313	0.378
	WLAN5GHz	802.11a 6Mbps	Left Tilted	0mm	157	5785	11.99	12.00	1.002	92.86	1.077	0.13	0.203	0.219

<Bluetooth SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
13	Bluetooth	1Mbps	Left Cheek	0mm	39	2441	7.05	7.50	1.109	0.04	0.045	0.050

14.2 Hotspot SAR

<GSM SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	SIM	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
14	GSM850	GPRS (2 Tx slots)	Back	10mm	SIM1	128	824.2	29.71	30.50	1.199	-0.15	0.395	0.474
16	GSM1900	GPRS (2 Tx slots)	Back	10mm	SIM1	810	1909.8	27.17	28.00	1.211	0.04	0.239	0.289

<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	SIM	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
16	WCDMA V	RMC 12.2Kbps	Back	10mm	SIM1	4132	826.4	23.29	23.50	1.050	-0.05	0.393	0.412
17	WCDMA IV	RMC 12.2Kbps	Back	10mm	SIM1	1413	1732.6	24.19	24.50	1.074	0.08	0.449	0.482
18	WCDMA II	RMC 12.2Kbps	Bottom Side	10mm	SIM1	9400	1880	23.89	24.00	1.026	-0.01	0.679	0.696

<LTE SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	SIM	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
19	LTE Band 17	10M	QPSK	1RB	0Offset	Back	10mm	SIM1	23800	711	22.44	23.50	1.276	0.08	0.073	0.093
20	LTE Band 5	10M	QPSK	1RB	0Offset	Right Side	10mm	SIM1	20450	829	22.32	23.50	1.312	0.13	0.278	0.365
21	LTE Band 4	20M	QPSK	1RB	0Offset	Back	10mm	SIM1	20300	1745	23.64	24.50	1.219	0.05	0.476	0.580
22	LTE Band 2	20M	QPSK	1RB	0Offset	Bottom Side	10mm	SIM1	19100	1900	22.81	23.50	1.172	-0.08	0.563	0.660
23	LTE Band 7	20M	QPSK	1RB	0offset	Back	10mm	SIM1	21350	2560	20.82	22.00	1.312	-0.02	0.277	0.363

<WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Power Setting	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
24	WLAN2.4GHz	802.11b 1Mbps	Back	10mm	11	2462	13	12.06	13.00	1.242	98.85	1.012	-0.01	0.040	0.050
25	WLAN5GHz	802.11a 6Mbps	Back	10mm	44	5220	15	11.43	12.00	1.140	92.86	1.077	0.15	0.158	0.194
	WLAN5GHz	802.11a 6Mbps	Back	10mm	157	5785	14	11.99	12.00	1.002	92.86	1.077	0.09	0.109	0.118

14.3 Body Worn Accessory SAR

<GSM SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	SIM	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
25	GSM850	GPRS (2 Tx slots)	Back	10mm	SIM1	128	824.2	29.71	30.50	1.199	-0.15	0.395	0.474
	GSM850	GSM Voice	Back	10mm	SIM2	251	848.8	32.91	33.50	1.146	0.16	0.198	0.227
	GSM1900	GPRS (2 Tx slots)	Back	10mm	SIM1	810	1909.8	27.17	28.00	1.211	0.04	0.239	0.289
26	GSM1900	GSM Voice	Back	10mm	SIM2	661	1880	27.90	28.00	1.023	0.05	0.288	0.295

<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	SIM	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
27	WCDMA V	RMC 12.2Kbps	Back	10mm	SIM1	4132	826.4	23.29	23.50	1.050	-0.05	0.393	0.412
28	WCDMA IV	RMC 12.2Kbps	Back	10mm	SIM1	1413	1732.6	24.19	24.50	1.074	0.08	0.449	0.482
29	WCDMA II	RMC 12.2Kbps	Back	10mm	SIM1	9538	1907.6	23.76	24.00	1.057	-0.06	0.481	0.508

<LTE SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (mm)	SIM	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
30	LTE Band 17	10M	QPSK	1RB	0Offset	Back	10mm	SIM1	23800	711	22.44	23.50	1.276	0.08	0.073	0.093
31	LTE Band 5	10M	QPSK	1RB	0Offset	Back	10mm	SIM1	20600	844	22.35	23.50	1.303	-0.06	0.368	0.480
32	LTE Band 4	20M	QPSK	1RB	0Offset	Back	10mm	SIM1	20300	1745	23.64	24.50	1.219	0.05	0.476	0.580
33	LTE Band 2	20M	QPSK	1RB	0Offset	Back	10mm	SIM1	19100	1900	22.81	23.50	1.172	-0.07	0.237	0.278
34	LTE Band 7	20M	QPSK	1RB	0offset	Back	10mm	SIM1	21350	2560	20.82	22.00	1.312	-0.02	0.277	0.363

<WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
35	WLAN2.4GHz	802.11b 1Mbps	Back	10mm	11	2462	12.06	13.00	1.242	98.85	1.012	-0.01	0.040	0.050
36	WLAN5GHz	802.11a 6Mbps	Back	10mm	44	5220	11.43	12.00	1.140	92.86	1.077	0.15	0.158	0.194

14.4 Repeated SAR Measurement

No.	Band	Mode	Test Position	Gap (mm)	SIM	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Ratio	Reported 1g SAR (W/kg)
1st	GSM1900	GSM Voice	Left Cheek	0mm	SIM2	810	1909.8	27.92	28.00	1.019	-0.1	1.100	-	1.120
2nd	GSM1900	GSM Voice	Left Cheek	0mm	SIM2	810	1909.8	27.92	28.00	1.019	-0.13	0.976	1.13	0.994

General Note:

1. Per KDB 865664 D01v01r03, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg
2. Per KDB 865664 D01v01r03, if the ratio among the repeated measurement is ≤ 1.2 and the measured SAR <1.45W/kg, only one repeated measurement is required.
3. The ratio is the difference in percentage between original and repeated *measured SAR*.
4. All measurement SAR result is scaled-up to account for tune-up tolerance and is compliant.

15. Simultaneous Transmission Analysis

NO.	Simultaneous Transmission Configurations	Portable Handset			Note
		Head	Body-worn	Hotspot	
1.	GSM(Voice) + WLAN2.4GHz(data)	Yes	Yes		
2.	WCDMA(Voice) + WLAN2.4GHz(data)	Yes	Yes		
3.	SIM2 GSM(Voice) + SIM1 GSM(data) + WLAN2.4GHz(data)	Yes	Yes		
4.	SIM2 GSM(Voice) + WCDMA(data) + WLAN2.4GHz(data)	Yes	Yes		
5.	GSM(Voice) + Bluetooth(data)	Yes	Yes		
6.	WCDMA((Voice) + Bluetooth(data)	Yes	Yes		
7.	SIM2 GSM(Voice) + SIM1 GSM(data) + Bluetooth(data)	Yes	Yes		
8.	SIM2 GSM(Voice) + WCDMA(data) + Bluetooth(data)	Yes	Yes		
9.	GSM(Voice) + WLAN5GHz(data)	Yes	Yes		
10.	WCDMA((Voice) + WLAN5GHz(data)	Yes	Yes		
11.	SIM2 GSM(Voice) + SIM1 GSM(data) + WLAN5GHz(data)	Yes	Yes		
12.	SIM2 GSM(Voice) + WCDMA(data) + WLAN5GHz (data)	Yes	Yes		
13.	GPRS/EDGE(Data) + WLAN2.4GHz(data)	Yes	Yes	Yes	2.4GHz Hotspot
14.	WCDMA(Data) + WLAN2.4GHz(data)	Yes	Yes	Yes	2.4GHz Hotspot
15.	LTE(Data) + WLAN2.4GHz(data)	Yes	Yes	Yes	2.4GHz Hotspot
16.	GPRS/EDGE(Data) + Bluetooth(data)	Yes	Yes	Yes	Bluetooth Tethering
17.	WCDMA(Data) + Bluetooth(data)	Yes	Yes	Yes	Bluetooth Tethering
18.	LTE(Data) + Bluetooth(data)	Yes	Yes	Yes	Bluetooth Tethering
19.	GPRS/EDGE(data) + WLAN5GHz(data)	Yes	Yes	Yes	WiFi Direct(5.8GHz)
20.	WCDMA(data) + WLAN5GHz(data)	Yes	Yes	Yes	WiFi Direct(5.8GHz)
21.	LTE(data) + WLAN5GHz(data)	Yes	Yes	Yes	WiFi Direct(5.8GHz)

General Note:

1. This device supported VoIP in EGPRS, WCDMA, LTE (e.g. 3rd party VoIP).
2. This device 2.4GHz WLAN supports Hotspot and 5.8GHz WLAN supports WiFi Direct (GC/GO), and 5.2GHz supports WiFi Direct (GC only).
3. WLAN and Bluetooth share the same antenna, and cannot transmit simultaneously.
4. EUT will choose either WLAN 2.4GHz or WLAN 5GHz according to the network signal condition; therefore, 2.4GHz WLAN and 5GHz WLAN will not operate simultaneously at any moment.
5. The Scaled SAR summation is calculated based on the same configuration and test position.
6. Per KDB 447498 D01v05r02, simultaneous transmission SAR is compliant if,
   i) Scalar SAR summation < 1.6W/kg.
   ii) SPLSR = (SAR1 + SAR2)^1.5 / (min. separation distance, mm), and the peak separation distance is determined from the square root of [(x1-x2)2 + (y1-y2)2 + (z1-z2)2], where (x1, y1, z1) and (x2, y2, z2) are the coordinates of the extrapolated peak SAR locations in the zoom scan.
   iii) If SPLSR ≤ 0.04, simultaneously transmission SAR measurement is not necessary.
   iv) Simultaneously transmission SAR measurement, and the reported multi-band SAR < 1.6W/kg.
7. For simultaneous transmission analysis, Bluetooth SAR is estimated per KDB 447498 D01v05r02 based on the formula below.
   i) (*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)]·[$\sqrt{f(GHz)/x}$] W/kg for *test separation distances* ≤ 50 mm; where *x* = 7.5 for 1-g SAR, and *x* = 18.75 for 10-g SAR.
   ii) When the minimum separation distance is < 5mm, the distance is used 5mm to determine SAR test exclusion.
   iii) 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the *test separation distances* is > 50 mm.

Bluetooth Max Power	Exposure Position	Hotspot	Body worn
	Test separation	10 mm	10 mm
7.5 dBm	Estimated SAR (W/kg)	0.126 W/kg	0.126 W/kg

15.1 Head Exposure Conditions

WWAN Band		Exposure Position	1 SIM1 WWAN 1g SAR (W/kg)	2 SIM2 GSM850 1g SAR (W/kg)	3 SIM2 GSM1900 1g SAR (W/kg)	4 2.4GHz WLAN 1g SAR (W/kg)	1+2+4 Summed 1g SAR (W/kg)	1+3+4 Summed 1g SAR (W/kg)
GSM	GSM850	Right Cheek	0.304				**0.30**	**0.30**
		Right Tilted				0.025	**0.03**	**0.03**
		Left Cheek		0.167	1.120		**0.17**	**1.12**
	GSM1900	Right Tilted				0.025	**0.03**	**0.03**
		Left Cheek	0.217	0.167	1.120		**0.38**	**1.34**
WCDMA	WCDMA V	Right Cheek	0.251				**0.25**	**0.25**
		Right Tilted				0.025	**0.03**	**0.03**
		Left Cheek		0.167	1.120		**0.17**	**1.12**
	WCDMA IV	Right Tilted				0.025	**0.03**	**0.03**
		Left Cheek	0.392	0.167	1.120		**0.56**	**1.51**
	WCDMA II	Right Tilted				0.025	**0.03**	**0.03**
		Left Cheek	0.393	0.167	1.120		**0.56**	**1.51**
LTE	LTE Band 17	Right Cheek	0.024				**0.02**	**0.02**
		Right Tilted				0.025	**0.03**	**0.03**
		Left Cheek		0.167	1.120		**0.17**	**1.12**
	LTE Band 5	Right Cheek	0.171				**0.17**	**0.17**
		Right Tilted				0.025	**0.03**	**0.03**
		Left Cheek		0.167	1.120		**0.17**	**1.12**
	LTE Band 4	Right Cheek	0.211				**0.21**	**0.21**
		Right Tilted				0.025	**0.03**	**0.03**
		Left Cheek		0.167	1.120		**0.17**	**1.12**
	LTE Band 2	Right Tilted				0.025	**0.03**	**0.03**
		Left Cheek	0.324	0.167	1.120		**0.49**	**1.44**
	LTE Band 7	Right Tilted				0.025	**0.03**	**0.03**
		Left Cheek	0.402	0.167	1.120		**0.57**	**1.52**

WWAN Band		Exposure Position	1	2	3	5	1+2+5 Summed 1g SAR (W/kg)	1+3+5 Summed 1g SAR (W/kg)
			SIM1 WWAN	SIM2 GSM850	SIM2 GSM1900	5GHz WLAN		
			1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)		
GSM	GSM850	Right Cheek	0.304			0.378	**0.68**	**0.68**
		Left Cheek		0.167	1.120		**0.17**	**1.12**
		Left Tilted				0.219	**0.22**	**0.22**
	GSM1900	Right Cheek				0.378	**0.38**	**0.38**
		Left Cheek	0.217	0.167	1.120		**0.38**	**1.34**
		Left Tilted				0.219	**0.22**	**0.22**
WCDMA	WCDMA V	Right Cheek	0.251			0.378	**0.63**	**0.63**
		Left Cheek		0.167	1.120		**0.17**	**1.12**
		Left Tilted				0.219	**0.22**	**0.22**
	WCDMA IV	Right Cheek				0.378	**0.38**	**0.38**
		Left Cheek	0.392	0.167	1.120		**0.56**	**1.51**
		Left Tilted				0.219	**0.22**	**0.22**
	WCDMA II	Right Cheek				0.378	**0.38**	**0.38**
		Left Cheek	0.393	0.167	1.120		**0.56**	**1.51**
		Left Tilted				0.219	**0.22**	**0.22**
LTE	LTE Band 17	Right Cheek	0.024			0.378	**0.40**	**0.40**
		Left Cheek		0.167	1.120		**0.17**	**1.12**
		Left Tilted				0.219	**0.22**	**0.22**
	LTE Band 5	Right Cheek	0.171			0.378	**0.55**	**0.55**
		Left Cheek		0.167	1.120		**0.17**	**1.12**
		Left Tilted				0.219	**0.22**	**0.22**
	LTE Band 4	Right Cheek	0.211			0.378	**0.59**	**0.59**
		Left Cheek		0.167	1.120		**0.17**	**1.12**
		Left Tilted				0.219	**0.22**	**0.22**
	LTE Band 2	Right Cheek				0.378	**0.38**	**0.38**
		Left Cheek	0.324	0.167	1.120		**0.49**	**1.44**
		Left Tilted				0.219	**0.22**	**0.22**
	LTE Band 7	Right Cheek				0.378	**0.38**	**0.38**
		Left Cheek	0.402	0.167	1.120		**0.57**	**1.52**
		Left Tilted				0.219	**0.22**	**0.22**

WWAN Band		Exposure Position	1	2	3	6	1+2+6 Summed 1g SAR (W/kg)	1+3+6 Summed 1g SAR (W/kg)
			SIM1 WWAN	SIM2 GSM850	SIM2 GSM1900	2.4GHz Bluetooth		
			1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)		
GSM	GSM850	Right Cheek	0.304			0.050	**0.35**	**0.35**
		Left Cheek		0.167	1.120	0.050	**0.22**	**1.17**
	GSM1900	Left Cheek	0.217	0.167	1.120	0.050	**0.43**	**1.39**
WCDMA	WCDMA V	Right Cheek	0.251			0.050	**0.30**	**0.30**
		Left Cheek		0.167	1.120	0.050	**0.22**	**1.17**
	WCDMA IV	Left Cheek	0.392	0.167	1.120	0.050	**0.61**	**1.56**
	WCDMA II	Left Cheek	0.393	0.167	1.120	0.050	**0.61**	**1.56**
LTE	LTE Band 17	Right Cheek	0.024			0.050	**0.07**	**0.07**
		Left Cheek		0.167	1.120	0.050	**0.22**	**1.17**
	LTE Band 5	Right Cheek	0.171			0.050	**0.22**	**0.22**
		Left Cheek		0.167	1.120	0.050	**0.22**	**1.17**
	LTE Band 4	Right Cheek	0.211			0.050	**0.26**	**0.26**
		Left Cheek		0.167	1.120	0.050	**0.22**	**1.17**
	LTE Band 2	Left Cheek	0.324	0.167	1.120	0.050	**0.54**	**1.49**
	LTE Band 7	Left Cheek	0.402	0.167	1.120	0.050	**0.62**	**1.57**

15.2 Hotspot Exposure Conditions

WWAN Band		Exposure Position	1	2	3	4	1+2 Summed 1g SAR (W/kg)	1+3 Summed 1g SAR (W/kg)	1+2+4 Summed 1g SAR (W/kg)
			SIM1 WWAN	2.4GHz WLAN	5GHz WLAN	2.4GHz Bluetooth			
			1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	Estimated 1g SAR (W/kg)			
GSM	GSM850	Back	0.474	0.050	0.194	0.126	**0.52**	**0.67**	**0.60**
	GSM1900	Back	0.289	0.050	0.194	0.126	**0.34**	**0.48**	**0.42**
WCDMA	WCDMA V	Back	0.412	0.050	0.194	0.126	**0.46**	**0.61**	**0.54**
	WCDMA IV	Back	0.482	0.050	0.194	0.126	**0.53**	**0.68**	**0.61**
	WCDMA II	Bottom side	0.696				**0.70**	**0.70**	**0.70**
LTE	LTE Band 17	Back	0.093	0.050	0.194	0.126	**0.14**	**0.29**	**0.22**
	LTE Band 5	Right side	0.365				**0.37**	**0.37**	**0.37**
	LTE Band 4	Back	0.580	0.050	0.194	0.126	**0.63**	**0.77**	**0.71**
	LTE Band 2	Bottom side	0.660				**0.66**	**0.66**	**0.66**
	LTE Band 7	Back	0.363	0.050	0.194	0.126	**0.41**	**0.56**	**0.49**

15.3 Body-Worn Accessory Exposure Conditions

WWAN Band		Exposure Position	1 SIM1 WWAN 1g SAR (W/kg)	2 SIM2 GSM850 1g SAR (W/kg)	3 SIM2 GSM1900 1g SAR (W/kg)	4 2.4GHz WLAN 1g SAR (W/kg)	1+2+4 Summed 1g SAR (W/kg)	1+3+4 Summed 1g SAR (W/kg)
GSM	GSM850	Back	0.474	0.227	0.295	0.050	**0.75**	**0.82**
	GSM1900	Back	0.289	0.227	0.295	0.050	**0.57**	**0.63**
WCDMA	WCDMA V	Back	0.412	0.227	0.295	0.050	**0.69**	**0.76**
	WCDMA IV	Back	0.482	0.227	0.295	0.050	**0.76**	**0.83**
	WCDMA II	Back	0.508	0.227	0.295	0.050	**0.79**	**0.85**
LTE	LTE Band 17	Back	0.093	0.227	0.295	0.050	**0.37**	**0.44**
	LTE Band 5	Back	0.480	0.227	0.295	0.050	**0.76**	**0.83**
	LTE Band 4	Back	0.580	0.227	0.295	0.050	**0.86**	**0.93**
	LTE Band 2	Back	0.278	0.227	0.295	0.050	**0.56**	**0.62**
	LTE Band 7	Back	0.363	0.227	0.295	0.050	**0.64**	**0.71**

WWAN Band		Exposure Position	1 SIM1 WWAN 1g SAR (W/kg)	2 SIM2 GSM850 1g SAR (W/kg)	3 SIM2 GSM1900 1g SAR (W/kg)	5 5GHz WLAN 1g SAR (W/kg)	1+2+5 Summed 1g SAR (W/kg)	1+3+5 Summed 1g SAR (W/kg)
GSM	GSM850	Back	0.474	0.227	0.295	0.194	**0.90**	**0.96**
	GSM1900	Back	0.289	0.227	0.295	0.194	**0.71**	**0.78**
WCDMA	WCDMA V	Back	0.412	0.227	0.295	0.194	**0.83**	**0.90**
	WCDMA IV	Back	0.482	0.227	0.295	0.194	**0.90**	**0.97**
	WCDMA II	Back	0.508	0.227	0.295	0.194	**0.93**	**1.00**
LTE	LTE Band 17	Back	0.093	0.227	0.295	0.194	**0.51**	**0.58**
	LTE Band 5	Back	0.480	0.227	0.295	0.194	**0.90**	**0.97**
	LTE Band 4	Back	0.580	0.227	0.295	0.194	**1.00**	**1.07**
	LTE Band 2	Back	0.278	0.227	0.295	0.194	**0.70**	**0.77**
	LTE Band 7	Back	0.363	0.227	0.295	0.194	**0.78**	**0.85**

WWAN Band		Exposure Position	1 SIM1 WWAN 1g SAR (W/kg)	2 SIM2 GSM850 1g SAR (W/kg)	3 SIM2 GSM1900 1g SAR (W/kg)	6 2.4GHz Bluetooth Estimated 1g SAR (W/kg)	1+2+6 Summed 1g SAR (W/kg)	1+3+6 Summed 1g SAR (W/kg)
GSM	GSM850	Back	0.474	0.227	0.295	0.126	**0.83**	**0.90**
	GSM1900	Back	0.289	0.227	0.295	0.126	**0.64**	**0.71**
WCDMA	WCDMA V	Back	0.412	0.227	0.295	0.126	**0.77**	**0.83**
	WCDMA IV	Back	0.482	0.227	0.295	0.126	**0.84**	**0.90**
	WCDMA II	Back	0.508	0.227	0.295	0.126	**0.86**	**0.93**
LTE	LTE Band 17	Back	0.093	0.227	0.295	0.126	**0.45**	**0.51**
	LTE Band 5	Back	0.480	0.227	0.295	0.126	**0.83**	**0.90**
	LTE Band 4	Back	0.580	0.227	0.295	0.126	**0.93**	**1.00**
	LTE Band 2	Back	0.278	0.227	0.295	0.126	**0.63**	**0.70**
	LTE Band 7	Back	0.363	0.227	0.295	0.126	**0.72**	**0.78**

Test Engineer： Poa Pan, Galen Zhang, Vic Yang and Frank Wu

16. Uncertainty Assessment

The component of uncertainly may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainly by the statistical analysis of a series of observations is termed a Type An evaluation of uncertainty. The evaluation of uncertainty by means other than the statistical analysis of a series of observation is termed a Type B evaluation of uncertainty. Each component of uncertainty, however evaluated, is represented by an estimated standard deviation, termed standard uncertainty, which is determined by the positive square root of the estimated variance.

A Type A evaluation of standard uncertainty may be based on any valid statistical method for treating data. This includes calculating the standard deviation of the mean of a series of independent observations; using the method of least squares to fit a curve to the data in order to estimate the parameter of the curve and their standard deviations; or carrying out an analysis of variance in order to identify and quantify random effects in certain kinds of measurement.

A type B evaluation of standard uncertainty is typically based on scientific judgment using all of the relevant information available. These may include previous measurement data, experience, and knowledge of the behavior and properties of relevant materials and instruments, manufacture's specification, data provided in calibration reports and uncertainties assigned to reference data taken from handbooks. Broadly speaking, the uncertainty is either obtained from an outdoor source or obtained from an assumed distribution, such as the normal distribution, rectangular or triangular distributions indicated in table below.

Uncertainty Distributions	Normal	Rectangular	Triangular	U-Shape
Multi-plying Factor[(a)]	1/k[(b)]	1/√3	1/√6	1/√2

(a) standard uncertainty is determined as the product of the multiplying factor and the estimated range of variations in the measured quantity

(b) κ is the coverage factor

Table 17.1. Standard Uncertainty for Assumed Distribution

The combined standard uncertainty of the measurement result represents the estimated standard deviation of the result. It is obtained by combining the individual standard uncertainties of both Type A and Type B evaluation using the usual "root-sum-squares" (RSS) methods of combining standard deviations by taking the positive square root of the estimated variances.

Expanded uncertainty is a measure of uncertainty that defines an interval about the measurement result within which the measured value is confidently believed to lie. It is obtained by multiplying the combined standard uncertainty by a coverage factor. Typically, the coverage factor ranges from 2 to 3. Using a coverage factor allows the true value of a measured quantity to be specified with a defined probability within the specified uncertainty range. For purpose of this document, a coverage factor two is used, which corresponds to confidence interval of about 95 %. The DASY uncertainty Budget is shown in the following tables.

Error Description	Uncertainty Value (±%)	Probability Distribution	Divisor	Ci (1g)	Ci (10g)	Standard Uncertainty (1g)	Standard Uncertainty (10g)
Measurement System							
Probe Calibration	6.0	Normal	1	1	1	± 6.0 %	± 6.0 %
Axial Isotropy	4.7	Rectangular	√3	0.7	0.7	± 1.9 %	± 1.9 %
Hemispherical Isotropy	9.6	Rectangular	√3	0.7	0.7	± 3.9 %	± 3.9 %
Boundary Effects	1.0	Rectangular	√3	1	1	± 0.6 %	± 0.6 %
Linearity	4.7	Rectangular	√3	1	1	± 2.7 %	± 2.7 %
System Detection Limits	1.0	Rectangular	√3	1	1	± 0.6 %	± 0.6 %
Readout Electronics	0.3	Normal	1	1	1	± 0.3 %	± 0.3 %
Response Time	0.8	Rectangular	√3	1	1	± 0.5 %	± 0.5 %
Integration Time	2.6	Rectangular	√3	1	1	± 1.5 %	± 1.5 %
RF Ambient Noise	3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %
RF Ambient Reflections	3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %
Probe Positioner	0.4	Rectangular	√3	1	1	± 0.2 %	± 0.2 %
Probe Positioning	2.9	Rectangular	√3	1	1	± 1.7 %	± 1.7 %
Max. SAR Eval.	1.0	Rectangular	√3	1	1	± 0.6 %	± 0.6 %
Test Sample Related							
Device Positioning	2.9	Normal	1	1	1	± 2.9 %	± 2.9 %
Device Holder	3.6	Normal	1	1	1	± 3.6 %	± 3.6 %
Power Drift	5.0	Rectangular	√3	1	1	± 2.9 %	± 2.9 %
Phantom and Setup							
Phantom Uncertainty	4.0	Rectangular	√3	1	1	± 2.3 %	± 2.3 %
Liquid Conductivity (Target)	5.0	Rectangular	√3	0.64	0.43	± 1.8 %	± 1.2 %
Liquid Conductivity (Meas.)	2.5	Normal	1	0.64	0.43	± 1.6 %	± 1.1 %
Liquid Permittivity (Target)	5.0	Rectangular	√3	0.6	0.49	± 1.7 %	± 1.4 %
Liquid Permittivity (Meas.)	2.5	Normal	1	0.6	0.49	± 1.5 %	± 1.2 %
Combined Standard Uncertainty						± 11.0 %	± 10.8 %
Coverage Factor for 95 %						K=2	
Expanded Uncertainty						**± 22.0 %**	**± 21.5 %**

Table 17.2. Uncertainty Budget for frequency range 300 MHz to 3 GHz

Error Description	Uncertainty Value (±%)	Probability Distribution	Divisor	Ci (1g)	Ci (10g)	Standard Uncertainty (1g)	Standard Uncertainty (10g)
Measurement System							
Probe Calibration	6.55	Normal	1	1	1	± 6.55 %	± 6.55 %
Axial Isotropy	4.7	Rectangular	√3	0.7	0.7	± 1.9 %	± 1.9 %
Hemispherical Isotropy	9.6	Rectangular	√3	0.7	0.7	± 3.9 %	± 3.9 %
Boundary Effects	2.0	Rectangular	√3	1	1	± 1.2 %	± 1.2 %
Linearity	4.7	Rectangular	√3	1	1	± 2.7 %	± 2.7 %
System Detection Limits	1.0	Rectangular	√3	1	1	± 0.6 %	± 0.6 %
Readout Electronics	0.3	Normal	1	1	1	± 0.3 %	± 0.3 %
Response Time	0.8	Rectangular	√3	1	1	± 0.5 %	± 0.5 %
Integration Time	2.6	Rectangular	√3	1	1	± 1.5 %	± 1.5 %
RF Ambient Noise	3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %
RF Ambient Reflections	3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %
Probe Positioner	0.8	Rectangular	√3	1	1	± 0.5 %	± 0.5 %
Probe Positioning	9.9	Rectangular	√3	1	1	± 5.7 %	± 5.7 %
Max. SAR Eval.	4.0	Rectangular	√3	1	1	± 2.3 %	± 2.3 %
Test Sample Related							
Device Positioning	2.9	Normal	1	1	1	± 2.9 %	± 2.9 %
Device Holder	3.6	Normal	1	1	1	± 3.6 %	± 3.6 %
Power Drift	5.0	Rectangular	√3	1	1	± 2.9 %	± 2.9 %
Phantom and Setup							
Phantom Uncertainty	4.0	Rectangular	√3	1	1	± 2.3 %	± 2.3 %
Liquid Conductivity (Target)	5.0	Rectangular	√3	0.64	0.43	± 1.8 %	± 1.2 %
Liquid Conductivity (Meas.)	2.5	Normal	1	0.64	0.43	± 1.6 %	± 1.1 %
Liquid Permittivity (Target)	5.0	Rectangular	√3	0.6	0.49	± 1.7 %	± 1.4 %
Liquid Permittivity (Meas.)	2.5	Normal	1	0.6	0.49	± 1.5 %	± 1.2 %
Combined Standard Uncertainty						± 12.8 %	± 12.6 %
Coverage Factor for 95 %						K=2	
Expanded Uncertainty						**± 25.6 %**	**± 25.2 %**

Table 17.3. Uncertainty Budget for frequency range 3 GHz to 6 GHz

17. References

[1] FCC 47 CFR Part 2 “Frequency Allocations and Radio Treaty Matters; General Rules and Regulations”

[2] ANSI/IEEE Std. C95.1-1992, “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”, September 1992

[3] IEEE Std. 1528-2003, “Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”, December 2003

[4] SPEAG DASY System Handbook

[5] FCC KDB 248227 D01 v02r01, “SAR Guidance for IEEE 802.11 (WiFi) Transmitters”, Jun 2015.

[6] FCC KDB 447498 D01 v05r02, “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”, Feb 2014

[7] FCC KDB 648474 D04 v01r02, “SAR Evaluation Considerations for Wireless Handsets”, Dec 2013.

[8] FCC KDB 941225 D01 v03, “3G SAR MEAUREMENT PROCEDURES”, Oct 2014

[9] FCC KDB 941225 D05 v02r03, “SAR Evaluation Considerations for LTE Devices”, Dec 2013

[10] FCC KDB 941225 D06 v02, "SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities", Oct 2014.

[11] FCC KDB 865664 D01 v01r03, "SAR Measurement Requirements for 100 MHz to 6 GHz", Feb 2014.

[12] FCC KDB 865664 D02 v01r01, “RF Exposure Compliance Reporting and Documentation Considerations” May 2013.