6.5 Conducted Power

Band	Modulation	Data Rate	CH	Frequency (MHz)	Average Power (dBm)	
					Time Average	Burst Average
GPRS 850 Multi Class :12 Max Up:4 Max Down:4 Sum:5	GMSK	4Down1Up Duty factor 1/8	Lowest	824.2	23.78	32.81
			Middle	836.6	23.80	32.83
			Highest	848.8	23.73	32.76
		3Down2Up Duty factor 2/8	Lowest	824.2	24.04	30.06
			Middle	836.6	24.06	30.08
			Highest	848.8	23.91	29.93
		2Down3Up Duty factor 3/8	Lowest	824.2	23.98	28.24
			Middle	836.6	24.01	28.27
			Highest	848.8	23.90	28.16
		1Down4Up Duty factor 4/8	Lowest	824.2	24.10	27.11
			Middle	836.6	24.12	27.13
			Highest	848.8	24.01	27.02
EGPRS 850 Multi Class :12 Max Up:4 Max Down:4 Sum:5	8PSK	4Down1Up Duty factor 1/8	Lowest	824.2	18.00	27.03
			Middle	836.6	17.91	26.94
			Highest	848.8	17.88	26.91
		3Down2Up Duty factor 2/8	Lowest	824.2	18.07	24.09
			Middle	836.6	18.02	24.04
			Highest	848.8	17.95	23.97
		2Down3Up Duty factor 3/8	Lowest	824.2	18.01	22.27
			Middle	836.6	17.92	22.18
			Highest	848.8	17.88	22.14
		1Down4Up Duty factor 4/8	Lowest	824.2	18.16	21.17
			Middle	836.6	18.06	21.07
			Highest	848.8	18.04	21.05

Note: 1. Time Average power slot duty cycle factor calculate:

1up: Average burst power+10*LOG(1/8)

2up: Average burst power+10*LOG(2/8)

3up: Average burst power+10*LOG(3/8)

4up: Average burst power+10*LOG(4/8)

Band	Modulation	Data Rate	CH	Frequency (MHz)	Average Power (dBm)	
					Time Average	Burst Average
GPRS 1900 Multi Class :12 Max Up:4 Max Down:4 Sum:5	GMSK	4Down1Up Duty factor 1/8	Lowest	1850.2	20.63	29.66
			Middle	1880.0	20.70	29.73
			Highest	1909.8	20.68	29.71
		3Down2Up Duty factor 2/8	Lowest	1850.2	20.82	26.84
			Middle	1880.0	20.91	26.93
			Highest	1909.8	20.90	26.92
		2Down3Up Duty factor 3/8	Lowest	1850.2	20.78	25.04
			Middle	1880.0	20.87	25.13
			Highest	1909.8	20.85	25.11
		1Down4Up Duty factor 4/8	Lowest	1850.2	20.75	23.76
			Middle	1880.0	20.83	23.84
			Highest	1909.8	20.80	23.81
EGPRS 1900 Multi Class :12 Max Up:4 Max Down:4 Sum:5	8PSK	4Down1Up Duty factor 1/8	Lowest	1850.2	16.30	25.33
			Middle	1880.0	16.28	25.31
			Highest	1909.8	16.54	25.57
		3Down2Up Duty factor 2/8	Lowest	1850.2	16.36	22.38
			Middle	1880.0	16.45	22.47
			Highest	1909.8	16.59	22.61
		2Down3Up Duty factor 3/8	Lowest	1850.2	16.31	20.57
			Middle	1880.0	16.35	20.61
			Highest	1909.8	16.55	20.81
		1Down4Up Duty factor 4/8	Lowest	1850.2	16.38	19.39
			Middle	1880.0	16.43	19.44
			Highest	1909.8	16.62	19.63

Note: 1. Time Average power slot duty cycle factor calculate:

1up: Average burst power+10*LOG(1/8)

2up: Average burst power+10*LOG(2/8)

3up: Average burst power+10*LOG(3/8)

4up: Average burst power+10*LOG(4/8)

Band	Modulation	Sub-test	CH	Frequency (MHz)	Burst Average Power (dBm)
WCDMA Band II (RMC12.2K)	QPSK	---	Lowest	1852.4	23.52
			Middle	1880.0	24.15
			Highest	1907.6	23.85
WCDMA Band V (RMC12.2K)	QPSK	---	Lowest	826.4	24.55
			Middle	836.6	24.39
			Highest	846.6	24.42

Band	Data Rate (Mbps)	Frequency (MHz)	Average Power (dBm)
IEEE 802.11b	1	2412	7.11
		2437	11.59
		2462	10.14
IEEE 802.11g	6	2412	2.77
		2437	6.74
		2462	4.35
IEEE 802.11n 2.4 GHz, 20MHz	6.5	2412	1.77
		2437	2.38
		2462	2.26

6.6 Antenna location

Antenna-User		
Side	WWAN antenna	WLAN antenna
Side 1	5	5
Side 2	5	5
Side 3	5	5
Side 4	5	5
Side 5	5	5
Side 6	5	5

6.7 Stand-alone SAR Evaluate

Transmitter and antenna implementation as below:

Band	WWAN antenna	WLAN antenna
WWAN	V	X
WLAN	X	V

Stand-alone transmission configurations as below:

Band	Side 1	Side 2	Side 3	Side 4	Side 5	Side 6
GPRS/EGPRS 850	v	v	v	v	v	v
GPRS/EGPRS 1900	v	v	v	v	v	v
WCDMA BandII	v	v	v	v	v	v
WCDMA BandV	v	v	v	v	v	v
IEEE 802.11b	v	v	v	v	v	v
IEEE 802.11g	-	-	-	-	-	-
IEEE 802.11n 2.4GHz 20MHz	-	-	-	-	-	-

Note: The "-" on behalf of Stand-alone SAR is not required (Refer to KDB447498 D01 v06 4.3.1 for the Standalone SAR test exclusion considerations)

Antenna	Operate Band	Channel	Frequency (GHz)	Tune-Power		Evaluate Distance of Ant.To User (mm)					
				(dBm)	(mW)	Side 1	Side 2	Side 3	Side 4	Side 5	Side 6
WWAN antenna	GPRS 850	188	0.8362	32.9	1950	5	5	5	5	5	5
	GPRS 1900	661	1.88	29.8	955	5	5	5	5	5	5
	WCDMA Band II	9400	1.88	24.2	263	5	5	5	5	5	5
	WCDMA Band V	4132	0.8264	24.6	288	5	5	5	5	5	5
WLAN antenna	IEEE 802.11 b	6	2.437	11.7	15	5	5	5	5	5	5
	IEEE 802.11 g	6	2.437	6.8	5	5	5	5	5	5	5
	IEEE 802.11 n 2.4GHz 20MHz	6	2.437	2.4	2	5	5	5	5	5	5

Antenna	Operate Band	Channel	Frequency (GHz)	Tune-Power		Calculated value and evaluated result (mm)					
				(dBm)	(mW)	Side 1	Side 2	Side 3	Side 4	Side 5	Side 6
WWAN antenna	GPRS 850	188	0.8362	32.9	1950	356.6	356.6	356.6	356.6	356.6	356.6
						MEASURE	MEASURE	MEASURE	MEASURE	MEASURE	MEASURE
	GPRS 1900	661	1.88	29.8	955	261.9	261.9	261.9	261.9	261.9	261.9
						MEASURE	MEASURE	MEASURE	MEASURE	MEASURE	MEASURE
	WCDMA BII	9400	1.88	24.2	263	72.1	72.1	72.1	72.1	72.1	72.1
						MEASURE	MEASURE	MEASURE	MEASURE	MEASURE	MEASURE
	WCDMA BV	4132	0.8264	24.6	288	52.4	52.4	52.4	52.4	52.4	52.4
						MEASURE	MEASURE	MEASURE	MEASURE	MEASURE	MEASURE
WLAN antenna	IEEE 802.11 b	6	2.437	11.7	15	4.7	4.7	4.7	4.7	4.7	4.7
						MEASURE	MEASURE	MEASURE	MEASURE	MEASURE	MEASURE
	IEEE 802.11 g	6	2.437	6.8	5	1.6	1.6	1.6	1.6	1.6	1.6
						EXEMPT	EXEMPT	EXEMPT	EXEMPT	EXEMPT	EXEMPT
	IEEE 802.11 n 2.4GHz 20MHz	6	2.437	2.4	2	0.6	0.6	0.6	0.6	0.6	0.6
						EXEMPT	EXEMPT	EXEMPT	EXEMPT	EXEMPT	EXEMPT

Note:
1. Calculated Value include string "mW",that is meam through compare output power with threshold, if the output power more than threshold value the SAR test should be perform. Otherwise,the SAR test could be exempt. (> 50mm)
2. Calculated Value only inculde number format, that is mean through compare output power with threshold, if the Calculated value more than 3, the SAR test should be perform. Otherwise, the SAR test could be exempt. (<50mm)
3. When an antenna qualifies for the standalone SAR test exclusion of KDB 447498 section 4.3.1 and also transmits simultaneously with other antennas, the standalone SAR value must be estimated according to KDB 447498 section "4.3.2. Simultaneous transmission SAR test exclusion considerations b) "
4. The ch and frequency used highest power frequency, that result should be evaluated the worst case.
5. Power and distance are rounded to the nearest mW and mm before calculation.
6. The result is rounded to one decimal place for comparison.

6.8 Simultaneous Transmitting Evaluate

Simultaneous transmission configurations as below:

Condition	Side	Frequency Band	
		WWAN	WLAN
1	1	V	V
	2	V	V
	3	V	V
	4	V	V
	5	V	V
	6	V	V

Estimated SAR

Antenna	Operate Band	Estimated SAR 1g (W/kg)					
		Side 1	Side 2	Side 3	Side 4	Side 5	Side 6
WLAN antenna	IEEE 802.11 g	0.21	0.21	0.21	0.21	0.21	0.21
	IEEE 802.11 n 2.4GHz 20MHz	0.08	0.08	0.08	0.08	0.08	0.08

6.8.1 Sum of 1-g SAR of all simultaneously transmitting

When the sum of 1-g SAR of all simultaneously transmitting antennas in and operating mode and exposure condition combination is within the SAR limit, SAR test exclusion applies to that simultaneous transmission configuration.

Sum of 1-g SAR of summary as below:

Phantom Position		Spacing (mm)	ASSY	WWAN Antenna		Bluetooth Antenna		∑ SAR_{1g} (W/kg)	Event
				Band	SAR_{1g} (W/kg)	Band	SAR_{1g} (W/kg)		
Flat	Side 1	5	N/A	GPRS 850	0.43	IEEE 802.11g	*0.21	0.64	<1.6
Flat	Side 2	5	N/A	GPRS 850	0.04	IEEE 802.11g	*0.21	0.25	<1.6
Flat	Side 3	5	N/A	WCDMA BandV	0.01	IEEE 802.11g	*0.21	0.22	<1.6
Flat	Side 4	5	N/A	GPRS 850	0.06	IEEE 802.11g	*0.21	0.27	<1.6
Flat	Side 5	5	N/A	GPRS 850	0.06	IEEE 802.11g	*0.21	0.27	<1.6
Flat	Side 6	5	N/A	WCDMA BandII	0.06	IEEE 802.11g	*0.21	0.27	<1.6

Note: 1. *=Estimated SAR

2. **The Estimated SAR 0.4W/Kg , test separation distances is > 50 mm
3. When the sum of 1-g SAR of all simultaneously transmitting antennas in and operating mode and exposure condition combination is within the SAR limit, SAR test exclusion applies to that simultaneous transmission configuration.

6.8.2 SAR to peak location separation ratio (SPLSR)

When the sum of SAR is larger than the limit, SAR test exclusion is determined by the SAR to peak location separation ratio. The ratio is determined by (SAR1 + SAR2)^1.5/Ri, rounded to two decimal digits, and must be ≤ 0.04 for all antenna pairs in the configuration to qualify for 1-g SAR test exclusion.

All of sum of SAR < 1.6 W/kg, therefore SPLSR is not required.

6.9 SAR test reduction according to KDB

General:

- The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used were according to FCC, Supplement C [June 2001], IEEE1528-2013.
- All modes of operation were investigated, and worst-case results are reported.
- Tissue parameters and temperatures are listed on the SAR plots.
- Batteries are fully charged for all readings.
- When the Channel's SAR 1g of maximum conducted power is > 0.8 mW/g, low, middle and high channel are supposed to be tested.

KDB 447498:

- The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used were according to IEEE1528-2013.

KDB 865664:

- Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg.
- When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
- Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg.
- Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

KDB 941225:

- In order to qualify for the above test reduction, the maximum burst-averaged output power for each mode (GMS/GPRS/EDGE) and the corresponding multi-slot class must be clearly identified in the SAR report for each frequency band.We perform worst case SAR with maximum time-average power on GMS/GPRS/EDGE mode.
- When HSDPA & (HSUPA / HSPA+ uplink with QPSK) power are not more than WCDMA 12.2K RMC 0.25dB and the SAR value of WCDMA BII/BV<1.2 mW/g ,therefore HSDPA & HSUPA / HSPA+ Stand-alone SAR is not required.

KDB 248227:

- Refer 6.4 SAR Testing with 802.11 Transmitters.

7. System Verification and Validation

7.1 Symmetric Dipoles for System Verification

Construction	Symmetrical dipole with l/4 balun enables measurement of feed point impedance with NWA matched for use near flat phantoms filled with head simulating solutions Includes distance holder and tripod adaptor Calibration Calibrated SAR value for specified position and input power at the flat phantom in head simulating solutions.
Frequency	835, 1900 and 2450 MHz
Return Loss	> 20 dB at specified verification position
Power Capability	> 100 W (f < 1GHz); > 40 W (f > 1GHz)
Options	Dipoles for other frequencies or solutions and other calibration conditions are available upon request
Dimensions	D835V2: dipole length 161 mm; overall height 340 mm D1900V2: dipole length 67.7 mm; overall height 300 mm D2450V2: dipole length 51.5 mm; overall height 300 mm

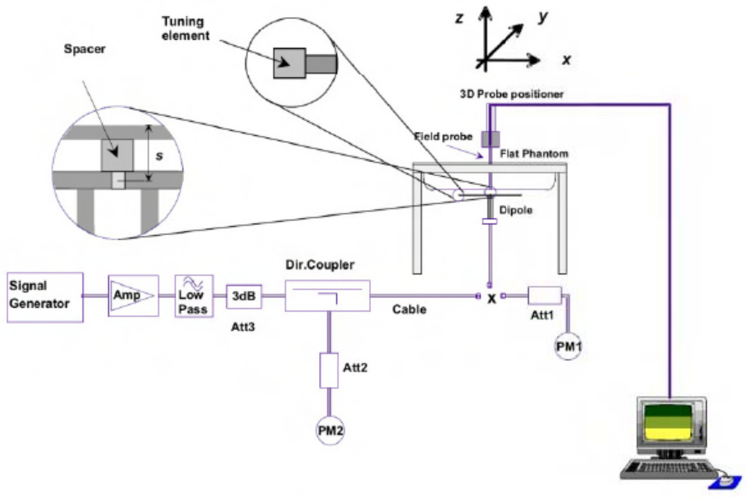


Figure 8. System Verification Setup Diagram

Figure 9. Validation Kit

7.2 Liquid Parameters

Liquid Verify								
Ambient Temperature： 22 ± 2 ℃；Relative Humidity：40 -70%								
Liquid Type	Frequency	Temp (℃)	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)	Measured Date
835MHz (Body)	820MHz	22.0	εr	55.26	55.06	-0.36	± 5	Dec. 22, 2016
			σ	0.969	0.951	-2.06	± 5	
	835MHz	22.0	εr	55.20	54.86	-0.54	± 5	
			σ	0.970	0.971	0.00	± 5	
	850MHz	22.0	εr	55.15	54.92	-0.54	± 5	
			σ	0.988	0.997	1.01	± 5	
1900MHz (Body)	1850MHz	22.0	εr	53.30	51.04	-4.32	± 5	Jan. 23, 2017
			σ	1.520	1.466	-3.29	± 5	
	1900MHz	22.0	εr	53.30	51.03	-4.32	± 5	
			σ	1.520	1.521	0.00	± 5	
	1950MHz	22.0	εr	53.30	50.81	-4.69	± 5	
			σ	1.520	1.564	2.63	± 5	
1900MHz (Body)	1850MHz	22.0	εr	53.30	51.04	-4.32	± 5	Jan. 24, 2017
			σ	1.520	1.466	-3.29	± 5	
	1900MHz	22.0	εr	53.30	51.03	-4.32	± 5	
			σ	1.520	1.521	0.00	± 5	
	1950MHz	22.0	εr	53.30	50.81	-4.69	± 5	
			σ	1.520	1.564	2.63	± 5	
2450MHz (Body)	2400MHz	22.0	εr	52.77	52.71	-0.19	± 5	Dec. 01, 2016
			σ	1.902	1.919	1.05	± 5	
	2450MHz	22.0	εr	52.70	52.40	-0.57	± 5	
			σ	1.950	1.964	0.51	± 5	
	2500MHz	22.0	εr	52.64	52.42	-0.38	± 5	
			σ	2.021	2.049	1.49	± 5	

Table 3. Measured Tissue dielectric parameters for body phantoms

7.3 Verification Summary

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of ± 7%. The verification was performed at 835, 1900 and 2450MHz.

Mixture Type	Frequency (MHz)	Power	SAR_{1g} (W/Kg)	SAR_{10g} (W/Kg)	Drift (dB)	Difference percentage		Probe	Dipole	1W Target		Date
						1g	10g	Model / Serial No.	Model / Serial No.	SAR_{1g} (mW/g)	SAR_{10g} (mW/g)	
Body	835	250 mW	2.48	1.64	-0.02	2.80%	1.90%	EX3DV4 SN:3977	D835V2 SN:4d082	9.65	6.44	Dec. 22, 2016
		Normalize to 1 Watt	9.92	6.56								
Body	1900	250 mW	10.3	5.37	-0.01	2.20%	0.40%	EX3DV4 SN:3977	D1900V2 SN:5d111	40.30	21.40	Jan. 23, 2017
		Normalize to 1 Watt	41.20	21.48								
Body	1900	250 mW	9.87	5.18	-0.05	-2.00%	-3.20%	EX3DV4 SN:3977	D1900V2 SN:5d111	40.30	21.40	Jan. 24, 2017
		Normalize to 1 Watt	39.48	20.72								
Body	2450	250 mW	12.9	5.98	-0.02	-1.50%	-2.40%	EX3DV4 SN:3977	D2450V2 SN:712	52.10	24.50	Dec. 01, 2016
		Normalize to 1 Watt	51.60	23.92								

7.4 Validation Summary

Per FCC KDB 865664 D02 v01r02, SAR system validation status should be documented to confirm measurement accuracy. The SAR systems (including SAR probes, system components and software versions) used for this device were validated against its performance specifications prior to the SAR measurements. Reference dipoles were used with the required tissue- equivalent media for system validation, according to the procedures outlined in IEEE 1528-2013 and FCC KDB 865664 D01v01r04. Since SAR probe calibrations are frequency dependent, each probe calibration point was validated at a frequency within the valid frequency range of the probe calibration point, using the system that normally operates with the probe for routine SAR measurements and according to the required tissue-equivalent media.

A tabulated summary of the system validation status including the validation date(s), measurement frequencies, SAR probes and tissue dielectric parameters as below.

Probe Type Model / Serial No.	Prob Cal. Point (MHz)	Head / Body	Cond.	Perm.	CW Validation			Mod. Validation			Date
			εr	σ	Sensitivity	Probe Linearity	Probe Isotropy	Mod. Type	Duty Factor	PAR	
EX3DV4 SN:3977	835	Body	54.86	0.971	Pass	Pass	Pass	GMSK, RMC 12.2K	Pass	N/A	Dec. 22, 2016
EX3DV4 SN:3977	1900	Body	51.03	1.521	Pass	Pass	Pass	GMSK, RMC 12.2K	Pass	N/A	Jan. 23, 2017
EX3DV4 SN:3977	1900	Body	51.03	1.521	Pass	Pass	Pass	GMSK, RMC 12.2K	Pass	N/A	Jan. 24, 2017
EX3DV4 SN:3977	2450	Body	52.40	1.964	Pass	Pass	Pass	DSSS	N/A	Pass	Dec. 01, 2016

8. Test Equipment List

Name of Equipment	Manufacturer	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
835MHz System Validation Kit	SPEAG	D835V2	4d082	Aug. 23, 2016	Aug. 23, 2017
1900MHz System Validation Kit	SPEAG	D1900V2	5d111	Aug. 25, 2016	Aug. 25, 2017
2450MHz System Validation Kit	SPEAG	D2450V2	712	Apr. 01, 2016	Apr. 01, 2017
Dosimetric E-Field Probe	SPEAG	EX3DV4	3977	Mar. 09, 2016	Mar. 09, 2017
Data Acquisition Electronics	SPEAG	DAE4	779	Mar. 02, 2016	Mar. 02, 2017
Device Holder	SPEAG	N/A	N/A	NCR	
Measurement Server	SPEAG	SE UMS 011 AA	1025	NCR	
Phantom (ELI V4.0)	SPEAG	QDOVA001BB	TP: 1036	NCR	
Robot	SPEAG	Staubli TX90XL	F07/564ZA1/C/01	NCR	
Software	SPEAG	DASY52 V52.8 (8)	N/A	NCR	
Software	SPEAG	SEMCAD X V14.6.10 (7331)	N/A	NCR	
Dielectric Probe Kit	Agilent	85070C	US99360094	NCR	
Wireless Communication Test Set	R & S	CMU200	109369	Dec. 01, 2016	Dec. 01, 2017
Wireless Communication Test Set	Agilent	E5515C(8960)	GB47020167	Jun. 02, 2016	Jun. 02, 2017
ENA Series Network Analyzer	Agilent	E5071B	MY42404655	Apr. 13, 2016	Apr. 13, 2017
MXF-G-B RF Vector Signal Generator	Agilent	N5182B	MY53050382	May 20, 2016	May 20, 2017
Power Sensor	R&S	NRP-Z22	100179	NCR	
Power Sensor	Agilent	8481H	3318A20779	Jun. 06, 2016	Jun. 06, 2017
Power Meter	Agilent	EDM Series E4418B	GB40206143	Jun. 06, 2016	Jun. 06, 2017
Power Meter	Anritsu	ML2495A	1135009	Aug. 24, 2016	Aug. 24, 2017
Dual Directional Coupler	Woken	0110AZ20200801O	11012409517	NCR	
Dual Directional Coupler	Agilent	778D	50334	NCR	
Power Amplifier	Mini-Circuits	ZHL-42W-SMA	D111103#5	NCR	
Power Amplifier	Mini-Circuits	ZVE-8G-SMA	D042005 671800514	NCR	
Attenuator	Aisi	IEAT 3dB	N/A	NCR	

Table 4. Test Equipment List

9. Measurement Uncertainty

Measurement uncertainties in SAR measurements are difficult to quantify due to several variables including biological, physiological, and environmental. However, we estimate the measurement uncertainties in SAR_{1g} to be less than ±21.76 % for 300MHz ~3GHz and 3GHz ~ 6GHz ±25.68 %〔8〕.

According to Std. C95.3〔9〕, the overall uncertainties are difficult to assess and will vary with the type of meter and usage situation. However, accuracy's of ±1 to 3 dB can be expected in practice, with greater uncertainties in near-field situations and at higher frequencies (shorter wavelengths), or areas where large reflecting objects are present. Under optimum measurement conditions, SAR measurement uncertainties of at least ±2dB can be expected.

Uncertainty of a Measure SAR of EUT with DASY System

Item	Uncertainty Component	Uncertainty Value	Prob. Dist	Div.	c_i (1g)	c_i (10g)	Std. Unc. (1-g)	Std. Unc. (10-g)	v_i or V_{eff}
Measurement System									
u1	Probe Calibration (k=1)	±6.0%	Normal	1	1	1	±6.0%	±6.0%	∞
u2	Axial Isotropy	±4.7%	Rectangular	$\sqrt{3}$	0.7	0.7	±1.9%	±1.9%	∞
u3	Hemispherical Isotropy	±9.6%	Rectangular	$\sqrt{3}$	0.7	0.7	±3.9%	±3.9%	
u4	Boundary Effect	±1.0%	Rectangular	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
u5	Linearity	±4.7%	Rectangular	$\sqrt{3}$	1	1	±2.7%	±2.7%	∞
u6	System Detection Limit	±1.0%	Rectangular	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
u7	Readout Electronics	±0.3%	Normal	1	1	1	±0.3%	±0.3%	∞
u8	Response Time	±0.8%	Rectangular	$\sqrt{3}$	1	1	±0.5%	±0.5%	∞
u9	Integration Time	±1.9%	Rectangular	$\sqrt{3}$	1	1	±1.1%	±1.1%	∞
u10	RF Ambient Conditions	±3.0%	Rectangular	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
u11	RF Ambient Reflections	±3.0%	Rectangular	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
u12	Probe Positioner Mechanical Tolerance	±0.4%	Rectangular	$\sqrt{3}$	1	1	±0.2%	±0.2%	∞
u13	Probe Positioning with respect to Phantom Shell	±2.9%	Rectangular	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
u14	Extrapolation, interpolation and integration Algorithms for Max. SAR Evaluation	±1.0%	Rectangular	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Test sample Related									
u15	Test sample Positioning	±3.6%	Normal	1	1	1	±3.6%	±3.6%	89
u16	Device Holder Uncertainty	±2.7%	Normal	1	1	1	±2.7%	±2.7%	5
u17	Output Power Variation - SAR drift measurement	±5.0%	Rectangular	$\sqrt{3}$	1	1	±2.9%	±2.9%	∞
Phantom and Tissue Parameters									
u18	Phantom Uncertainty (shape and thickness tolerances)	±4.0%	Rectangular	$\sqrt{3}$	1	1	±2.3%	±2.3%	∞
u19	Liquid Conductivity - deviation from target values	±5.0%	Rectangular	$\sqrt{3}$	0.64	0.43	±1.8%	±1.2%	∞
u20	Liquid Conductivity - measurement uncertainty	±2.5%	Normal	1	0.64	0.43	±1.6%	±1.08%	69
u21	Liquid Permittivity - deviation from target values	±5.0%	Rectangular	$\sqrt{3}$	0.6	0.49	±1.7%	±1.4%	∞
u22	Liquid Permittivity - measurement uncertainty	±2.5%	Normal	1	0.6	0.49	±1.5%	±1.23%	69
Combined standard uncertainty			RSS				±10.88%	±10.66%	313
Expanded uncertainty (95% CONFIDENCE LEVEL)			k=2				±21.76%	±21.31%	

Table 5. Uncertainty Budget for frequency range 300MHz to 3GHz

Uncertainty of a Measure SAR of EUT with DASY System

Item	Uncertainty Component	Uncertainty Value	Prob. Dist	Div.	c_i (1g)	c_i (10g)	Std. Unc. (1-g)	Std. Unc. (10-g)	v_i or V_{eff}
Measurement System									
u1	Probe Calibration (*k*=1)	±6.5%	Normal	1	1	1	±6.5%	±6.5%	∞
u2	Axial Isotropy	±4.7%	Rectangular	$\sqrt{3}$	0.7	0.7	±1.9%	±1.9%	∞
u3	Hemispherical Isotropy	±9.6%	Rectangular	$\sqrt{3}$	0.7	0.7	±3.9%	±3.9%	
u4	Boundary Effect	±2.0%	Rectangular	$\sqrt{3}$	1	1	±1.2%	±1.2%	∞
u5	Linearity	±4.7%	Rectangular	$\sqrt{3}$	1	1	±2.7%	±2.7%	∞
u6	System Detection Limit	±1.0%	Rectangular	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
u7	Readout Electronics	±0.0%	Normal	1	1	1	±0.0%	±0.0%	∞
u8	Response Time	±0.8%	Rectangular	$\sqrt{3}$	1	1	±0.5%	±0.5%	∞
u9	Integration Time	±2.8%	Rectangular	$\sqrt{3}$	1	1	±2.8%	±2.8%	∞
u10	RF Ambient Conditions	±3.0%	Rectangular	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
u11	RF Ambient Reflections	±3.0%	Rectangular	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
u12	Probe Positioner Mechanical Tolerance	±0.7%	Rectangular	$\sqrt{3}$	1	1	±0.7%	±0.7%	∞
u13	Probe Positioning with respect to Phantom Shell	±9.9%	Rectangular	$\sqrt{3}$	1	1	±5.7%	±5.7%	∞
u14	Extrapolation, interpolation and integration Algorithms for Max. SAR Evaluation	±3.0%	Rectangular	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
Test sample Related									
u15	Test sample Positioning	±3.6%	Normal	1	1	1	±3.6%	±3.6%	89
u16	Device Holder Uncertainty	±2.7%	Normal	1	1	1	±2.7%	±2.7%	5
u17	Output Power Variation - SAR drift measurement	±5.0%	Rectangular	$\sqrt{3}$	1	1	±2.9%	±2.9%	∞
Phantom and Tissue Parameters									
u18	Phantom Uncertainty (shape and thickness tolerances)	±4.0%	Rectangular	$\sqrt{3}$	1	1	±2.3%	±2.3%	∞
u19	Liquid Conductivity - deviation from target values	±5.0%	Rectangular	$\sqrt{3}$	0.64	0.43	±1.8%	±1.2%	∞
u20	Liquid Conductivity - measurement uncertainty	±2.5%	Normal	1	0.64	0.43	±1.6%	±1.08%	69
u21	Liquid Permittivity - deviation from target values	±5.0%	Rectangular	$\sqrt{3}$	0.6	0.49	±1.7%	±1.4%	∞
u22	Liquid Permittivity - measurement uncertainty	±2.5%	Normal	1	0.6	0.49	±1.5%	±1.23%	69
Combined standard uncertainty			RSS				±12.84%	±12.65%	313
Expanded uncertainty (95% CONFIDENCE LEVEL)			*k*=2				±25.68%	±25.29%	

Table 6. ncertainty Budget for frequency range 3GHz to 6GHz

10. Measurement Procedure

The measurement procedures are as follows:

1. For WLAN function, engineering testing software installed on Notebook can provide continuous transmitting signal.
2. Measure output power through RF cable and power meter
3. Set scan area, grid size and other setting on the DASY software
4. Find out the largest SAR result on these testing positions of each band
5. Measure SAR results for other channels in worst SAR testing position if the 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:

1. Power reference measurement
2. Area scan
3. Zoom scan
4. Power drift measurement

10.1 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

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

10.2 Area & Zoom Scan Procedures

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan measures points and step size follow as below. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10 g.

Grid Type	Frequency		Step size (mm)			X*Y*Z (Point)	Cube size			Step size		
			X	Y	Z		X	Y	Z	X	Y	Z
uniform grid	≦ 3GHz	≦2GHz	≤ 8	≤ 8	≤ 5	5*5*7	32	32	30	8	8	5
		2G - 3G	≤ 5	≤ 5	≤ 5	7*7*7	30	30	30	5	5	5
	3 - 6GHz	3 - 4GHz	≤ 5	≤ 5	≤ 4	7*7*8	30	30	28	5	5	4
		4 - 5GHz	≤ 4	≤ 4	≤ 3	8*8*10	28	28	27	4	4	3
		5 - 6GHz	≤ 4	≤ 4	≤ 2	8*8*12	28	28	22	4	4	2

(Our measure settings are refer KDB Publication 865664 D01v01r04)

10.3 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 DUT 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.

10.4 SAR Averaged Methods

In DASY, the interpolation and extrapolation are both based on the modified Quadratic Shepard's method. The interpolation scheme combines a least-square fitted function method and a weighted average method which are the two basic types of computational interpolation and approximation. Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5 mm.

10.5 Power Drift Monitoring

All SAR testing is under the DUT 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 DUT 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 drift more than 5%, the SAR will be retested.

11. SAR Test Results Summary

1. According KDB 447498 D01 V06 section 4.1.4, the "Reported" explanation as below:
   "When SAR or MPE is measured at or scaled to the maximum tune-up tolerance limit, the results are referred to as reported."
2. If actual power less than tune-up power that Scaling SAR is required.
3. The formula of Reported SAR, that represent as below:
   Reported SAR = Original SAR * 10^[(Tune-up power - Actual power)/10]
4. When the WWAN band channel's reported SAR1g of the position is > 0.8 W/kg, low, middle and high channel are supposed to be tested.
5. Require the middle channel to be tested first, if the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel must be used.
6. According to the FCC guide, we utilize the guidance found in KDB 941225 D07 UMPC Mini Tablet v01r02; a test separation distance of 5 mm is required between the phantoms.
7. When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode.
8. SAR test reduction for GPRS and EDGE modes is determined by the source-based time-averaged output power.
9. The data mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions.
10. The 3G SAR test reduction procedure is applied to 8-PSK EDGE with GMSK GPRS/EDGE as the primary mode.
11. When KDB Publication 447498 SAR test exclusion is applies, SAR is not required for 2.4G OFDM configuration.
12. SAR for the initial test configuration is measured using the highest maximum output power channel.
13. When the reported SAR of the highest measured maximum output power channel is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS.

11.1 Head Measurement SAR

Evaluated head SAR is not available.

11.2 Body Measurement SAR

Index.	Position	Band	Ch.	Data Rate or Sub-Test	Test Position	Spacing (mm)	SAR 1g (W/kg)	Power Drift	Burst Avg Power	Max tune-up	Reported SAR 1g (W/kg)
#1	Flat	GPRS 850	188	1D4U	Side 1	5	0.422	0.17	27.13	27.2	0.43
#2	Flat	GPRS 850	188	1D4U	Side 2	5	0.035	0.04	27.13	27.2	0.04
#3	Flat	GPRS 850	188	1D4U	Side 3	5	0.00315	0.19	27.13	27.2	0.00
#4	Flat	GPRS 850	188	1D4U	Side 4	5	0.056	-0.03	27.13	27.2	0.06
#5	Flat	GPRS 850	188	1D4U	Side 5	5	0.059	0	27.13	27.2	0.06
#6	Flat	GPRS 850	188	1D4U	Side 6	5	0.038	0.19	27.13	27.2	0.04
#13	Flat	GPRS 1900	661	3D2U	Side 1	5	0.036	-0.16	26.93	27	0.04
#14	Flat	GPRS 1900	661	3D2U	Side 2	5	0.00313	-0.04	26.93	27	0.00
#15	Flat	GPRS 1900	661	3D2U	Side 3	5	0.00216	0.01	26.93	27	0.00
#16	Flat	GPRS 1900	661	3D2U	Side 4	5	0.00171	-0.04	26.93	27	0.00
#17	Flat	GPRS 1900	661	3D2U	Side 5	5	0.00135	0.07	26.93	27	0.00
#18	Flat	GPRS 1900	661	3D2U	Side 6	5	0.00193	0.1	26.93	27	0.00
#7	Flat	WCDMA Band V	4183	RMC 12.2K	Side 1	5	0.221	0.02	24.39	24.6	0.23
#8	Flat	WCDMA Band V	4183	RMC 12.2K	Side 2	5	0.025	-0.16	24.39	24.6	0.03
#9	Flat	WCDMA Band V	4183	RMC 12.2K	Side 3	5	0.00705	-0.06	24.39	24.6	0.01
#10	Flat	WCDMA Band V	4183	RMC 12.2K	Side 4	5	0.052	0.12	24.39	24.6	0.06
#11	Flat	WCDMA Band V	4183	RMC 12.2K	Side 5	5	0.051	0.14	24.39	24.6	0.05
#12	Flat	WCDMA Band V	4183	RMC 12.2K	Side 6	5	0.032	0.13	24.39	24.6	0.03
#23	Flat	WCDMA Band II	9400	RMC 12.2K	Side 1	5	0.104	-0.01	24.15	24.2	0.11
#24	Flat	WCDMA Band II	9400	RMC 12.2K	Side 2	5	0.016	-0.05	24.15	24.2	0.02
#25	Flat	WCDMA Band II	9400	RMC 12.2K	Side 3	5	0.00268	0.08	24.15	24.2	0.00
#26	Flat	WCDMA Band II	9400	RMC 12.2K	Side 4	5	0.011	-0.01	24.15	24.2	0.01
#27	Flat	WCDMA Band II	9400	RMC 12.2K	Side 5	5	0.012	-0.12	24.15	24.2	0.01
#28	Flat	WCDMA Band II	9400	RMC 12.2K	Side 6	5	0.055	-0.1	24.15	24.2	0.06
#19	Flat	IEEE 802.11b	6	1M	Side 1	5	0.164	-0.09	11.59	11.7	0.17
#20	Flat	IEEE 802.11b	6	1M	Side 2	5	0.209	-0.11	11.59	11.7	0.21
#21	Flat	IEEE 802.11b	6	1M	Side 3	5	0.044	0.15	11.59	11.7	0.05
#22	Flat	IEEE 802.11b	6	1M	Side 4	5	0.013	0.14	11.59	11.7	0.01
#29	Flat	IEEE 802.11b	6	1M	Side 5	5	0.075	-0.16	11.59	11.7	0.08
#30	Flat	IEEE 802.11b	6	1M	Side 6	5	0.034	-0.09	11.59	11.7	0.04

11.3 Hot-spot mode Measurement SAR

Evaluated Hot-spot mode SAR is not available.

11.4 Extremity Measurement SAR

Evaluated extremity SAR is not available.

11.5 Std. C95.1-1992 RF Exposure Limit

Human Exposure	Population Uncontrolled Exposure (W/kg) or (mW/g)	Occupational Controlled Exposure (W/kg) or (mW/g)
Spatial Peak SAR* (head)	1.60	8.00
Spatial Peak SAR** (Whole Body)	0.08	0.40
Spatial Peak SAR*** (Partial-Body)	1.60	8.00
Spatial Peak SAR**** (Hands / Feet / Ankle / Wrist)	4.00	20.00

Table 7. Safety Limits for Partial Body Exposure

Notes :

* The Spatial Peak value of the SAR averaged over any 1 gram of tissue.
(defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

** The Spatial Average value of the SAR averaged over the whole – body.

*** The Spatial Average value of the SAR averaged over the partial – body.

**** The Spatial Peak value of the SAR averaged over any 10 grams of tissue.
(defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

Population / Uncontrolled Environments : are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

Occupational / 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).

12. References

[1] Std. C95.1-1999, "*American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 300KHz to 100GHz"*, New York.

[2] NCRP, National Council on Radiation Protection and Measurements, "Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields", NCRP report NO. 86, 1986.

[3] T. Schmid, O. Egger, and N. Kuster, "Automatic E-field scanning system for dosimetric assessments", IEEE Transactions on Microwave Theory and Techniques, vol. 44, pp, 105-113, Jan. 1996.

[4] K. Pokovič, T. Schmid, and N. Kuster, "Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequency", in ICECOM'97, Dubrovnik, October 15-17, 1997, pp.120-124.

[5] K. Pokovič, T. Schmid, and N. Kuster, "E-field probe with improved isotropy in brain simulating liquids", in Proceedings of the ELMAR, Zadar, Croatia, 23-25 June, 1996, pp.172-175.

[6] N. Kuster, and Q. Balzano, "Energy absorption mechanism by biological bodies in the near field of dipole antennas above 300MHz", IEEE Transaction on Vehicular Technology, vol. 41, no. 1, Feb. 1992, pp. 17-23.

[7] Robert J. Renka, "Multivariate Interpolation Of Large Sets Of Scattered Data", University of North Texas ACM Transactions on Mathematical Software, vol. 14, no. 2, June 1988 , pp. 139-148.

[8] N. Kuster, R. Kastle, T. Schmid, Dosimetric evaluation of mobile communications equipment with known precision, IEEE Transaction on Communications, vol. E80-B, no. 5, May 1997, pp. 645-652.

[9] Std. C95.3-1991, "IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave, New York: IEEE, Aug. 1992.

[10] CENELEC CLC/SC111B, European Prestandard (prENV 50166-2), Human Exposure to Electromagnetic Fields High-frequency: 10KHz-300GHz, Jan. 1995.

[11] IEEE Std 1528™-2013 - IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head From Wireless Communications Devices: Measurement Techniques

Appendix A - System Performance Check

Test Laboratory: A Test Lab Techno Corp.
Date/Time: 2016/12/22 PM 06:04:44
System Performance Check at 835MHz_20161222_Body
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d082

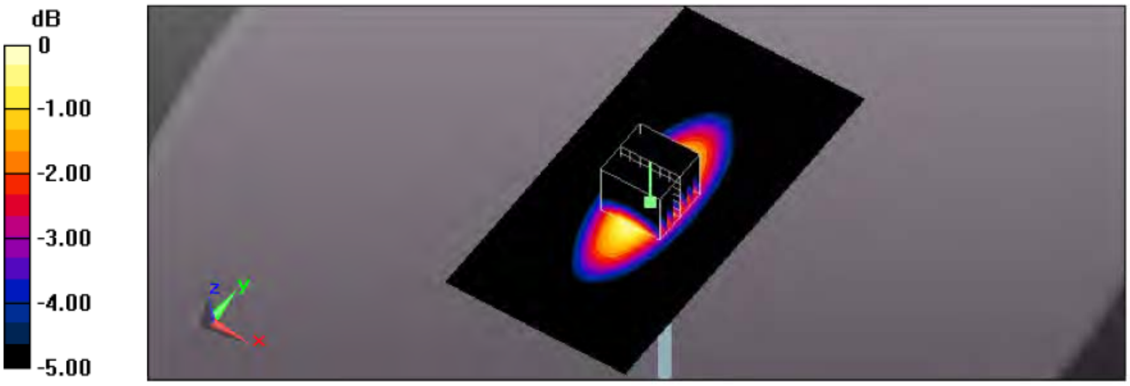
Communication System: UID 0, CW (0); Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 0.971 S/m; ε_r = 54.857; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY5.2 Configuration:

- Area Scan setting - Find Secondary Maximum Within:2.0dB and with a peak SAR value greater than 0.5 W/Kg
- Probe: EX3DV4 - SN3977; ConvF(9.82, 9.82, 9.82); Calibrated: 2016/3/9;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn779; Calibrated: 2016/3/2
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1036
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

System Performance Check at 835MHz/Area Scan (61x121x1):
Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 3.14 W/kg

System Performance Check at 835MHz/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.57 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 3.66 W/kg
SAR(1 g) = 2.48 W/kg; SAR(10 g) = 1.64 W/kg
Maximum value of SAR (measured) = 3.12 W/kg



0 dB = 3.12 W/kg = 4.94 dBW/kg