10.5Body-Worn Simultaneous Transmission Analysis

Table 10.6 Simultaneous Transmission Scenario with 2.4 GHz W-LAN (Body-Worn at 10 mm)

Configuration	Mode	2G/3G SAR (W/kg)	2.4G W-LAN (802.11b) SAR (W/kg)	ΣSAR (W/kg)
Rear Side	PCS1900	0.181	0.544	0.725

Table 10.7 Simultaneous Transmission Scenario with 5.2 GHz W-LAN (Body-Worn at 10 mm)

Configuration	Mode	2G/3G SAR (W/kg)	5.2G W-LAN (802.11b) SAR (W/kg)	ΣSAR (W/kg)
Rear Side	PCS1900	0.181	0.186	0.367

Table 10.8 Simultaneous Transmission Scenario with 5.3 GHz W-LAN (Body-Worn at 10 mm)

Configuration	Mode	2G/3G SAR (W/kg)	5.3G W-LAN (802.11b) SAR (W/kg)	ΣSAR (W/kg)
Rear Side	PCS1900	0.181	0.327	0.508

Table 10.9 Simultaneous Transmission Scenario with 5.6 GHz W-LAN (Body-Worn at 10 mm)

Configuration	Mode	2G/3G SAR (W/kg)	5.6G W-LAN (802.11b) SAR (W/kg)	ΣSAR (W/kg)
Rear Side	PCS1900	0.181	0.272	0.453

Table 10.10 Simultaneous Transmission Scenario with Bluetooth (Body-Worn at 10 mm)

Configuration	Mode	2G/3G SAR (W/kg)	Bluetooth SAR (W/kg)	ΣSAR (W/kg)
Rear Side	PCS1900	0.181	0.097	0.278

Note: Bluetooth SAR was not required to be measured per FCC KDB 447498. Estimated SAR resultswere used in the above table to determine simultaneous transmission SAR test exclusion.

10.6Hotspot SAR Simultaneous Transmission Analysis

Per FCC KDB Publication 941225 D06v01, the device edges with antennas more than 2.5 cm from edge are not required to be evaluated for SAR ("-").

Table 10.11 Simultaneous Transmission Scenario (Hotspot at 10 mm)

Simult TX	Configuration	PCS1900 SAR (W/kg)	2.4G W-LAN (802.11b) SAR (W/kg)	ΣSAR (W/kg)
Body SAR	Top	-	0.180	0.180
	Bottom	0.123	-	0.123
	Front	0.266	0.166	0.432
	Rear	0.237	0.544	0.781
	Right	0.256	-	0.256
	Left	0.042	0.387	0.429

Simultaneous Transmission Conclusion

The above numerical summed SAR results for all the worst-case simultaneous transmission conditions were below the SAR limit. Therefore, the above analysis is sufficient to determine that simultaneous transmission cases will not exceed the SAR limit and therefore no measured volumetric simultaneous SAR summation is required per FCC KDB Publication 447498 D01_v05.

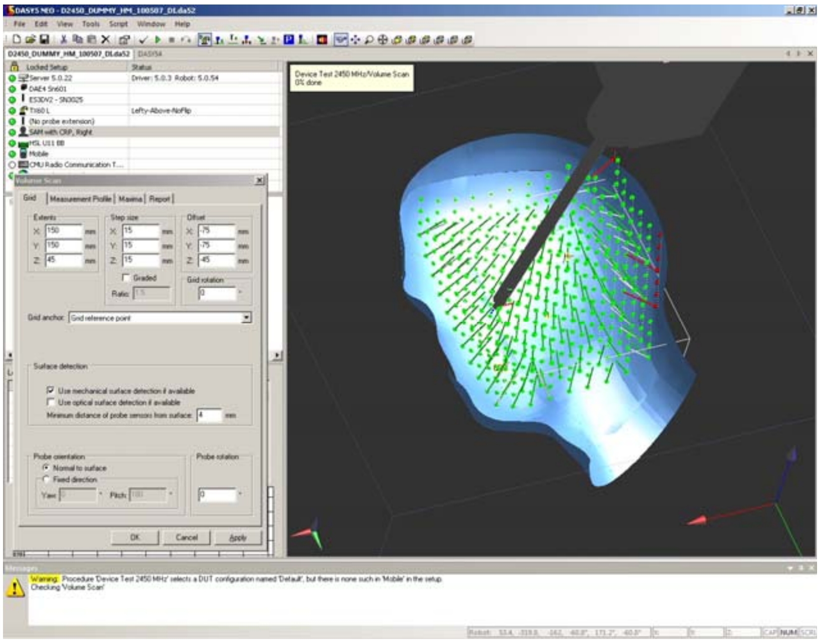
10.7 Description of Volume Scan

In order to determine the EM field distribution in a three-dimensional spatial extension, volume scans are required. In free space, these assessments can help to gain more information on the performance of the DUT (e.g., to determine the degree of symmetry of the filed radiated from a horn antenna).

For dosimetric application, it is necessary to assess the peak spatial SAR value averaged over a volume. For this purpose, fine resolution volume scans need to be performed at the peak SAR location(s) determined during the Area Scan. In DASY4 software these scans are called Zoom Scan jobs. The default Zoom Scan measures 7 x 7 x 7 points with a step size of 5 mm. Faster evaluations can be achieved with a reduced number of measurement points. For example, a Zoom Scan with a grid step size in x- and y-directions of 7.5 mm (5 x 5 x 7cube configuration) reduces the measurement time to almost half with only 1-2% difference in SAR reading compared to the fine-resolution 7 x 7 x 7 scan.

For SAR evaluations with larger spatial extensions (e.g., within a complete phantom head section)a Volume Scan job should be used.

The Volume Scan job is compatible with DASY4 SAR, PRO and NEO system levels. Volume Scans are used to assess peak SAR and averaged SAR measurement in largely extended 3-dimensionalvolumes within any phantom. This measurement does not need any previous area scan. The grid can be anchored to a user specific point or to the current probe location With an Administrator access mode, the grid can be optionally graded in Z-direction, whereby the smallest grid step and the grading ratio can be defined. Chosen grading ratio is automatically adjusted so that the desired extent in Z-direction is fully covered.



Under the Report page, the quantity to be evaluated for an instant report may be selected. This quantity can be: field magnitude, SAR, interpolated SAR or averaged SAR.

10.8 SAR Assessment

Alternative1

- Evaluation Method
  - Maximum summed SAR Value
- Description
  - Easiest and most conservative method to determine the upper limit of multi-band SAR
  - Example
    - F1's SAR Value is 0.9
    - F2's SAR Value is 1.3
    - Multi-band SAR Value is 0.9 + 1.3 = 2.2

Alternative2

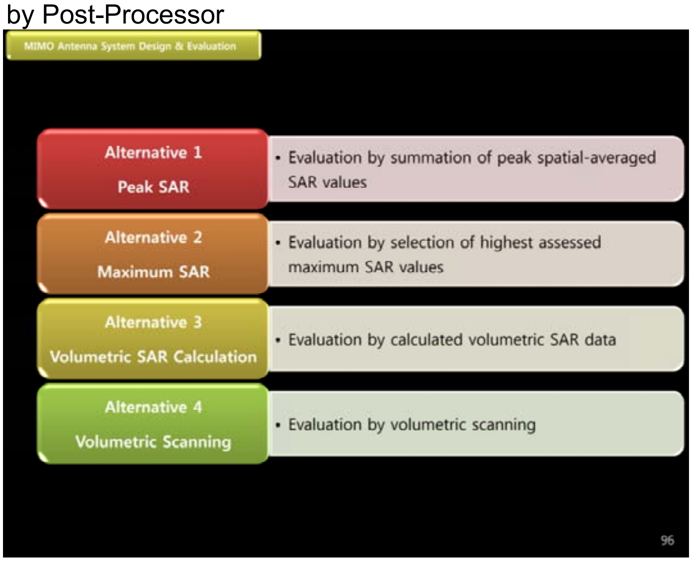
- Evaluation Method
  - Selection of highest assessed maximum SAR Value
- Description
  - Accurate estimate of the multi-band SAR
  - Example
    - F1's SAR Value is 0.9
    - F2's SAR Value is 1.3
    - Multi-band SAR Value is 1.3

Alternative3

- Evaluation Method
  - Combining existing Area and Zoom Scan results by Post-Processor
- Description
  - Rapid way of obtaining the multi-band SAR. It is always applicable.
  - Example
    - F1's SAR Value is 0.9
    - F2's SAR Value is 1.3
    - Combining results by Post-Processor

Alternative4

- Evaluation Method
  - Combining existing Area and Zoom Scan results by Post-Processor
- Description
  - The most accurate way of assessing the multi-band SAR and always applicable.
  - Example
    - F1's SAR Value is 0.9
    - F2's SAR Value is 1.3
    - Combining results by Post-Processor



11. FCC MEASUREMENT PROCEDURES

Power measurements were performed using a base station simulator under digital average power.

11.1 Measured and Reported SAR

Per FCC KDB Publication 447498 D01v05, When SAR is not measured at the maximum power level allowed for production units; the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance. For simultaneous transmission, the measured aggregate SAR must be scaled according to the sum of the differences between the maximum tune-up tolerance and actual power used to test each transmitter. When SAR is measured at or scaled to the maximum tune-up tolerance limit, the results are referred to as *reported* AR. The highest *reported* SAR results are identified on the grant of equipment authorization according to procedures in KDB 690783 D01v01r02.

11.2 Procedures Used to Establish RF Signal for SAR

The following procedures are according to FCC KDB Publication 941225 D01 "SAR Measurement Procedures for 3G Devices" v02, October 2007.

The device was placed into a simulated call using a base station simulator in a RF shielded chamber. Establishing connections in this manner ensure a consistent means for testing SAR and are recommended for evaluating SAR. Devices under test were evaluated prior to testing, with a fully charged battery and were configured to operate at maximum output power. In order to verify that the device was tested throughout the SAR test at maximum output power, the SAR measurement system measures a "point SAR" at an arbitrary reference point at the start and end of the 1 gram SAR evaluation, to assess for any power drifts during the evaluation. If the power drift deviated by more than 5%, the SAR test and drift measurements were repeated.

11.2.1 SAR Testing with 802.11 Transmitters

SAR Testing with IEEE 802.11 a/b/g Transmitters

Per KDB publication 248227, normal network operating configurations are not suitable for measuring the SAR of 802.11 a/b/g/n transmitters. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure the results are consistent and reliable. See KDB Publication 248227 for more details.

General Device Setup

Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters. The test frequencies should correspond to actual channel frequencies defined for domestic use. SAR for devices with switched diversity should be measured with only one antenna transmitting at a time during each SAR measurement, according to a fixed modulation and data rate. The same data pattern should be sued for all measurements.

Frequency Channel Configurations

For 2.4 GHz, the highest average RF output power channel between the low, mid and high channel at the lowest data rate was selected for SAR evaluation in 802.11b mode. 802.11g/n modes and higher data rates for 802.11b were additionally evaluated for SAR if the output power of the respective mode was 0.25 dB or higher than the powers of the SAR configurations tested in the 802.11b mode.

For 5 GHz, the highest average RF output power channel across the default test cannels at the lowest data rate was selected for SAR evaluation in 802.11a. When the adjacent channels are higher in power then the default channels, these "required channels" were considered instead of the default channels for SAR testing. 802.11n modes and higher data rates for 802.11a/n were evaluated only if the respective mode was 0.25 dB or higher than the 802.11a mode.

If the maximum extrapolated peak SAR of the zoom scan for the highest output channel was less than 1.6 W/kg or if the 1g averaged SAR was less than 0.8 W/kg, SAR testing was not required for the other test channels in the band.

12. RF CONDUCTED POWERS

GSM Conducted Powers for 202K (Burst-Averaged)

Band	Channel	Test Result(dBm)								
		Voice	GPRS/EDGE (GMSK) Data				EDGE(8-PSK) Data			
		GSM CS 1 Slot	GPRS 1 TX Slot	GPRS 2 TX Slot	GPRS 3 TX Slot	GPRS 4 TX Slot	EDGE 1TX Slot	EDGE 2TX Slot	EDGE 3TX Slot	EDGE 4TX Slot
PCS 1900	512	30.0	30.0	26.9	25.1	23.9	N/A	N/A	N/A	N/A
	661	30.1	30.1	27.0	25.2	23.9	N/A	N/A	N/A	N/A
	810	30.1	30.0	27.0	25.2	23.8	N/A	N/A	N/A	N/A

Table 12.1 The power was measured by E5515C

GSM Conducted Powers for 202K (Calculated Frame-Averaged)

Band	Channel	Test Result(dBm)								
		Voice	GPRS/EDGE (GMSK) Data				EDGE(8-PSK) Data			
		GSM CS 1 Slot	GPRS 1 TX Slot	GPRS 2 TX Slot	GPRS 3 TX Slot	GPRS 4 TX Slot	EDGE 1TX Slot	EDGE 2TX Slot	EDGE 3TX Slot	EDGE 4TX Slot
PCS 1900	512	20.97	20.97	20.88	20.84	20.89	N/A	N/A	N/A	N/A
	661	21.07	21.07	20.98	20.94	20.89	N/A	N/A	N/A	N/A
	810	21.07	20.97	20.98	20.94	20.79	N/A	N/A	N/A	N/A

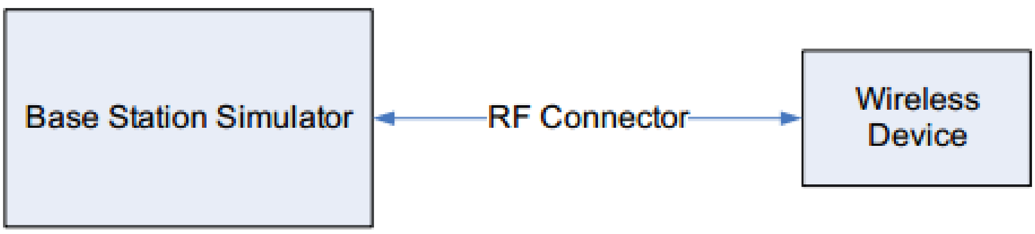
Note:

- Both burst-averaged and calculated frame-averaged powers are included. Frame-averaged power was calculated from the measured burst-averaged power by converting the slot powers into linear units and calculating the energy over 8 timeslots.
- The bolded GPRS modes were selected according to the highest frame-averaged output power table according to KDB 941225 D03v01.
- GPRS (GMSK) output powers were measured with CS1.

This device does not support evolved EDGE (eEDGE).

GSM Class: B
GPRS Multislot class: 12 (max 4 TX Uplink slots)
EDGE Multislot class: Rx Only
DTM Multislot Class: N/A

GSM Power Measurement Setup



WLAN Conducted Powers for 202K

Band	Channel	Conducted Power (dBm)			
		Data Rate (Mbps)			
		1	2	5.5	11
802.11b	1	16.19	16.16	16.17	16.04
	6	16.46	16.44	16.44	16.42
	11	**16.57**	16.27	16.38	16.25

Table 12.2 IEEE 802.11b Average RF Power

Band	Channel	Conducted Power (dBm)							
		Data Rate (Mbps)							
		6	9	12	18	24	36	48	54
802.11g	1	11.54	11.3	11.26	11.27	11.15	11.12	10.02	9.98
	6	11.60	11.56	11.56	11.53	11.47	11.34	9.98	9.97
	11	11.64	11.62	11.62	11.61	11.55	11.52	10.47	10.46

Table 12.3 IEEE 802.11g Average RF Power

Band	Channel	Conducted Power (dBm)							
		Data Rate (Mbps)							
		6.5	13	19.5	26	39	52	58.5	65
802.11n (HT-20)	1	11.66	11.63	11.59	11.49	11.12	10.04	10.02	10.14
	6	11.61	11.45	11.47	11.35	11.24	10.09	10.08	10.08
	11	11.73	11.70	11.68	11.63	11.60	10.56	10.55	10.54

Table 12.4 IEEE 802.11n Average RF Power

Mode	Freq [MHz]	Channel	conducted Power [dBm]							
			Data Rate [Mbps]							
			6	9	12	18	24	36	48	54
802.11a	5180	36	**13.03**	12.95	12.81	12.78	12.68	12.50	12.48	12.45
	5200	40	13.03	12.63	12.45	12.43	12.40	12.37	12.32	12.30
	5240	48	12.97	12.48	12.48	12.46	12.40	12.35	11.95	11.87
	5260	52	15.08	14.84	14.05	13.85	13.78	13.14	12.56	12.09
	5280	56	15.09	14.89	14.05	13.79	13.56	13.41	12.51	12.17
	5320	64	**15.41**	15.01	14.51	14.49	13.89	12.99	12.29	12.23
	5500	100	**16.21**	15.95	15.12	14.89	14.06	13.95	13.10	12.94
	5580	116	15.56	15.14	14.92	14.15	13.95	13.14	12.60	12.58
	5700	140	15.76	15.11	14.23	14.22	13.13	13.13	12.95	12.97

Table 12.5 IEEE 802.11a Average RF Power

Mode	Freq [MHz]	Channel	conducted Power [dBm] 20M Bandwidth							
			Data Rate [Mbps]							
			6.5	13	19.5	26	39	52	58.5	65
802.11n	5180	36	13.01	12.49	12.47	12.44	12.41	12.37	12.36	12.01
	5200	40	12.84	12.35	12.34	12.32	12.30	12.27	12.16	11.98
	5240	48	12.86	12.22	12.21	12.19	12.18	12.16	12.14	11.64
	5260	52	14.85	13.95	13.39	12.21	12.20	11.92	11.95	11.57
	5280	56	15.00	14.05	13.48	12.29	12.27	12.24	12.21	11.94
	5320	64	15.32	14.59	13.95	13.01	12.18	12.15	12.12	11.87
	5500	100	16.11	15.98	15.84	15.01	14.51	13.89	12.98	12.54
	5580	116	15.22	14.89	14.74	14.51	13.87	13.01	12.15	11.98
	5700	140	15.59	14.95	14.61	14.35	13.51	12.89	12.05	11.59

Table 12.6 IEEE 802.11n Average RF Power – 20 MHz Bandwidth

Mode	Freq [MHz]	Channel	conducted Power [dBm] 40MHz Bandwidth							
			Data Rate [Mbps]							
			13.5/15	27/30	40.5/45	54/60	81/90	108/120	121.5 /135	135/150
802.11n	5190	38	12.77	12.51	11.98	11.74	11.42	11.05	10.59	10.02
	5230	46	12.56	12.15	11.89	11.15	10.95	10.84	10.36	9.89
	5270	54	12.60	12.26	11.85	11.17	10.79	10.54	10.12	9.59
	5310	62	12.53	11.98	11.51	11.05	10.94	10.44	9.94	9.36
	5510	102	13.50	12.85	12.53	12.12	12.05	11.85	10.99	10.05
	5550	110	13.09	12.84	12.46	12.07	11.89	11.46	11.14	10.49
	5670	134	13.37	12.87	12.61	12.14	11.95	11.53	11.23	10.69

Table 12.7 IEEE 802.11n Average RF Power – 40 MHz Bandwidth

Bluetooth Conducted Powers for 202K

Channel	Frequency	Output Power(1Mbps)		Output power (2Mbps)		Output power (3Mbps)		Output power (LE)	
	(MHz)	(dBm)	(mW)	(dBm)	(mW)	(dBm)	(mW)	(dBm)	(mW)
Low	**2402**	**6.51**	**4.477**	5.05	3.199	5.08	3.221	-2.17	0.607
Mid	2441	5.47	3.524	4.03	2.529	4.06	2.547	-3.04	0.497
High	2480	6.07	4.046	4.63	2.904	4.64	2.911	-2.14	0.611

Table 12.8 Bluetooth Average RF Power

W-LAN Notes

Justification for reduced test configurations for WIFI channels per KDB Publication 248227 D01v01r02 and October 2012 FCC/TCB Meeting Notes:

- For 2.4 GHz, highest average RF output power channel for the lowest data rate for IEEE 802.11b were selected for SAR evaluation. Other IEEE 802.11 modes (including 802.11g/n) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11b mode.
- For 5 GHz, highest average RF output power channel for the lowest data rate for IEEE 802.11a were selected for SAR evaluation. Other IEEE 802.11 modes (including 802.11n 20 MHz and 40 MHz) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11a mode.
- Since the maximum extrapolated peak SAR of the zoom scan for the maximum output channel is <1.6 W/kg and the reported 1g averaged SAR is <0.8 W/kg, SAR testing on other channels is not required. Otherwise, the other default (or corresponding required) test channels were additionally tested using the lowest data rate.
- The underlined data rate and channel above were tested for SAR.
- This device does not support 5.8 GHz W-LAN.

W-LAN and Bluetooth Power Measurement Setup

13. SAR TEST RESULTS

13.1 Head SAR Results

Table 13.1 PCS1900 Head SAR

FREQUENCY		Mode/ Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Phantom Position	Device Serial Number	Duty Cycle	1g SAR (W/kg)	Scaling Factor	1g Scaled SAR (W/kg)
MHz	Ch											
1880.0	661	PCS1900	PCS	30.1	30.1	-0.005	Left Touch	FCC #1	1:8.3	0.271	1.000	0.271
1880.0	661	PCS1900	PCS	30.1	30.1	-0.079	Right Touch	FCC #1	1:8.3	0.467	1.000	**0.467**
1880.0	661	PCS1900	PCS	30.1	30.1	0.044	Left Tilt	FCC #1	1:8.3	0.154	1.000	0.154
1880.0	661	PCS1900	PCS	30.1	30.1	-0.113	Right Tilt	FCC #1	1:8.3	0.174	1.000	0.174
ANSI / IEEE C95.1-2005– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure								**Head 1.6 W/kg (mW/g)** averaged over 1 gram				

Table 13.2 DTS Head SAR

FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Phantom Position	Device Serial Number	Data Rate [Mbps]	Duty Cycle	1g SAR (W/kg)	Scaling Factor	1g Scaled SAR (W/kg)
MHz	Ch												
2462	11	802.11b	DSSS	16.7	16.57	-0.094	Left Touch	FCC #1	1	1:1	0.407	1.030	0.419
2462	11	802.11b	DSSS	16.7	16.57	-0.089	Right Touch	FCC #1	1	1:1	0.456	1.030	**0.470**
2462	11	802.11b	DSSS	16.7	16.57	-0.101	Left Tilt	FCC #1	1	1:1	0.344	1.030	0.354
2462	11	802.11b	DSSS	16.7	16.57	-0.113	Right Tilt	FCC #1	1	1:1	0.408	1.030	0.420
ANSI / IEEE C95.1-2005– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure								**Head 1.6 W/kg (mW/g)** averaged over 1 gram					

Table 13.3 NII Head SAR

FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Phantom Position	Device Serial Number	Data Rate [Mbps]	Duty Cycle	1g SAR (W/kg)	Scaling Factor	1g Scaled SAR (W/kg)
MHz	Ch												
5180	36	802.11a	OFDM	16.7	13.03	0.000	Left Touch	FCC #1	6	1:1	0.083	2.328	0.193
5180	36	802.11a	OFDM	16.7	13.03	0.045	Right Touch	FCC #1	6	1:1	0.144	2.328	**0.335**
5180	36	802.11a	OFDM	16.7	13.03	0.002	Left Tilt	FCC #1	6	1:1	0.033	2.328	0.077
5180	36	802.11a	OFDM	16.7	13.03	0.160	Right Tilt	FCC #1	6	1:1	0.043	2.328	0.100
5320	64	802.11a	OFDM	16.7	15.41	-0.039	Left Touch	FCC #1	6	1:1	0.206	1.346	0.277
5320	64	802.11a	OFDM	16.7	15.41	0.078	Right Touch	FCC #1	6	1:1	0.327	1.346	**0.440**
5320	64	802.11a	OFDM	16.7	15.41	-0.042	Left Tilt	FCC #1	6	1:1	0.063	1.346	0.085
5320	64	802.11a	OFDM	16.7	15.41	-0.116	Right Tilt	FCC #1	6	1:1	0.088	1.346	0.118
5500	100	802.11a	OFDM	16.7	16.21	0.016	Left Touch	FCC #1	6	1:1	0.219	1.119	0.245
5500	100	802.11a	OFDM	16.7	16.21	0.069	Right Touch	FCC #1	6	1:1	0.355	1.119	**0.397**
5500	100	802.11a	OFDM	16.7	16.21	0.013	Left Tilt	FCC #1	6	1:1	0.056	1.119	0.063
5500	100	802.11a	OFDM	16.7	16.21	0.162	Right Tilt	FCC #1	6	1:1	0.104	1.119	0.116
ANSI / IEEE C95.1-2005– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure								**Head 1.6 W/kg (mW/g)** averaged over 1 gram					

13.2 Body-Worn SAR Results

Table 13.4 PCS1900 Body-Worn SAR

FREQUENCY		Mode/ Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Spacing [Side]	Device Serial Number	# of Time Slots	Duty Cycle	1g SAR (W/kg)	Scaling Factor	1g Scaled SAR (W/kg)
MHz	Ch												
1880.0	661	PCS1900	PCS	30.1	30.1	0.096	10 mm [Rear]	FCC #1	1	1:8.3	0.181	1.000	0.181
ANSI / IEEE C95.1-2005– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure								**Body 1.6 W/kg (mW/g)** averaged over 1 gram					

Table 13.5 DTS Body-Worn SAR

FREQUENCY		Mode/ Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Spacing [Side]	Device Serial Number	Data Rate [Mbps]	Duty Cycle	1g SAR (W/kg)	Scaling Factor	1g Scaled SAR (W/kg)
MHz	Ch												
2462	11	802.11b	DSSS	16.7	16.57	0.032	10 mm [Rear]	FCC #1	1	1:1	0.528	1.030	**0.544**
ANSI / IEEE C95.1-2005– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure								**Body 1.6 W/kg (mW/g)** averaged over 1 gram					

Table 13.6NII Body-Worn SAR

FREQUENCY		Mode/ Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Spacing [Side]	Device Serial Number	Data Rate [Mbps]	Duty Cycle	1g SAR (W/kg)	Scaling Factor	1g Scaled SAR (W/kg)
MHz	Ch												
5180	36	802.11a	OFDM	16.7	13.03	-0.075	10 mm [Rear]	FCC #1	6	1:1	0.080	2.328	**0.186**
5320	64	802.11a	OFDM	16.7	15.41	0.008	10 mm [Rear]	FCC #1	6	1:1	0.243	1.346	**0.327**
5500	100	802.11a	OFDM	16.7	16.21	0.083	10 mm [Rear]	FCC #1	6	1:1	0.243	1.119	**0.272**
ANSI / IEEE C95.1-2005– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure								**Body 1.6 W/kg (mW/g)** averaged over 1 gram					

13.3 Wireless router SAR Results

Table 13.7 PCS1900 GPRS Hotspot SAR

FREQUENCY		Mode/ Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Spacing [Side]	Device Serial Number	# of Time Slots	Duty Cycle	1g SAR (W/kg)	Scaling Factor	1g Scaled SAR (W/kg)
MHz	Ch												
1880.0	661	PCS1900	GPRS	24.0	23.9	-0.024	10 mm [Bottom]	FCC #1	4	1:2.075	0.120	1.023	0.123
1880.0	661	PCS1900	GPRS	30.1	30.1	0.062	10 mm [Front]	FCC #1	1	1:8.3	0.210	1.000	0.210
1880.0	661	PCS1900	GPRS	27.0	27.0	-0.055	10 mm [Front]	FCC #1	2	1:4.15	0.221	1.000	0.221
1880.0	661	PCS1900	GPRS	25.2	25.2	0.009	10 mm [Front]	FCC #1	3	1:2.77	0.235	1.000	0.235
1880.0	661	PCS1900	GPRS	24.0	23.9	-0.029	10 mm [Front]	FCC #1	4	1:2.075	0.260	1.023	**0.266**
1880.0	661	PCS1900	GPRS	24.0	23.9	0.146	10 mm [Rear]	FCC #1	4	1:2.075	0.232	1.023	0.237
1880.0	661	PCS1900	GPRS	24.0	23.9	-0.073	10 mm [Right]	FCC #1	4	1:2.075	0.250	1.023	0.256
1880.0	661	PCS1900	GPRS	24.0	23.9	0.195	10 mm [Left]	FCC #1	4	1:2.075	0.041	1.023	0.042
ANSI / IEEE C95.1-2005– SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure/General Population Exposure**								**Body** **1.6 W/kg (mW/g)** averaged over 1 gram					

Table 13.8 W-LAN Hotspot SAR

FREQUENCY		Mode/ Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Spacing [Side]	Device Serial Number	Data Rate [Mbps]	Duty Cycle	1g SAR (W/kg)	Scaling Factor	1g Scaled SAR (W/kg)
MHz	Ch												
2462	11	802.11b	DSSS	16.7	16.57	0.119	10 mm [Top]	FCC #1	1	1:1	0.175	1.030	0.180
2462	11	802.11b	DSSS	16.7	16.57	0.081	10 mm [Front]	FCC #1	1	1:1	0.161	1.030	0.166
2462	11	802.11b	DSSS	16.7	16.57	0.032	10 mm [Rear]	FCC #1	1	1:1	0.528	1.030	**0.544**
2462	11	802.11b	DSSS	16.7	16.57	-0.027	10 mm [Left]	FCC #1	1	1:1	0.376	1.030	0.387
ANSI / IEEE C95.1-2005– SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure/General Population Exposure**								**Body** **1.6 W/kg (mW/g)** averaged over 1 gram					

13.4 SAR Test Notes

General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in IEEE 1528-2003, FCC/OET Bulletin 65, Supplement C [June 2001] and FCC KDB Publication447498 D01v05.
2. Batteries are fully charged at the beginning of the SAR measurements. A standard battery was used for all SAR measurements.
3. Liquid tissue depth was at least 15.0 cm for all frequencies.
4. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units
5. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCCKDB Publication 447498 D01v05.
6. Device was tested using a fixed spacing for body-worn accessory testing. A separation distance of 10 mm was considered because the manufacturer has determined that there will be body-worn accessories available in the marketplace for users to support this separation distance.
7. Per FCC KDB Publication 648474 D04v01, SAR was evaluated without a headset connected to the device. Since the standalone reported SAR was ≤ 1.2 W/kg, no additional SAR evaluations using a headset cable were required.
8. During SAR Testing for the Wireless Router conditions per FCC KDB Publication 941225 D06v01, the actual Portable Hotspot operation (with actual simultaneous transmission of a transmitter with WIFI) was not activated (See Section 6.7 for more details).
9. Per FCC KDB 865664 D01 v01, variability SAR tests were performed when the measured SAR results for a frequency band were greater than 0.8 W/kg. Repeated SAR measurements are highlighted in the tables above for clarity. Please see Section 14 for variability analysis.

GSM Test Notes:

1. Body-Worn accessory testing is typically associated with voice operations. Therefore, GSM voice was evaluated for body-worn SAR.
2. Per FCC KDB Publication 447498 D01v05, since the reported (scaled) SAR measured at the middle channel for each test configuration is ≤0.8 W/kg then testing at the other channels is not performed for such test configuration(s). Since the maximum output power variation across the required test channels is < ½ dB, the middle channel is tested.

WLAN Notes:

1. Justification for reduced test configurations for WIFI channels per KDB Publication 248227D01v01r02 and October 2012 FCC/TCB Meeting Notes for 2.4 GHz WIFI: Highest average RF output power channel for the lowest data rate was selected for SAR evaluation in 802.11b. Other IEEE 802.11 modes (including 802.11g/n) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11b mode.
2. Justification for reduced test configurations for WIFI channels per KDB Publication 248227D01v01r02 and October 2012 FCC/TCB Meeting Notes for 5 GHz WIFI: Highest average RF output power channel for the lowest data rate was selected for SAR evaluation in 802.11a. Other IEEE 802.11 modes (including 802.11n 20 MHz and 40 MHz bandwidths and 802.11ac) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11a mode.
3. When Hotspot is enabled, all 5 GHz bands are disabled. Therefore no 5 GHz WIFI Wireless Router SAR Data was required.
4. WIFI transmission was verified using an uncalibrated spectrum analyzer.
5. Because the maximum extrapolated peak SAR of the zoom scan for the maximum output channel was <1.6 W/kg and the reported 1g averaged SAR is <0.8 W/kg, SAR testing on other default channels was not required.

14. SAR MEASUREMENT VARIABILITY

Measurement Variability

Per FCC KDB Publication 865664 D01v01, SAR measurement variability was assessed for each frequency band, which was determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media were required for SAR measurements in a frequency band, the variability measurement procedures were applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. These additional measurements were repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The testdevice was returned to ambient conditions (normal room temperature) with the battery fully charged before it was re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

SAR Measurement Variability was assessed using the following procedures for each frequency band:

1. When the original highest measured SAR is ≥ 0.80 W/kg, the measurement was repeated once.
2. A second repeated measurement was performed only if the ratio of largest to smallest SAR for the original and first repeated measurements was > 1.20 or when the original or repeated measurement was ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
3. A third repeated measurement was performed only if the original, first or second repeated measurement was ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.
4. Repeated measurements are not required when the original highest measured SAR is < 0.80 W/kg

Measurement Uncertainty

The measured SAR was <1.5 W/kg for all frequency bands. Therefore, per KDB Publication 865664D01v01, the standard measurement uncertainty analysis per IEEE 1528-2003 was not required.

15.CONCLUSION

Measurement Conclusion

The SAR measurement indicates that the EUT complies with the RF radiation exposure limits of the FCC. These measurements are taken to simulate the RF effects exposure under the worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The tested device complies with the requirements in respect to all parameters subject to the test. The test results and statements relate only to the item(s) tested.

Please note that the absorption and distribution of electromagnetic energy in the body are very complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role impossible biological effect are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease).

Because innumerable factors may interact to determine the specific biological outcome of an exposure to electromagnetic fields, any protection guide shall consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables.

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Attachment 1. – Probe Calibration Data

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Digital EMC (Dymstec)**

Certificate No: **EX3-3916_Apr13**

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3916
Calibration procedure(s)	QA CAL-01.v8, QA CAL-12.v7, QA CAL-14.v3, QA CAL-23.v4, QA CAL-25.v4 Calibration procedure for dosimetric E-field probes
Calibration date:	April 29, 2013

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-13 (No. 217-01735)	Apr-14
Reference 30 dB Attenuator	SN: S5129 (30b)	04-Apr-13 (No. 217-01738)	Apr-14
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	31-Jan-13 (No. DAE4-660_Jan13)	Jan-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-15
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: May 1, 2013

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: EX3-3916_Apr13 Page 1 of 11

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z: A, B, C, D* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe EX3DV4

SN:3916

Manufactured: December 18, 2012
Calibrated: April 29, 2013

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)