

Appendix 5. Simulated Tissues

The body mixture consists of water, Polysorbate (Tween 20) and salt. Visual inspection is made to ensure air bubbles are not trapped during the mixing process. The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the tissue.

Ingredient (% by weight)	Frequency 750/835/850/900 MHz
	Body
De-Ionized Water	71.30
Polysorbate 20	28.00
Salt	0.70

Ingredient (% by weight)	Frequency 1800/1900 MHz
	Body
De-Ionized Water	71.50
Polysorbate 20	28.00
Salt	0.50

Ingredient (% by weight)	Frequency 2450/2600 MHz
	Body
De-Ionized Water	71.70
Polysorbate 20	28.00
Salt	0.30

Stimulating Liquid for 3700 MHz to 5800 MHz are supplied and manufactured by SPEAG

Ingredient (% by weight)	Frequency
	3700 - 5800 MHz Body
De-Ionized Water	~78.00
Mineral Oil	~11.00
Emulsifiers	~9.00
Additives and Salt	~2.00

Appendix 6. System Check and Dielectric Parameters

Dielectric Property Measurements: The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within ± 2°C of the temperature when the tissue parameters are characterized.

The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3-4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.

Tissue dielectric parameters were measured at the low, middle and high frequency of each operating frequency range of the test device.

System Performance Check: Prior to the assessment, the system was verified in the flat region of the phantom, 750 MHz, 900 MHz, 1800 MHz, 1900 MHz, 2450 MHz, 2600 MHz and 5.0 GHz dipoles were used. A forward power of 250 mW was applied to the 750 MHz, 900 MHz, 1800 MHz, 1900 MHz, 2450 MHz, 2600 MHz dipoles and 100 mW was applied to 5.0 GHz dipole and the system was verified to a tolerance of ±5% for the 900MHz, 1800MHz, 1900MHz, 2450 MHz, 2600 MHz and 5.0 GHz dipoles.

The applicable verification normalised to 1 Watt.

Site 57

System Check 750 Body

Date: 24/07/2014

Validation Dipole and Serial Number: D750V3 SN: 1011

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	750	22.5	21.8	ϵ_r	55.55	54.64	-1.64	5.00
				σ	0.96	0.94	-2.52	5.00
				1g SAR	8.84	8.64	-2.26	5.00
				10g SAR	5.84	5.88	0.68	5.00

Channel Number	Band	Frequency (MHz)	Parameters	
			ϵ_r	σ
23180	LTE Band 13	777.0	ϵ_r	54.49
			σ	0.95
23230		782.0	ϵ_r	54.50
			σ	0.96
23279		786.9	ϵ_r	54.44
			σ	0.96
23780	LTE Band 17	709.0	ϵ_r	54.90
			σ	0.91
23790		710.0	ϵ_r	54.90
			σ	0.91
23800		711.0	ϵ_r	54.80
			σ	0.91

Site 57 (Continued)

System Check 900 Body

Date: 17/07/2014

Validation Dipole and Serial Number: D900V2 SN: 035

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	900	24.0	21.5	ϵ_r	55.00	53.20	-3.27	5.00
				σ	1.05	1.03	-2.33	5.00
				1g SAR	10.40	10.16	-2.31	5.00
				10g SAR	6.73	6.80	1.04	5.00

Channel Number	Band	Frequency (MHz)	Parameters	
128	GSM850	824.2	ϵ_r	53.50
			σ	0.98
190		836.6	ϵ_r	53.50
			σ	0.98
251		848.8	ϵ_r	53.50
			σ	0.99

System Check 900 Body

Date: 21/07/2014

Validation Dipole and Serial Number: D900V2 SN: 035

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	900	23.0	22.8	ϵ_r	55.00	56.35	2.45	5.00
				σ	1.05	1.02	-2.95	5.00
				1g SAR	10.40	10.12	-2.69	5.00
				10g SAR	6.73	6.56	-2.53	5.00

Channel Number	Band	Frequency (MHz)	Parameters	
4132	WCDMA FDD 5	826.4	ϵ_r	56.60
			σ	0.98
4183		836.6	ϵ_r	56.60
			Σ	0.98
4233		846.6	ϵ_r	56.60
			σ	0.99
20450	LTE Band 5	829.0	ϵ_r	56.60
			σ	0.98
20525		836.5	ϵ_r	56.60
			σ	0.98
20600		844.0	ϵ_r	56.60
			σ	0.99
26965	LTE Band 26	841.5	ϵ_r	56.60
			σ	0.99

Site 57 (Continued)

System Check 900 Body

Date: 24/07/2014

Validation Dipole and Serial Number: D900V2 SN: 035

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	900	23.0	23.0	ϵ_r	55.00	54.00	-1.82	5.00
				σ	1.05	1.03	-1.90	5.00
				1g SAR	10.40	10.20	-1.92	5.00
				10g SAR	6.73	6.84	1.63	5.00

Channel Number	Band	Frequency (MHz)	Parameters	
20450	LTE Band 5	829.0	ϵ_r	54.22
			σ	0.99
20525		836.5	ϵ_r	54.20
			σ	0.99
20600		844.0	ϵ_r	1.00
			σ	54.15
384	CDMA BC0	836.52	ϵ_r	54.20
			σ	0.99
777		848.31	ϵ_r	54.70
			σ	0.98
1013		824.7	ϵ_r	54.24
			σ	0.98

System Check 900 Body

Date: 28/07/2014

Validation Dipole and Serial Number: D900V2 SN: 035

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	900	23.0	22.0	ϵ_r	55.00	53.44	-2.84	5.00
				σ	1.05	1.02	-2.76	5.00
				1g SAR	10.40	10.24	-1.54	5.00
				10g SAR	6.73	6.84	1.63	5.00

Channel Number	Band	Frequency (MHz)	Parameters	
4132	WCDMA FDD 5	826.4	ϵ_r	53.80
			σ	0.97
4183		836.6	ϵ_r	53.70
			σ	0.98
4233		846.6	ϵ_r	53.70
			σ	0.99
476	CDMA BC10	817.9	ϵ_r	53.80
			σ	0.97
580		820.5	ϵ_r	53.80
			σ	0.97
684		823.1	ϵ_r	53.80
			σ	0.97

Site 57 (Continued)

System Check 900 Body

Date: 31/07/2014

Validation Dipole and Serial Number: D900V2 SN: 035

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	900	23.0	21.2	ϵ_r	55.00	54.47	-0.96	5.00
				σ	1.05	1.01	-3.38	5.00
				1g SAR	10.40	10.16	-2.31	5.00
				10g SAR	6.73	6.80	1.04	5.00

Channel Number	Band	Frequency (MHz)	Parameters	
384	CDMA BC0	836.52	ϵ_r	54.80
			σ	0.97
777		848.31	ϵ_r	54.70
			σ	0.98
1013		824.7	ϵ_r	54.80
			σ	0.96

System Check 900 Body

Date: 04/08/2014

Validation Dipole and Serial Number: D900V2 SN: 035

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	900	23.0	23.0	ϵ_r	55.00	53.34	-3.02	5.00
				σ	1.05	1.02	-3.19	5.00
				1g SAR	10.40	10.16	-2.31	5.00
				10g SAR	6.73	6.76	0.45	5.00

Channel Number	Band	Frequency (MHz)	Parameters	
384	CDMA BC0	836.52	ϵ_r	53.61
			σ	0.98
777		848.31	ϵ_r	53.60
			σ	0.99
1013		824.7	ϵ_r	53.70
			σ	0.97
476	CDMA BC10	817.9	ϵ_r	53.70
			σ	0.97
580		820.5	ϵ_r	53.70
			σ	0.97
684		823.1	ϵ_r	53.70
			σ	0.97

Site 57 (Continued)

System Check 900 Body

Date: 06/08/2014

Validation Dipole and Serial Number: D900V2 SN: 035

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	900	23.0	23.0	ϵ_r	55.00	53.34	-3.02	5.00
				σ	1.05	1.02	-3.19	5.00
				1g SAR	10.40	10.12	-2.69	5.00
				10g SAR	6.73	6.72	-0.15	5.00

Channel Number	Band	Frequency (MHz)	Parameters	
384	CDMA BC0	836.52	ϵ_r	54.00
			σ	0.97
777		848.31	ϵ_r	53.90
			σ	0.98
1013		824.7	ϵ_r	54.00
			σ	0.97

System Check 1800 Body

Date: 28/07/2014

Validation Dipole and Serial Number: D1800V2 SN: 2d009

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	1800	23.0	23.0	ϵ_r	53.30	53.30	0.24	5.00
				σ	1.52	1.55	1.84	5.00
				1g SAR	36.50	37.92	3.89	5.00
				10g SAR	19.50	20.00	2.56	5.00

Channel Number	Band	Frequency (MHz)	Parameters	
20050	LTE Band 4	1720.0	ϵ_r	52.60
			σ	1.50
20175		1732.5	ϵ_r	52.60
			σ	1.51
20300		1745.0	ϵ_r	52.50
			σ	1.52
25	CDMA BC15	1711.25	ϵ_r	52.60
			σ	1.49
450		1732.5	ϵ_r	52.60
			σ	1.51
875		1753.75	ϵ_r	52.50
			σ	1.53

Site 57 (Continued)

System Check 2450 Body

Date: 04/09/2014

Validation Dipole and Serial Number: D2440V2 SN: 701

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	2450	24.0	23.5	ϵ_r	52.70	50.62	-3.95	5.00
				σ	1.95	2.04	4.77	5.00
				1g SAR	51.40	52.80	2.72	5.00
				10g SAR	23.90	24.32	1.76	5.00

Channel Number	Band	Frequency (MHz)	Parameters	
6	Wi-Fi 2.4 GHz	2437.0	ϵ_r	50.62
			σ	2.04
39	Bluetooth	2441.0	ϵ_r	50.60
			σ	2.03

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System Check 1800 Body

Date: 28/07/2014

Validation Dipole and Serial Number: D1800V2 SN: 2d009

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	1800	23.0	23.0	ϵ_r	53.30	52.13	-2.20	5.00
				σ	1.52	1.57	3.03	5.00
				1g SAR	36.50	37.04	1.48	5.00
				10g SAR	19.50	20.32	4.21	5.00

Channel Number	Band	Frequency (MHz)	Parameters	
1312	WCDMA FDD 4	1712.4	ϵ_r	52.64
			σ	1.49
1412		1732.4	ϵ_r	52.56
			σ	1.52
1513		1752.6	ϵ_r	52.48
			σ	1.53

System Check 5200 Body

Date: 29/07/2014

Validation Dipole and Serial Number: D5GHzV2 SN: 1016

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	5200	24.0	23.0	ϵ_r	49.01	49.64	1.29	5.00
				σ	5.30	5.23	-1.23	5.00
				1g SAR	73.10	72.30	-1.09	5.00
				10g SAR	20.40	21.10	20.40	5.00

Channel Number	Band	Frequency (MHz)	Parameters	
46	Wi-Fi 5.0 GHz	5230.0	ϵ_r	49.58
			σ	5.30
48		5240.0	ϵ_r	49.56
			σ	5.32
52		5260.0	ϵ_r	49.49
			σ	5.35

Site 59 (Continued)

System Check 5200 Body

Date: 04/08/2014

Validation Dipole and Serial Number: D5GHzV2 SN: 1016

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	5200	24.0	24.0	ϵ_r	49.01	47.91	-2.24	5.00
				σ	5.30	5.29	-0.20	5.00
				1g SAR	73.10	70.30	-3.83	5.00
				10g SAR	20.40	20.60	0.98	5.00

Channel Number	Band	Frequency (MHz)	Parameters	
46	Wi-Fi 5.0 GHz	5230.0	ϵ_r	49.58
			σ	5.30
48		5240.0	ϵ_r	49.56
			σ	5.32
54		5270.0	ϵ_r	47.58
			σ	5.39
60		5300.0	ϵ_r	47.46
			σ	5.44

System Check 5500 Body

Date: 29/07/2014

Validation Dipole and Serial Number: D5GHzV2 SN: 1016

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	5500	24.0	24.0	ϵ_r	48.60	47.65	-1.95	5.00
				σ	5.65	5.81	2.81	5.00
				1g SAR	79.00	82.70	4.68	5.00
				10g SAR	21.90	22.80	4.11	5.00

Channel Number	Band	Frequency (MHz)	Parameters	
100	Wi-Fi 5.0 GHz	5500.0	ϵ_r	48.75
			σ	5.64
116		5580.0	ϵ_r	48.54
			σ	5.79
140		5700.0	ϵ_r	48.28
			σ	5.96

Site 59 (Continued)

System Check 5500 Body

Date: 04/08/2014

Validation Dipole and Serial Number: D5GHzV2 SN: 1016

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	5500	24.0	24.0	ϵ_r	48.60	46.77	-3.77	5.00
				σ	5.65	5.68	0.54	5.00
				1g SAR	79.00	78.30	-0.89	5.00
				10g SAR	21.90	22.80	4.11	5.00

Channel Number	Band	Frequency (MHz)	Parameters	
116	Wi-Fi 5.0 GHz	5580.0	ϵ_r	46.64
			σ	5.81
134		5670.0	ϵ_r	46.41
			σ	5.93

System Check 5500 Body

Date: 11/08/2014

Validation Dipole and Serial Number: D5GHzV2 SN: 1016

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	5500	23.2	23.0	ϵ_r	48.60	47.52	-2.22	5.00
				σ	5.65	5.74	1.56	5.00
				1g SAR	79.00	77.40	-2.03	5.00
				10g SAR	21.90	22.20	1.37	5.00

Channel Number	Band	Frequency (MHz)	Parameters	
100	Wi-Fi 5.0 GHz	5500.0	ϵ_r	4.05
			σ	5.67
102		5510.0	ϵ_r	47.01
			σ	5.68
140		5700.0	ϵ_r	46.54
			σ	5.99

Site 59 (Continued)

System Check 5500 Body

Date: 14/08/2014

Validation Dipole and Serial Number: D5GHzV2 SN: 1016

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	5500	24.0	24.0	ϵ_r	48.60	46.94	-3.42	5.00
				σ	5.65	5.68	0.54	5.00
				1g SAR	79.00	75.30	-4.68	5.00
				10g SAR	21.90	22.10	0.91	5.00

Channel Number	Band	Frequency (MHz)	Parameters	
102	Wi-Fi 5.0 GHz	5510.0	ϵ_r	46.87
			σ	5.76
110		5550.0	ϵ_r	46.92
			σ	5.70

System Check 5800 Body

Date: 01/09/2014

Validation Dipole and Serial Number: D5GHzV2 SN: 1016

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	5800	24.0	24.0	ϵ_r	48.20	48.11	-0.19	5.00
				σ	6.00	6.08	1.29	5.00
				1g SAR	73.20	74.00	1.09	5.00
				10g SAR	20.20	20.40	0.99	5.00

Channel Number	Band	Frequency (MHz)	Parameters	
165	Wi-Fi 5.0 GHz	5825	ϵ_r	47.56
			σ	6.23

Site 60

System Check 2450 Body

Date: 21/07/2014

Validation Dipole and Serial Number: D2440V2 SN: 701

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	2450	24.0	23.5	ϵ_r	52.70	50.85	-3.51	5.00
				σ	1.95	1.92	-1.44	5.00
				1g SAR	51.40	53.20	3.50	5.00
				10g SAR	23.90	24.80	3.77	5.00

Channel Number	Band	Frequency (MHz)	Parameters	
1	Wi-Fi 2.4 GHz	2412.0	ϵ_r	50.93
			σ	1.89
6		2437.0	ϵ_r	50.88
			σ	1.91
11		2462.0	ϵ_r	50.82
			σ	1.94

System Check 2450 Body

Date: 06/08/2014

Validation Dipole and Serial Number: D2440V2 SN: 701

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	2450	24.0	24.0	ϵ_r	52.70	53.45	1.42	5.00
				σ	1.95	2.01	3.24	5.00
				1g SAR	51.40	52.80	2.72	5.00
				10g SAR	23.90	24.68	3.26	5.00

Channel Number	Band	Frequency (MHz)	Parameters	
0	Bluetooth	2402.0	ϵ_r	53.36
			σ	1.95
39		2441.0	ϵ_r	53.46
			σ	2.00
78		2480.0	ϵ_r	53.35
			σ	2.05

Site 60 (Continued)

System Check 5200 Body

Date: 01/09/2014

Validation Dipole and Serial Number: D5GHzV2 SN: 1016

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	5200	24.0	24.0	ϵ_r	49.01	49.38	0.75	5.00
				σ	5.30	5.13	-3.25	5.00
				1g SAR	73.10	71.70	-1.92	5.00
				10g SAR	20.40	21.00	2.94	5.00

Channel Number	Band	Frequency (MHz)	Parameters	
46	Wi-Fi 5.0 GHz	5230.0	ϵ_r	49.35
			σ	5.20
54		5270.0	ϵ_r	49.27
			σ	5.26

System Check 5500 Body

Date: 01/09/2014

Validation Dipole and Serial Number: D5GHzV2 SN: 1016

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	5500	24.0	24.0	ϵ_r	48.60	48.81	0.43	5.00
				σ	5.65	5.60	-0.82	5.00
				1g SAR	79.00	76.90	-2.66	5.00
				10g SAR	21.90	22.30	1.83	5.00

Channel Number	Band	Frequency (MHz)	Parameters	
116	Wi-Fi 5.0 GHz	5580.0	ϵ_r	48.58
	σ		5.74	

Site 60 (Continued)

System Check 5800 Body

Date: 30/07/2014

Validation Dipole and Serial Number: D5GHzV2 SN: 1016

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	5800	24.0	24.0	ϵ_r	48.20	46.39	-3.76	5.00
				σ	6.00	6.11	1.77	5.00
				1g SAR	73.20	71.50	-2.32	5.00
				10g SAR	20.20	19.80	-1.98	5.00

Channel Number	Band	Frequency (MHz)	Parameters	
149	Wi-Fi 5.0 GHz	5745.0	ϵ_r	46.40
			σ	6.05
157		5785.0	ϵ_r	46.39
			σ	6.10
159		5795.0	ϵ_r	46.39
			σ	6.11
165		5825.0	ϵ_r	46.34
			σ	6.14

System Check 5800 Body

Date: 04/08/2014

Validation Dipole and Serial Number: D5GHzV2 SN: 1016

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	5800	24.0	24.0	ϵ_r	48.20	46.40	-3.73	5.00
				σ	6.00	5.97	-0.54	5.00
				1g SAR	73.20	76.00	3.83	5.00
				10g SAR	20.20	20.30	0.50	5.00

Channel Number	Band	Frequency (MHz)	Parameters	
149	Wi-Fi 5.0 GHz	5745.0	ϵ_r	46.92
			σ	5.92
157		5785.0	ϵ_r	46.89
			σ	5.95
159		5795.0	ϵ_r	46.89
			σ	5.96
165		5825.0	ϵ_r	46.86
			σ	6.01

Site 60 (Continued)

System Check 5800 Body

Date: 07/08/2014

Validation Dipole and Serial Number: D5GHzV2 SN: 1016

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	5800	24.0	24.0	ϵ_r	48.20	46.56	-3.40	5.00
				σ	6.00	6.15	2.57	5.00
				1g SAR	73.20	71.90	-1.78	5.00
				10g SAR	20.20	20.60	1.98	5.00

Channel Number	Band	Frequency (MHz)	Parameters	
159	Wi-Fi 5.0 GHz	5795.0	ϵ_r	46.57
			σ	6.23

Site 61

System Check 1800 Body

Date: 05/08/2014

Validation Dipole and Serial Number: D1800V2 SN: 2d009

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	1800	24.0	23.0	ϵ_r	53.30	53.30	-0.01	5.00
				σ	1.52	1.53	0.46	5.00
				1g SAR	36.50	38.20	4.66	5.00
				10g SAR	19.50	20.24	3.79	5.00

Channel Number	Band	Frequency (MHz)	Parameters	
25	CDMA BC15	1711.25	ϵ_r	53.60
			σ	1.44
450		1732.5	ϵ_r	53.55
			σ	1.46
875		1753.75	ϵ_r	53.50
			σ	1.48

System Check 1900 Body

Date: 17/07/2014

Validation Dipole and Serial Number: D1900V2 SN: 537

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	1900	23.0	23.1	ϵ_r	53.30	52.25	-1.97	5.00
				σ	1.52	1.56	2.57	5.00
				1g SAR	40.20	40.40	0.50	5.00
				10g SAR	21.1	20.84	-1.23	5.00

Channel Number	Band	Frequency (MHz)	Parameters	
512	PCS1900	1850.2	ϵ_r	52.392
			σ	1.505
661		1880.0	ϵ_r	52.309
			σ	1.539
810		1909.8	ϵ_r	52.22
			σ	1.57

Site 61 (Continued)

System Check 1900 Body

Date: 21/07/2014

Validation Dipole and Serial Number: D1900V2 SN: 537

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	1900	24.0	23.8	ϵ_r	53.30	52.58	-1.35	5.00
				σ	1.52	1.53	0.42	5.00
				1g SAR	40.20	41.60	3.48	5.00
				10g SAR	21.1	21.60	2.37	5.00

Channel Number	Band	Frequency (MHz)	Parameters	
9262	WCDMA FDD 2	1852.4	ϵ_r	52.75
			σ	1.49
9400		1880.0	ϵ_r	2.65
			σ	1.51
9538		1907.6	ϵ_r	52.54
			σ	1.54

System Check 1900 Body

Date: 24/07/2014

Validation Dipole and Serial Number: D1900V2 SN: 537

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	1900	24.0	24.0	ϵ_r	53.30	52.46	-1.58	5.00
				σ	1.52	1.56	2.78	5.00
				1g SAR	40.20	38.52	-4.18	5.00
				10g SAR	21.1	20.12	-4.64	5.00

Channel Number	Band	Frequency (MHz)	Parameters	
18700	LTE Band 2	1860.0	ϵ_r	53.64
			σ	1.51
18900		1880.0	ϵ_r	53.56
			σ	1.53
19100		1900.0	ϵ_r	53.49
			σ	1.55
26140	LTE Band 25	1860.0	ϵ_r	53.64
			σ	1.51
26365		1882.5	ϵ_r	53.56
			σ	1.53
26590		1905.0	ϵ_r	53.48
			σ	1.55

Site 61 (Continued)

System Check 1900 Body

Date: 28/07/2014

Validation Dipole and Serial Number: D1900V2 SN: 537

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	1900	24.3	23.0	ϵ_r	53.30	51.54	-3.30	5.00
				σ	1.52	1.55	2.29	5.00
				1g SAR	40.20	40.40	0.50	5.00
				10g SAR	21.1	21.08	-0.09	5.00

Channel Number	Band	Frequency (MHz)	Parameters		
512	PCS1900	1850.2	ϵ_r	52.07	
			σ	1.51	
			ϵ_r	51.97	
661		WCDMA FDD 2	1880.0	σ	1.54
				ϵ_r	51.87
810			1909.8	σ	1.57
				ϵ_r	52.06
9262				1852.4	σ
			ϵ_r		51.97
9400	1880.0		σ		1.54
			ϵ_r	51.87	
9538			1907.6	σ	1.56
	ϵ_r	52.07			
25	CDMA BC1	1851.25		σ	1.51
			ϵ_r	51.97	
600		1880	σ	1.54	
			ϵ_r	51.87	
1175			1908.75	σ	1.57
		ϵ_r		51.87	
σ		1.57			

System Check 1900 Body

Date: 04/08/2014

Validation Dipole and Serial Number: D1900V2 SN: 537

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	1900	24.2	23.0	ϵ_r	53.30	51.05	-4.22	5.00
				σ	1.52	1.56	2.50	5.00
				1g SAR	40.20	40.40	0.50	5.00
				10g SAR	21.1	20.28	-3.89	5.00

Channel Number	Band	Frequency (MHz)	Parameters	
25	CDMA BC1	1851.25	ϵ_r	51.24
			σ	1.51
600		1880.0	ϵ_r	51.13
			σ	1.54
1175			1908.75	ϵ_r
		σ		1.57
σ		1.57		

Appendix 7. Measurement Uncertainty Table

Measurement uncertainty tables for technologies tested.

A.7.1. GSM / GPRS / EDGE 850 / WCDMA FDD 5 / CDMA BC 0 / CDMA BC 10 / LTE Band 5 / LTE Band 13 / LTE Band 17 / LTE Band 26 Body Configurations 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	C _i (1g)	Standard Uncertainty		U _i or U _{eff}
							+ u (%)	- u (%)	
B	Probe calibration	6.000	6.000	normal (k=1)	1.0000	1.0000	6.000	6.000	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	1.730	1.730	Rectangular	1.7321	1.0000	0.999	0.999	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration /Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	2.510	2.510	normal (k=1)	1.0000	1.0000	2.510	2.510	10
A	Device Holder uncertainty	0.154	0.154	normal (k=1)	1.0000	1.0000	0.154	0.154	10
B	Phantom Uncertainty	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Drift of output power	5.000	5.000	Rectangular	1.7321	1.0000	2.887	2.887	∞
B	Liquid Conductivity (target value)	5.000	5.000	Rectangular	1.7321	0.6400	1.848	1.848	∞
A	Liquid Conductivity (measured value)	2.000	2.000	normal (k=1)	1.0000	0.6400	1.280	1.280	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	1.560	1.560	normal (k=1)	1.0000	0.6000	0.936	0.936	5
	Combined standard uncertainty			t-distribution			9.37	9.37	>500
	Expanded uncertainty			k = 1.96			18.36	18.36	>500

A.7.2. WCDMA FDD 4 / CDMA BC 15 / LTE Band 4 Body Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	C _i (1g)	Standard Uncertainty		U _i or U _{eff}
							+ u (%)	- u (%)	
B	Probe calibration	6.000	6.000	normal (k=1)	1.0000	1.0000	6.000	6.000	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	1.730	1.730	Rectangular	1.7321	1.0000	0.999	0.999	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration/ Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	2.460	2.460	normal (k=1)	1.0000	1.0000	2.460	2.460	10
A	Device Holder uncertainty	0.154	0.154	normal (k=1)	1.0000	1.0000	0.154	0.154	10
B	Phantom Uncertainty	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Drift of output power	5.000	5.000	Rectangular	1.7321	1.0000	2.887	2.887	∞
B	Liquid Conductivity (target value)	5.000	5.000	Rectangular	1.7321	0.6400	1.848	1.848	∞
A	Liquid Conductivity (measured value)	2.210	2.210	normal (k=1)	1.0000	0.6400	1.414	1.414	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	2.150	2.150	normal (k=1)	1.0000	0.6000	1.290	1.290	5
	Combined standard uncertainty			t-distribution			9.42	9.42	>500
	Expanded uncertainty			k = 1.96			18.45	18.45	>500

A.7.3. PCS / GPRS / EDGE 1900 / WCDMA FDD 2 / CDMA BC 1 / LTE Band 2 / LTE Band 25 Body Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	C _i (1g)	Standard Uncertainty		U _i OR U _{eff}
							+ u (%)	- u (%)	
B	Probe calibration	6.000	6.000	normal (k=1)	1.0000	1.0000	6.000	6.000	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	1.730	1.730	Rectangular	1.7321	1.0000	0.999	0.999	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration / Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	1.860	1.860	normal (k=1)	1.0000	1.0000	1.860	1.860	10
A	Device Holder uncertainty	0.154	0.154	normal (k=1)	1.0000	1.0000	0.154	0.154	10
B	Phantom Uncertainty	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Drift of output power	5.000	5.000	Rectangular	1.7321	1.0000	2.887	2.887	∞
B	Liquid Conductivity (target value)	5.000	5.000	Rectangular	1.7321	0.6400	1.848	1.848	∞
A	Liquid Conductivity (measured value)	2.610	2.610	normal (k=1)	1.0000	0.6400	1.670	1.670	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	2.140	2.140	normal (k=1)	1.0000	0.6000	1.284	1.284	5
	Combined standard uncertainty			t-distribution			9.32	9.32	>500
	Expanded uncertainty			k = 1.96			18.26	18.26	>500

A.7.4. Wi-Fi 2450 MHz Body Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	C _i (1g)	Standard Uncertainty		U _i or U _{eff}
							+ u (%)	- u (%)	
B	Probe calibration	6.000	6.000	normal (k=1)	1.0000	1.0000	6.000	6.000	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration / Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	2.440	2.440	normal (k=1)	1.0000	1.0000	2.440	2.440	10
A	Device Holder uncertainty	0.154	0.154	normal (k=1)	1.0000	1.0000	0.154	0.154	10
B	Phantom Uncertainty	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Drift of output power	5.000	5.000	Rectangular	1.7321	1.0000	2.887	2.887	∞
B	Liquid Conductivity (target value)	5.000	5.000	Rectangular	1.7321	0.6400	1.848	1.848	∞
A	Liquid Conductivity (measured value)	2.260	2.260	normal (k=1)	1.0000	0.6400	1.446	1.446	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	2.150	2.150	normal (k=1)	1.0000	0.6000	1.290	1.290	5
	Combined standard uncertainty			t-distribution			9.36	9.36	>500
	Expanded uncertainty			k = 1.96			18.35	18.35	>500

A.7.5. Wi-Fi 5GHz Body Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	C _i (19)	Standard Uncertainty		U _i OR U _{eff}
							+ u (%)	- u (%)	
B	Probe calibration	6.550	6.550	normal (k=1)	1.0000	1.0000	6.550	6.550	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration / Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	1.960	1.960	normal (k=1)	1.0000	1.0000	1.960	1.960	10
A	Device Holder uncertainty	0.154	0.154	normal (k=1)	1.0000	1.0000	0.154	0.154	10
B	Phantom Uncertainty	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Drift of output power	5.000	5.000	Rectangular	1.7321	1.0000	2.887	2.887	∞
B	Liquid Conductivity (target value)	5.000	5.000	Rectangular	1.7321	0.6400	1.848	1.848	∞
A	Liquid Conductivity (measured value)	4.370	4.370	normal (k=1)	1.0000	0.6400	2.797	2.797	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	4.270	4.270	normal (k=1)	1.0000	0.6000	2.562	2.562	5
	Combined standard uncertainty			t-distribution			10.15	10.15	>450
	Expanded uncertainty			k = 1.96			19.90	19.90	>450

Appendix 8. 3G Test set-up
3G (12.K RMC / HSDPA / HSUPA) setup

The module power levels were measured in both HSPA and 3G RMC 12.2kbps modes and compared to ensure the correct mode of operation had been established.

The following tables taken from FCC 3G SAR procedures (KDB 941225 D01 SAR test for 3G devices v02) below were applied using an wireless communications test set which supports 3G / HSDPA release 5 / HSUPA release 6.

Sub-test Setup for Release 5 HSDPA

Sub-test	β_c	β_d	B_d (SF)	β_c / β_d	$\beta_{hs}^{(1)}$	SM (dB) ⁽²⁾
1	2/15	15/15	64	2/15	4/15	0.0
2	12/15 ⁽³⁾	15/15 ⁽³⁾	64	12/15 ⁽³⁾	24/15	1.0
3	15/15	8/15	64	15/8	30/15	1.5
4	15/15	4/15	64	15/4	30/15	1.5

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

Note 2: CM = 1 for $\beta_c / \beta_d = 12/15, B_{hs} / \beta_c = 24/15$

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

Sub-test Setup for Release 6 HSUPA

Sub-test	β_c	β_d	B_d (SF)	β_c / β_d	$\beta_{hs}^{(1)}$	B_{oc}	B_{od}	B_{od} (SF)	B_{od} (codes)	CM ⁽²⁾ (dB)	MPR (dB)	AG ⁽⁴⁾ Index	E-TFCI
1	11/15 ⁽³⁾	15/15 ⁽³⁾	64	11/15 ⁽³⁾	22/15	209/225	1039/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	31/15	$B_{a11}: 47/15$ $B_{a12}: 47/15$	4	1	2.0	1.0	15	92
4	2/15	15/15	64	2/15	2/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 ⁽⁴⁾	15/15 ⁽⁴⁾	64	15/15 ⁽⁴⁾	24/15	24/15	134/15	4	1	1.0	0.0	21	81

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

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

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

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

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

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

Appendix 9. DC-HSDPA CAT24 Test set-up

A.9.1. Establish a DC-HSDPA RB Test Mode Connection with DL 42Mbps

RB (radio bearer) test mode is a special, defined-channel configuration designed to simplify the testing environment. Since W-CDMA is an incredibly flexible system, defined radio bearers, called RMCs (reference measurement channels) simplify which configurations need to be tested for RF performance. RB test mode provides the ability to set up a standalone channel configuration originating from the 8960 via call-processing. The direction of the call setup is always from the 8960 to the UE. This is the typical RF test that is used throughout the lifecycle of a device's design process. Using RB test mode is attractive to device manufacturers because it does not require extra software to control the UE. In this type of call connection, the radio bearer (within the 8960) essentially controls the UE during test.

A.9.1.1 Configure 8960

1. Press **Operating Mode (F1)**, select **Cell Off** operating mode.

Call Setup Screen			
Call Control	Active Cell Operating Mode		Call Parms
Operating Mode	UE Information		Cell Power
Cell Off	INSI: INEI(SV): (--) Power Class: Detected PRACH Sig: ---- Called Party Number:		-75.00 dBm/3.84 MHz
	UE Expected Open Loop Transmit Power		Channel Type
	Init PRACH TX Pou: -22.70 dBm	Init DPCCH TX Pou: -11.55 dBm	12.2k RNC
Originate Call	Current Service Type		Paging Service
	None		RB Test Mode
Paging Parameters	Call Processing Status		HSPA Parameters
	RRC State: MM Status: GMM State: FDD Test	Operating Mode Active Cell FDD Test	per State: Off Mode State: Off fset: 0 chips
Handovers	HSUPA Information		34,121 Preset Call Configs
	UE Rep E-DCH Last Happy Bit Throughput: ACKs Transmitt	Cell Off	
Clear UE Info	Background		Channel (UARFCN) Parms
	Cell Off	Sys Type: UTRA FDD	
		Logging: No Conn	
1 of 5	IntRef	Offset	1 of 3

2. Set the **Channel type** to **12.2k + HSDPA**.

3. Set the downlink channel code. In order to achieve the 42 Mbps maximum downlink throughput, you have to set up 15 HS-PDSCHs which will possibly cause a code collision.

To easily configure the downlink 15 HS-PDSCH for a maximum throughput, use the code preset to configure the code channels for both the serving cell and the secondary serving cell.

Select **Call Control 2 of 6-> Generator Info (F3) -> Downlink Channel Configs (F4) -> DL Chan code Preset Configs (F5)**, choose **34.121 Tables E.6.2.3,4 (HSDPA 15 HS-PDSCHs)**.

Set the **Conn S-CCPCH Cfg** to **Off** to avoid the code collision.

To see the channel code allocation for the serving cell and the secondary serving cell, select **Additional Gen Info Screens (F1) -> DC-HSDPA DL Code Chan Info (F4)**.

Call Setup Screen									
Screen Ctrl	DC-HSDPA DL Code Channel Information							Call Parm	
DL Code Channel Info Screen	Serving Cell Primary Scrambling Code: 0							Cell Power	
	Secondary Serving Cell Primary Scrambling Code: 2							-75.00	
Generated Power Info Screen	Channel	Serving Cell DL Chan Info			Sec Cell DL Chan Info			dBm/3.84 MHz	
	Channel	Level (dB) Current	Desired	QVSF	Chan Code	Level (dB) Current	Desired	QVSF	Chan Code
OCNS Info Screen	CPICH:	Off	-3.30	256	0	Off	Off	256	0
	P-CCPCH/SCH:	Off	-5.30	256	1	Off	Off	256	1
DC-HSDPA DL Code Chan Info	S-CCPCH:	Off	-10.30	64	2	Off	Off	256	2
	PICH:	Off	-8.30	256	2	Off	Off	256	2
Return	AICH:	Off	-9.30	256	3	Off	Off	256	3
	(F-)DPCH:	Off	Off	128	7	Off	Off	128	7
Return	E-AGCH:	Off	Off	256	42	Off	Off	256	42
	E-HICH:	Off	Off	128	22	Off	Off	128	22
Return	E-RGCH:	Off	Off	128	22	Off	Off	128	22
	HS-SCCH 1:	Off	Off	128	2	Off	Off	128	2
Return	HS-SCCH 2:	Off	Off	128	3	Off	Off	128	3
	HS-SCCH 3:	Off	Off	128	3	Off	Off	128	3
Return	HS-SCCH 4:	Off	Off	128	3	Off	Off	128	3
	HS-PDSCHs:	Off	Off	16	1-15	Off	Off	16	1-15
Return	Comp OCNS:	Off	Off	128	WCDMA	Off	Off	128	HSDPA
	Cell Off							Sys Type: UTRA FDD	
							Logging: No Conn		
DBUS-INT							IntRef		
							Offset		
							1 of 3		

4. Configure DC-HSDPA parameters to achieve the Maximum Downlink Data Rate:

First of all, you must know the maximum data rate of the device under test according to its category and the key factors to achieve the maximum data rate. In this lab, you use a category 24 device whose maximum data rate is 42 Mbps when DC-HSDPA is configured.

a) Set up the HSDPA RB Test Mode Parameters

Path: Call Parm 1 of 3 -> HSPA Parameters (F10) -> HSDPA Parameters (F10) -> HSDPA RB Test Mode Setup (F8) -> HSDPA RB Test Mode Settings (F8).

- RB Test HS-DSCH Configuration Type = User Defined
- RB Test User Defined HS-DSCH MAC entity = MAC-ehs (Note 1)
- RB Test User Defined HARQ Processes = 6 (Note 2)
- RB Test User Defined UE IR Buffer Allocation = Implicit
- RB Test User Defined DC-HSDPA State = On
- RB Test Mode DC-HSDPA DPCH Loopback State = On

Note 1: DC-HSDPA requires MAC-ehs. You must set the MAC entity to MAC-ehs before setting the DC-HSDPA state)

Note 2: To restrict the amount of soft memory that can be allocated to a single HARQ process (and thus limit the amount of data that has to be transferred across the UE's internal data buses) the specifications require that when setting up a DC-HSDPA call with the implicit HARQ memory partitioning the network must configure 6, 7, or 8 HARQ processes per cell. For the explicit HARQ memory partitioning case, the number of HARQ processes can be 1 through 8, but the memory size for each HARQ process cannot be greater than the number of soft channel bits for an implicit memory partitioning with 6 processes per HS-DSCH channel.

b) Set up the Serving Cell Parameters

Path: F10

- RB Test User Defined 64QAM State =On
- RB Test User Defined Active HS-PDSCHs =15
- RB Test User Def Transport Block Size Index =62
- RB Test User Defined Modulation Type =64QAM
- RB Test User Defined Inter-TTI Interval =1

c) Set up the Secondary Serving Cell Parameters

Path: F11

- RB Test User Def Secondary Cell 64QAM State =On
- RBTM User Def Sec Cell Active HS-PDSCHs = 15
- RBTM User Def Sec Cell TB Size Index = 62
- RBTM User Def Sec Cell Modulation Type =64QAM
- RBTM User Def Sec Cell Inter-TTI Interval = 1

d) Set the **Secondary Serving Cell Power (dBm/3.84 MHz)** to **-25 dBm/3.84 MHz**

Path: Return (F12) -> HSDPA Parm 2 of 2 -> Secondary Serv Cell Parm (F10)

e) Set the **Cell power** to **-25 dBm/3.84 MHz**

Path: CALL SETUP -> F7

f) Set the HSDPA Conn DL Channel Levels

Path: CALL SETUP -> Call Control 2 of 6 -> Generator Info (F3) ->Downlink Channel Levels (F3) -> Connected DL Channel Levels (F3) -> F3

- HSDPA Cell 1 Connected CPICH Level = -8
- HSDPA Cell 1 Connected P-CCPCH/SCH Level = -20
- HSDPA Cell 1 Connected PICH Level = off
- HSDPA Cell 1 Connected DPCH Level = -30
- HSDPA Cell 1 Connected HS-PDSCH Level (Sum) = -1 dBm
- HSDPA Cell 1 Connected HS-SCCH 1 to 4 Level = -20,-20,off,off
- Secondary Cell HSDPA Conn CPICH Level = -8
- Secondary Cell HSDPA Conn PCCPCH/SCH Level = -20
- Secondary Cell HSDPA Conn PICH Level = off
- Secondary Cell HSDPA Conn HS-PDSCHs Lvl (Sum) = -1 dBm
- Secondary Cell HSDPA Conn HS-SCCH 1 to 4 Level = -20,-20,off,off

5. Set the **Operating Mode (F1)** to **Active Cell**.

A.9.1.2. Power on the UE and Set up the Connection

Power on the device, and then wait for it to camp on 8960. You should be able to see the following screen.

Call Setup Screen										
Call Control	Active Cell Operating Mode							Call Parm		
Operating Mode	UE Information							Cell Power		
Active Cell	INSI: 001012345678901			Power Class: 4		-25.00		dBm/3.84 MHz		
	IMEI(SV):352358040214948(--)			Detected PRACH Sig: 0		Channel Type		12.2k + HSDPA		
	Called Party Number:							Paging Service		
	UE Expected Open Loop Transmit Power							RB Test mode		
	Init PRACH TX Pou: -60.00 dBm			Init DPCH TX Pou: -11.55 dBm				HSPA Parameters		
Originate Call	Current Service Type							34.121 Preset Call Configs		
	None							Channel (UARFCN) Parm		
Paging Parameters	Call Processing Status							1 of 3		
	RRC State: Idle		Soft Handover State: Off		Compressed Mode State: Off					
	RNI Status: None		Cur DPCH Offset: 0 chips							
	GMM State: Attached									
Handovers	HSUPA Information				HSDPA Information					
	Rep EDCH Cat/Ext: 6/Unrep		Cur UE HS-DSCH Cat: 24		Block Error Ratio: ---- %					
	Last Happy Bit: None		Throughput: ---- kbps		Blocks Transmitted: ----					
	Throughput: ---- kbps									
Clear UE Info	ACKs Transmitted: ----									
	Active Cell			Sys Type: UTRA FDD						
	Idle			Logging: No Conn						
1 of 6	DBUS-INT	IntRef	Offset							

The UE reports HSDPA categories to 8960, which represents its maximum data rate capability. DC-HSDPA requires UE categories 21 to 24.

The GMM state must be **Attached**, otherwise you cannot establish a HSDPA connection.

2. Originate the Connection

a) Now, Originate an RB Test call with DC-HSDPA by pressing „F3“ from the main Call Setup screen.

b) After a connection is set up, you will be able to see the throughput from the HSDPA Information window. Press the **Measurement Reset** key to reset the calculation.

Call Setup Screen									
Call Control	Active Cell Operating Mode						Call Parm		
Operating Mode	UE Information						Cell Power		
Active Cell	INSI: 001012345678901		Power Class: 4		Detected PRACH Sig: 0		-25.00		
	IMEI(SV):352358040214948(--)						dBm/3.84 MHz		
	Called Party Number:						Channel Type		
	UE Expected Open Loop Transmit Power						12.2k + HSDPA		
	Init PRACH TX Pou: -60.00 dBm		Init DPCCH TX Pou: -11.55 dBm				Paging Service		
End Call	Current Service Type						RB Test Mode		
	RB Test Mode - HSDPA								
	Call Processing Status						HSPA Parameters		
Paging Parameters	RRC State: CELL_DCH		Soft Handover State: Off		Compressed Mode State: Off				
	MM Status: None		Cur DPCH Offset: 0 chips						
	GMM State: Attached						34.121 Preset Call Configs		
Handovers	HSUPA Information			HSDPA Information					
	Rep EDCH Cat/Ext: 6/Unrep		Cur UE HS-DSCH Cat: 24		Block Error Ratio: 0 %				
	Last Happy Bit: None		Throughput: 42101 kbps		Blocks Transmitted: 115500				
Clear UE Info	ACKs Transmitted: ----						Channel (UARFCN) Parm		
			Active Cell Connected		Sys Type: UTRA FDD				
					Logging: No Conn				
1 of 6	DBUS-INT	IntRef	Offset				1 of 3		

Now you can also check the connected DC-HSDPA downlink channel levels.

Path: CALL SETUP->Call Control 2 of 6 -> Generator Info (F3) -> Additional Gen Info Screens (F1) ->DC-HSDPA DL Code Chan Info (F4).

Call Setup Screen									
Screen Ctrl	DC-HSDPA DL Code Channel Information						Call Parm		
DL Code Channel Info Screen	Serving Cell Primary Scrambling Code: 0						Cell Power		
	Secondary Serving Cell Primary Scrambling Code: 2						-25.00		
							dBm/3.84 MHz		
Generated Power Info Screen	Channel		Serving Cell DL Chan Info		Sec Cell DL Chan Info		Channel Type		
	Channel	Level (dB)	Chan	Level (dB)	Chan				
		Current	Desired	OVSF	Code	Current	Desired	OVSF	Code
	CPICH:	-8.00	-8.00	256	0	-8.00	-8.00	256	0
	P-CCPCH/SCH:	-20.00	-20.00	256	1	-20.00	-20.00	256	1
OCNS Info Screen	S-CCPCH:	Off	Off	64	2				
	PICH:	Off	Off	256	2	Off	Off	256	2
	AICH:								
DC-HSDPA DL Code Chan Info	(F-)DPCH:	-30.00	-30.00	128	7				
	E-AGCH:	Off	Off	256	42				
	E-HICH:	Off	Off	128	22				
	E-RGCH:	Off	Off	128	22				
	HS-SCCH 1:	-20.00	-20.00	128	2	-20.00	-20.00	128	2
	HS-SCCH 2:	-20.00	-20.00	128	3	-20.00	-20.00	128	3
	HS-SCCH 3:								
	HS-SCCH 4:								
Return	HS-PDSCHs:	-1.00	-1.00	16	1-15	-1.00	-1.00	16	1-15
	Comp OCNS:	-17.91	-17.91	128	HSDPA	-17.65	-17.65	128	HSDPA
			Active Cell Connected		Sys Type: UTRA FDD				
					Logging: No Conn				
	DBUS-INT	IntRef	Offset				1 of 3		

A.9.2. Activate/ Deactivate the Secondary Serving Cell

Once a DC-HSDPA connection is established, 8960 can control the UE to start or stop monitoring the secondary serving cell using HS-SCCH orders. The HS-SCCH orders can be sent on either the serving or secondary serving cell.

A.9.2.1 Deactivate the Secondary Serving Cell

1. Setup the Deactivate Secondary Cell Parameter

Path: CALL SETUP->Call Control 6 of 6 -> HS-SCCH Order (F3) -> Deactivate Secondary Cell (F2)

In this lab you set it to deactivate the secondary serving cell from the serving cell.

- Deactivate Secondary Cell HS-SCCH Order From = Serving Cell

Press **Send Deactivate Secondary Cell (F5)**

Press Measurement Reset key and see the throughput has dropped to 21 Mbps or so, like the figure below:

Call Setup Screen						
Call Control	Active Cell Operating Mode				Call Parm	
Operating Mode	UE Information				Cell Power	
Active Cell	INSI: 001012345678901		Power Class: 4		-25.00	
	IMEI(SV):352358040214948(--)		Detected PRACH Sig: 0		dBm/3.84 MHz	
	Called Party Number:				Channel Type	
	UE Expected Open Loop Transmit Power				12.2k + HSDPA	
	Init PRACH TX Pou: -60.00 dBm		Init DPCH TX Pou: -11.55 dBm		Paging Service	
End Call	Current Service Type				RB Test Mode	
	RB Test Mode - HSDPA					
	Call Processing Status				HSPA Parameters	
Paging Parameters	RRC State: CELL_DCH	Soft Handover State: Off				
	MN Status: None	Compressed Mode State: Off				
	GMN State: Attached	Cur DPCH Offset: 0 chips				
Handovers	HSUPA Information		HSDPA Information		34,121 Preset Call Configs	
	Rep EDCH Cat/Ext: 6/Unrep		Cur UE HS-DSCH Cat: 24			
	Last Happy Bit: None		Block Error Ratio: 0 %			
	Throughput: ---- kbps		Throughput: 21088 kbps			
Clear UE Info	ACKs Transmitted: ----		Blocks Transmitted: 35000		Channel (UARFCH) Parm	
	Active Cell Connected			Sys Type: UTRA FDD		
				Logging: No Conn		
1 of 6	DBUS-INT	IntRef	Offset			1 of 3

You can see more on the DC-HSDPA Information screen.

Path: CALL SETUP->Call Control 2 of 6 -> Additional Screens (F1) -> HSDPA Information (F4) -> DC-HSDPA Information (F4).

Call Setup Screen																																																												
Screen Ctrl	DC-HSDPA Information							Call Parm																																																				
Channel (UARFCH) Info	Secondary Serving Cell Status							Cell Power																																																				
	Current Secondary Serving Cell Status: Configured-Inactive							-25.00																																																				
HSPA Information	DC-HSDPA Information							dBm/3.84 MHz																																																				
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	Summary	Serving Cell	Secondary Serving Cell																																																									
Block Error Ratio:	0 %	0 %	---- %																																																									
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				Connected			Logging: No Conn																																																					
1 of 2		DBUS-INT		IntRef	Offset			1 of 3																																																				

A.9.2.2 Re-activate the Secondary Serving Cell

Now you can activate the secondary serving cell by pressing back to the HS-SCCH Order menu.

Path: CALL SETUP->Call Control 6 of 6 -> HS-SCCH Order (F3)

Press **Send Activate Secondary Cell (F1)**.

Press the Measurement Reset key and see the throughput has increased to 42 Mbps. When you look at the DC-HSDPA Information screen, you can see the secondary serving cell is set up again.

Call Setup Screen																																																												
Screen Ctrl	DC-HSDPA Information							Call Parm																																																				
Channel (UARFCH) Info	Secondary Serving Cell Status							Cell Power																																																				
	Current Secondary Serving Cell Status: Configured-Active							-25.00																																																				
HSPA Information	DC-HSDPA Information							dBm/3.84 MHz																																																				
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1 of 2		DBUS-INT		IntRef	Offset			1 of 3																																																				

When DC-HSDPA is active, the HBLER measurement can also be used to perform receiver testing. 3GPP TS 34.121-1 sections 6.3C and 6.3D are supported and can be set up and tested as described in an appendix in another document, DC-HSDPA User Guide.