

Appendix 5. System Check

Prior to the assessment, the system was verified in the flat region of the phantom, 900 MHz, 1800 MHz, 1900 MHz, 2450 MHz and 5.0 GHz dipoles were used. A forward power of 250 mW was applied to the 900 MHz, 1800 MHz, 1900 MHz, 2450 MHz dipoles and 100 mW was applied to 5.0 GHz dipole and the system was verified to a tolerance of $\pm 5\%$ for the 900MHz, 1800MHz, 1900MHz, 2450 MHz and 5.0 GHz dipoles.

The applicable verification normalised to 1 Watt.

System Check 900 Head

Date: 05/02/2013

Validation Dipole and Serial Number: D900V2; SN: 035

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Head	900	24.0 °C	23.0 °C	ϵ_r	41.50	40.55	-2.29	5.00
				σ	0.97	0.96	-0.67	5.00
				1g SAR	10.50	10.60	0.95	5.00
				10g SAR	6.74	6.88	2.08	5.00

Dielectrics for Frequencies Tested

Channel Number	Channel Description	Frequency (MHz)	Parameters	
128	Low	824.2	ϵ_r	41.00
			σ	0.92
190	Middle	836.6	ϵ_r	41.00
			σ	0.93
251	High	848.8	ϵ_r	40.90
			σ	0.93

System Check 900 Head (Continued):

Date: 06/02/2013

Validation Dipole and Serial Number: D900V2; SN: 035

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Head	900	24.0 °C	23.0 °C	ϵ_r	41.50	40.55	-2.29	5.00
				σ	0.97	0.96	-0.67	5.00
				1g SAR	10.50	10.60	0.95	5.00
				10g SAR	6.74	6.92	2.67	5.00

Dielectrics for Frequencies Tested

Channel Number	Channel Description	Frequency (MHz)	Parameters	
128	Low	824.2	ϵ_r	41.00
			σ	0.92
190	Middle	836.6	ϵ_r	41.00
			σ	0.93
251	High	848.8	ϵ_r	40.90
			σ	0.93
Channel Number	Channel Description	Frequency (MHz)	Parameters	
4132	Low	826.4	ϵ_r	41.10
			σ	0.92
4183	Middle	836.6	ϵ_r	41.00
			σ	0.92
4233	High	846.6	ϵ_r	40.90
			σ	0.93

System Check 900 Body
Date: 31/01/2013
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 °C	21.9 °C	ϵ_r	55.00	53.78	-2.22	5.00
				σ	1.05	1.03	-1.76	5.00
				1g SAR	10.80	10.88	0.74	5.00
				10g SAR	6.96	7.16	2.87	5.00

Dielectrics for Frequencies Tested

Channel Number	Channel Description	Frequency (MHz)	Parameters	
128	Low	824.2	ϵ_r	55.24
			σ	0.97
190	Middle	836.6	ϵ_r	55.00
			σ	0.98
251	High	848.8	ϵ_r	55.15
			σ	0.98

Date: 01/02/2013
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 °C	21.9 °C	ϵ_r	55.00	53.78	-2.22	5.00
				σ	1.05	1.03	-1.76	5.00
				1g SAR	10.80	10.84	0.37	5.00
				10g SAR	6.96	7.12	2.30	5.00

Dielectrics for Frequencies Tested

Channel Number	Channel Description	Frequency (MHz)	Parameters	
128	Low	824.2	ϵ_r	55.24
			σ	0.97
190	Middle	836.6	ϵ_r	55.00
			σ	0.98
251	High	848.8	ϵ_r	55.15
			σ	0.98

System Check 900 Body (Continued):

Date: 04/02/2013

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 °C	21.4°C	ϵ_r	55.00	53.79	-2.20	5.00
				σ	1.05	1.01	-3.38	5.00
				1g SAR	10.80	10.80	0.00	5.00
				10g SAR	6.96	7.08	1.72	5.00

Dielectrics for Frequencies Tested

Channel Number	Channel Description	Frequency (MHz)	Parameters	
4132	Low	826.4	ϵ_r	54.17
			σ	0.97
4183	Middle	836.6	ϵ_r	54.13
			σ	0.98
4233	High	846.6	ϵ_r	54.09
			σ	0.98

System Check 1800 Head
Date: 06/02/2013
Validation Dipole and Serial Number: D1800V2; SN: 264

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Head	1800	24.0 °C	21.9 °C	ϵ_r	40.00	40.71	1.78	5.00
				σ	1.40	1.38	-1.21	5.00
				1g SAR	37.20	36.84	-0.97	5.00
				10g SAR	19.60	19.60	0.00	5.00

Dielectrics for Frequencies Tested

Channel Number	Channel Description	Frequency (MHz)	Parameters	
1312	Low	1712.4	ϵ_r	41.00
			σ	1.31
1412	Middle	1732.4	ϵ_r	41.00
			σ	1.33
1513	High	1752.6	ϵ_r	40.90
			σ	1.34

Date: 07/02/2013
Validation Dipole and Serial Number: D1800V2; SN: 264

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Head	1800	24.0 °C	21.9 °C	ϵ_r	40.00	40.71	1.78	5.00
				σ	1.40	1.38	-1.21	5.00
				1g SAR	37.20	37.32	0.32	5.00
				10g SAR	19.60	19.76	0.82	5.00

Dielectrics for Frequencies Tested

Channel Number	Channel Description	Frequency (MHz)	Parameters	
20050	Low	1720.0	ϵ_r	41.00
			σ	1.31
20175	Middle	1732.5	ϵ_r	41.00
			σ	1.33
20300	High	1745.0	ϵ_r	40.90
			σ	1.34

System Check 1800 Head (Continued):

Date: 11/02/2013

Validation Dipole and Serial Number: D1800V2; SN: 264

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Head	1800	24.0 °C	22.6 °C	ϵ_r	40.00	39.78	-0.55	5.00
				σ	1.40	1.39	-0.50	5.00
				1g SAR	37.20	38.12	2.47	5.00
				10g SAR	19.60	20.16	2.86	5.00

Dielectrics for Frequencies Tested

Channel Number	Channel Description	Frequency (MHz)	Parameters	
19957	Low	1710.7	ϵ_r	40.10
			σ	1.31
20175	Middle	1732.5	ϵ_r	40.00
			σ	1.33
20393	High	1754.3	ϵ_r	39.90
			σ	1.35

System Check 1800 Body
Date: 14/02/2013
Validation Dipole and Serial Number: D1800V2; SN: 264

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	1800	22.0°C	22.6 °C	ϵ_r	53.30	52.60	-1.31	5.00
				σ	1.52	1.51	-0.59	5.00
				1g SAR	37.80	39.68	4.97	5.00
				10g SAR	20.10	21.04	4.68	5.00

Dielectrics for Frequencies Tested

Channel Number	Channel Description	Frequency (MHz)	Parameters	
1312	Low	1712.4	ϵ_r	52.70
			σ	1.45
1412	Middle	1732.4	ϵ_r	52.80
			σ	1.43
1513	High	1752.6	ϵ_r	52.70
			σ	1.47
Channel Number	Channel Description	Frequency (MHz)	Parameters	
20050	Low	1720.0	ϵ_r	52.70
			σ	1.44
20175	Middle	1732.5	ϵ_r	52.70
			σ	1.45
20300	High	1745.0	ϵ_r	52.70
			σ	1.46

System Check 1800 Body (Continued):
Date: 15/02/2013
Validation Dipole and Serial Number: D1800V2; SN: 264

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	1800	22.0 °C	21.9 °C	ϵ_r	53.30	52.67	-1.18	5.00
				σ	1.52	1.53	0.39	5.00
				1g SAR	37.80	36.44	-3.60	5.00
				10g SAR	20.10	19.40	-3.48	5.00

Dielectrics for Frequencies Tested

Channel Number	Channel Description	Frequency (MHz)	Parameters	
20050	Low	1720.0	ϵ_r	52.90
			σ	1.45
20175	Middle	1732.5	ϵ_r	52.90
			σ	1.46
20300	High	1745.0	ϵ_r	52.90
			σ	1.47
Channel Number	Channel Description	Frequency (MHz)	Parameters	
19957	Low	1710.7	ϵ_r	52.94
			σ	1.44
20175	Middle	1732.5	ϵ_r	52.90
			σ	1.46
20393	High	1754.3	ϵ_r	52.90
			σ	1.48

Date: 16/02/2013
Validation Dipole and Serial Number: D1800V2; SN: 264

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	1800	22.0 °C	21.9 °C	ϵ_r	53.30	52.67	-1.18	5.00
				σ	1.52	1.53	0.39	5.00
				1g SAR	37.80	35.92	-4.97	5.00
				10g SAR	20.10	19.20	-4.48	5.00

Dielectrics for Frequencies Tested

Channel Number	Channel Description	Frequency (MHz)	Parameters	
20050	Low	1720.0	ϵ_r	52.90
			σ	1.45
20175	Middle	1732.5	ϵ_r	52.90
			σ	1.46
20300	High	1745.0	ϵ_r	52.90
			σ	1.47

System Check 1800 Body (Continued):

Date: 18/02/2013

Validation Dipole and Serial Number: D1800V2; SN: 264

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	1800	22.0 °C	23.2 °C	ϵ_r	53.30	53.96	1.24	5.00
				σ	1.52	1.58	3.95	5.00
				1g SAR	37.80	37.24	-1.48	5.00
				10g SAR	20.10	19.84	-1.29	5.00

Dielectrics for Frequencies Tested

Channel Number	Channel Description	Frequency (MHz)	Parameters	
19957	Low	1710.7	ϵ_r	54.30
			σ	1.49
20175	Middle	1732.5	ϵ_r	54.20
			σ	1.51
20393	High	1754.3	ϵ_r	54.10
			σ	1.54

Date: 19/02/2013

Validation Dipole and Serial Number: D1800V2; SN: 264

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	1800	22.0 °C	23.2 °C	ϵ_r	53.30	53.96	1.24	5.00
				σ	1.52	1.58	3.95	5.00
				1g SAR	37.80	37.44	-0.95	5.00
				10g SAR	20.10	19.88	-1.09	5.00

Dielectrics for Frequencies Tested

Channel Number	Channel Description	Frequency (MHz)	Parameters	
19957	Low	1710.7	ϵ_r	54.30
			σ	1.49
20175	Middle	1732.5	ϵ_r	54.20
			σ	1.51
20393	High	1754.3	ϵ_r	54.10
			σ	1.54

System Check 1900 Head
Date: 05/02/2013
Validation Dipole and Serial Number: D1900V2; SN: 540

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Head	1900	24.0 °C	22.2 °C	ϵ_r	40.00	39.50	-1.25	5.00
				σ	1.40	1.43	2.24	5.00
				1g SAR	40.30	40.40	0.25	5.00
				10g SAR	21.00	20.80	-0.95	5.00

Dielectrics for Frequencies Tested

Channel Number	Channel Description	Frequency (MHz)	Parameters	
512	Low	1850.2	ϵ_r	40.00
			σ	1.38
661	Middle	1880.0	ϵ_r	39.90
			σ	1.41
810	High	1909.8	ϵ_r	39.80
			σ	1.44

Dielectrics for Frequencies Tested

Channel Number	Channel Description	Frequency (MHz)	Parameters	
9262	Low	1852.4	ϵ_r	40.00
			σ	1.38
9400	Middle	1880.0	ϵ_r	39.90
			σ	1.41
9538	High	1907.6	ϵ_r	39.80
			σ	1.44

System Check 1900 Body
Date: 01/02/2013
Validation Dipole and Serial Number: D1900V2; SN: 540

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	1900	24.0 °C	24.0 °C	ϵ_r	53.30	51.20	-3.94	5.00
				σ	1.52	1.53	0.69	5.00
				1g SAR	40.70	40.40	-0.74	5.00
				10g SAR	21.60	20.96	-2.96	5.00

Dielectrics for Frequencies Tested

Channel Number	Channel Description	Frequency (MHz)	Parameters	
9262	Low	1852.4	ϵ_r	51.30
			σ	1.48
9400	Middle	1880.0	ϵ_r	51.30
			σ	1.51
9538	High	1907.6	ϵ_r	51.20
			σ	1.54

Date: 04/02/2013
Validation Dipole and Serial Number: D1900V2; SN: 540

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	1900	24.0 °C	22.5 °C	ϵ_r	53.30	51.79	-2.83	5.00
				σ	1.52	1.52	-0.14	5.00
				1g SAR	40.70	40.00	-1.72	5.00
				10g SAR	21.60	20.80	-3.70	5.00

Dielectrics for Frequencies Tested

Channel Number	Channel Description	Frequency (MHz)	Parameters	
512	Low	1850.2	ϵ_r	51.90
			σ	1.46
661	Middle	1880.0	ϵ_r	51.80
			σ	1.50
810	High	1909.8	ϵ_r	51.80
			σ	1.53

System Check 2450 Head

Date: 25/02/2013

Validation Dipole and Serial Number: D2440V2; SN: 701

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Head	2450	24.0 °C	24.0 °C	ϵ_r	39.20	37.99	-3.09	5.00
				σ	1.80	1.83	1.86	5.00
				1g SAR	52.30	51.60	-1.34	5.00
				10g SAR	24.20	23.40	-3.31	5.00

Dielectrics for Frequencies Tested

Channel Number	Channel Description	Frequency (MHz)	Parameters	
1	Low	2412.0	ϵ_r	38.20
			σ	1.79
6	Middle	2437.0	ϵ_r	38.00
			σ	1.82
11	High	2462.0	ϵ_r	37.90
			σ	1.85

System Check 2450 Body

Date: 26/02/2013

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 °C	22.5 °C	ϵ_r	52.70	51.16	-2.92	5.00
				σ	1.95	1.97	1.21	5.00
				1g SAR	52.00	54.40	4.62	5.00
				10g SAR	24.10	24.68	2.41	5.00

Dielectrics for Frequencies Tested

Channel Number	Channel Description	Frequency (MHz)	Parameters	
1	Low	2412.0	ϵ_r	51.20
			σ	1.92
6	Middle	2437.0	ϵ_r	51.20
			σ	1.96
11	High	2462.0	ϵ_r	51.10
			σ	1.99

Date: 27/02/2013

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 °C	22.5 °C	ϵ_r	52.70	51.50	-2.28	5.00
				σ	1.95	2.02	3.79	5.00
				1g SAR	52.00	54.40	4.62	5.00
				10g SAR	24.10	24.40	1.24	5.00

Dielectrics for Frequencies Tested

Channel Number	Channel Description	Frequency (MHz)	Parameters	
1	Low	2412.0	ϵ_r	51.60
			σ	1.98
6	Middle	2437.0	ϵ_r	51.50
			σ	2.01
11	High	2462.0	ϵ_r	51.50
			σ	2.04

System Check 5200/5500/5800 Head

Date: 27/02/2013

Validation Dipole and Serial Number: D5GHzV2; SN: 1016

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Head	5200	24.0 °C	22.0 °C	ϵ_r	36.00	35.87	-0.36	10.00
				σ	4.66	4.57	-1.99	5.00
				1g SAR	78.10	77.70	-0.51	5.00
				10g SAR	22.30	22.60	1.35	5.00

Dielectrics for Frequencies Tested

Channel Number	Channel Description	Frequency (MHz)	Parameters	
36	Middle	5180.0	ϵ_r	36.00
			σ	4.57
52	Middle	5260.0	ϵ_r	35.90
			σ	4.64

Date: 27/02/2013

Validation Dipole and Serial Number: D5GHzV2; SN: 1016

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Head	5500	24.0 °C	22.0 °C	ϵ_r	35.60	35.39	-0.59	10.00
				σ	4.96	4.87	-1.74	5.00
				1g SAR	82.50	79.20	-4.00	5.00
				10g SAR	23.50	22.60	-3.83	5.00

Dielectrics for Frequencies Tested

Channel Number	Channel Description	Frequency (MHz)	Parameters	
52	Middle	5260.0	ϵ_r	35.90
			σ	4.64
104	Middle	5520.0	ϵ_r	35.60
			σ	4.92

Date: 27/02/2013

Validation Dipole and Serial Number: D5GHzV2; SN: 1016

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Head	5800	24.0 °C	22.0 °C	ϵ_r	35.30	35.12	-0.51	10.00
				σ	5.27	5.19	-1.50	5.00
				1g SAR	77.00	78.10	1.43	5.00
				10g SAR	21.90	21.80	-0.46	5.00

Dielectrics for Frequencies Tested

Channel Number	Channel Description	Frequency (MHz)	Parameters	
149	Middle	5745.0	ϵ_r	35.30
			σ	5.18

Appendix 6. 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	
	Head	Body
De-Ionized Water	52.87	71.30
Polysorbate 20	46.10	28.00
Salt	1.03	0.70

Ingredient (% by weight)	Frequency 1800/1900 MHz	
	Head	Body
De-Ionized Water	55.40	71.50
Polysorbate 20	44.22	28.00
Salt	0.38	0.50

Ingredient (% by weight)	Frequency 2450/2600 MHz	
	Head	Body
De-Ionized Water	55.75 ⁽¹⁾	71.70
Polysorbate 20	45.25 ⁽¹⁾	28.00
Salt	0.00	0.30

Simulated Tissues (Continued)

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

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

Note(s):

1. As per the recipe provided by National Physical Laboratory, the 2450 MHz Head Fluid recipe is mixed to the total percentage of weight is by 101.0 %.

Appendix 7. DASY4 System Details

A.7.1. DASY4 SAR Measurement System

UL, SAR measurement facility utilises the Dosimetric Assessment System (DASY™) manufactured by Schmid & Partner Engineering AG (SPEAG™) of Zurich, Switzerland. The DASY4 system is comprised of the robot controller, computer, near-field probe, probe alignment sensor, and the SAM phantom containing brain or muscle equivalent material. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF). A cell controller system contains the power supply, robot controller; teach pendant (Joystick), and remote control. This is used to drive the robot motors. The Staubli robot is connected to the cell controller to allow software manipulation of the robot. The data acquisition electronics (DAE) performs signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection etc. The DAE is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the PC plug-in card. The DAE3 utilises a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16-bit AD-converter and a command decoder and control logic unit. Transmission to the PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe-mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer.

A.7.2. DASY4 SAR System Specifications

Robot System

Positioner:	Stäubli Unimation Corp. Robot Model: RX90L
Repeatability:	0.025 mm
No. of Axis:	6
Serial Number:	F00/SD89A1/A/01
Reach:	1185 mm
Payload:	3.5 kg
Control Unit:	CS7
Programming Language:	V+

Robot System

Positioner:	Stäubli Unimation Corp. Robot Model: RX90L
Repeatability:	0.025 mm
No. of Axis:	6
Serial Number:	F01/5J86A1/A/01
Reach:	1185 mm
Payload:	3.5 kg
Control Unit:	CS7
Programming Language:	V+

Robot System

Positioner:	Stäubli Unimation Corp. Robot Model: TX60L
Repeatability:	±0.030 mm
No. of Axis:	6
Serial Number:	F12/5MZ7A1/A/01
Reach:	920 mm
Payload:	2.0 kg
Control Unit:	CS8C
Programming Language:	V+

Data Acquisition Electronic (DAE) System

Serial Number:	DAE3 SN:432
Serial Number:	DAE3 SN:431
Serial Number:	DAE3 SN:450

DASY4 SAR System Specifications (Continued)	
PC Controller	
PC:	Dell Precision 340
Operating System:	Windows 2000
Data Card:	DASY4 Measurement Server
Serial Number:	1080
Data Converter	
Features:	Signal Amplifier, multiplexer, A/D converted and control logic.
Software:	DASY4 Software
Connecting Lines:	Optical downlink for data and status info. Optical uplink for commands and clock.
PC Interface Card	
Function:	24 bit (64 MHz) DSP for real time processing Link to DAE3 16 nit A/D converter for surface detection system serial link to robot direct emergency stop output for robot.
E-Field Probe	
Model:	EX3DV4
Serial No:	3814
Construction:	Triangular core
Frequency:	10 MHz to >6 GHz
Linearity:	±0.2 dB (30 MHz to 6 GHz)
Probe Length (mm):	337
Probe Diameter (mm):	10
Tip Length (mm):	9
Tip Diameter (mm):	2.5
Sensor X Offset (mm):	1
Sensor Y Offset (mm):	1
Sensor Z Offset (mm):	1
E-Field Probe	
Model:	ES3DV3
Serial No:	3304
Construction:	Triangular core
Frequency:	10 MHz to >4 GHz
Linearity:	±0.2 dB (30 MHz to 4 GHz)
Probe Length (mm):	337
Probe Diameter (mm):	10
Tip Length (mm):	10
Tip Diameter (mm):	4
Sensor X Offset (mm):	2
Sensor Y Offset (mm):	2
Sensor Z Offset (mm):	2

DASY4 SAR System Specifications (Continued)	
E-Field Probe	
Model:	ET3DV6
Serial No:	1587
Construction:	Triangular core
Frequency:	10 MHz to 2.55GHz
Linearity:	±0.2 dB (30 MHz to 2.55GHz)
Probe Length (mm):	337
Probe Diameter (mm):	10
Tip Length (mm):	10
Tip Diameter (mm):	6.8
Sensor X Offset (mm):	2.7
Sensor Y Offset (mm):	2.7
Sensor Z Offset (mm):	2.7
Phantom	
Phantom:	SAM Phantom, Eli Phantom
Shell Material:	Fibreglass
Thickness:	2.0 ±0.1 mm

Appendix 8. 3G Test set-up

3G (12.K RMC / HSDPA / HSUPA) setup

To switch from 2G to 3G, on the system config screen choose Format Switch and select WCDMA. The Call Setup Screen as shown in figure 1 pops up.

Call Setup Screen						
Call Control	Active Cell Operating Mode				Call Parms	
Operating Mode	UE Information				Cell Power	
Active Cell	INSI: INEI(SU): (---) Power Class:				-35.00 dBm/3.84 MHz	
	UE Expected Open Loop Transmit Power				Channel Type	
	Initial PRACH TX Power: -60.00 dBm Initial DPCCH TX Power: -11.55 dBm				12.2k RMC	
Originate Call	Call Processing Status				Paging Service	
	Current Service Type: None RN Status: None GMM State: None Current DPCH Offset: 0 chips				RB Test Mode	
Paging Parameters	HSUPA Information		HSDPA Information		HSPA Parameters	
	Rep EDCH Cat/Ext: Unrep/Unrep Last received E-TFCI: ---- Throughput: ---- kbps Acks Transmitted: ----		Cur UE HS-DSCH Cat: ---- Block Error Ratio: ---- % Throughput: ---- kbps Blocks Transmitted: ----		34,121 Preset Call Configs	
Handovers	Active Cell				Channel (UARFCN) Parms	
	Idle				Sys Type: UTRA FDD	
Clear UE Info	IntRef				1 of 3	
1 of 5						

Figure 1: 3G Call Setup Screen

For a 12.2k RMC call follow the steps below.

8.1. Steps for 12.2k RMC

1. Ensure that the Operating Mode of the cell is off before setting up the instrument.
2. On the Call Setup Screen, under Call Parameters, press the button against Cell Power. The Cell Power value is set to about -35dBm to account for all the losses and ensure sufficient signal strength to the EUT.
3. The Channel Type is selected to 12.2k RMC. Press button against Channel (UARFCN) Parms select the correct Downlink Channel for the required UMTS FDD Band.
4. On the Call Setup Screen, under Call Parameters, press the button against HSPA Parameters. Under HSDPA Parameters on page 1, press HSDPA Uplink parameters and set the Delta ACK, Delta NACK, Delta CQI values to 8. Under HSDPA Parms itself, press HSDPA RB Test Mode Setup button and then the HSDPA RB Test Mode Settings and change HS-DSCH Data Pattern to All Ones.

Call Setup Screen									
Call Control	Active Cell Operating Mode						HSDPA Parm		
	UE Information INSI: INEI(SU): (--) Power Class:						HSDPA RB Test Node Setup		
	UE Expected Open Loop Transmit Power Initial PRACH TX Power: -60.00 dBm Initial DPCCH TX Power: -11.55 dBm						UE Category Parameters ▾		
	HSDPA Uplink Parameters				Value				
	DeltaACK				8		MAC-(e)hs Parameters ▾		
	DeltaNACK				8				
	DeltaCQI				8				
	Ack-Nack Repetition Factor				1		HSDPA Uplink Parameters ▾		
	CQI Feedback Cycle (k)				2 ms				
	CQI Repetition Factor				1				
	Close Menu							Return	
		Active Cell Idle			Sys Type: UTRA FDD				
		IntRef				1 of 2			

Figure 2: HSDPA Parameters

- On the Call Setup Screen, under Call Parameters, on page 2, check if the DL DTCH Data is set to All Ones. On page 3, ensure that the Receiver is set to Manual. On page 3 itself, under UL CL Power Ctrl Parameters, UL CL Power Ctrl Mode is set to All Up Bits.

Call Setup Screen									
Call Control	Active Cell Operating Mode						Call Parm		
Operating Mode	UE Information INSI: INEI(SU): (--) Power Class:						DL DTCH Data		
Active Cell	UE Expected Open Loop Transmit Power Initial PRACH TX Power: -60.00 dBm Initial DPCCH TX Power: -11.55 dBm						All Ones		
Originate Call	Call Processing Status Current Service Type: None RIM Status: None GMM State: None Current DPCH Offset: 0 chips						RLC Reestablish Auto		
Paging Parameters ▾	HSUPA Information Rep EDCH Cat/Ext: Unrep/Unrep Last received E-TFCI: ---- Throughput: ---- kbps Acks Transmitted: ----		HSDPA Information Cur UE HS-DSCH Cat: ---- Block Error Ratio: ---- % Throughput: ---- kbps Blocks Transmitted: ----				Call Limit State Off		
Handovers							Call Drop Timer On		
Clear UE Info							SRB Parameters ▾		
		Active Cell Idle			Sys Type: UTRA FDD				
1 of 5		IntRef				2 of 3			

Figure 3: DL DTCH Data Parm

Call Setup Screen						
Call Control	Active Cell Operating Mode				Call Params	
Close Menu	UE Information				UE Target Power	
	INSI: INEI(SU): (--) Power Class:				-5 dBm	
	UE Expected Open Loop Transmit Power				UL CL Power Ctrl Parameters	
	Initial PRACH TX Power: -60.00 dBm Initial DPCCH TX Power: -11.55 dBm					
	UL CL Power Ctrl Parameters			Value		
	UL CL Power Ctrl Mode			All Up bits		Send Step Up TPC Bit Pattern
	UL CL Power Ctrl Algorithm			Two		
	UL CL Power Ctrl Stepsize			1 dB		Send Step Down TPC Bit Pattern
						Receiver Control
			Active Cell Idle		Sys Type: UTRA FDD	
			IntRef		3 of 3	

Figure 4: UL CL Power Ctrl Parameters

6. On the Call Setup Screen, under Call Control, page 2, Cell Parameters, it is ensured that PS Domain information is kept as Absent for RMC.

Call Setup Screen						
Call Control	Active Cell Operating Mode				Call Params	
Additional Screens	UE Information				Cell Power	
	INSI: INEI(SU): (--) Power Class:				-35.00 dBm/3.84 MHz	
	UE Expected Open Loop Transmit Power				Channel Type	
	Initial PRACH TX Power: -60.00 dBm Initial DPCCH TX Power: -11.55 dBm				12.2k RMC	
	Cell Parameters			Value		Paging Service
	BCCH Update Page			Inhibit		RB Test Mode
	PS Domain Information			Absent		HSPA Parameters
	NCC (Mobile Country Code)			1		
	NMC (Mobile Network Code)			1		34,121 Preset Call Configs
	NMC (Mobile Network Code) Length			Auto		
LAC (Local Area Code)			1		Channel (UARFCN) Params	
RAC (Routing Area Code)			1			
Cell Identity			1			
			Active Cell Idle		Sys Type: UTRA FDD	
			IntRef		1 of 3	

Figure 5: Cell Parameters

7. On the same page under Uplink Parameters the maximum Uplink Transmit Power is made 24dBm. Uplink DPCH Bc/Bd Control Settings are kept at Auto for RMC. These vary according for HSDPA and HSUPA as per the values given in KDB 941225 D01 SAR test for 3G devices v02.

Call Setup Screen										
Call Control	Active Cell Operating Mode						Call Parm			
Additional Screens	UE Information						Cell Power	-35.00		
	INSI: INEI(SU): (--) Power Class:						dBm/3.84 MHz	Channel Type		
Cell Parameters	UE Expected Open Loop Transmit Power						12.2k RNC			
Generator Info	Initial PRACH TX Power: -60.00 dBm Initial DPCCH TX Power: -11.55 dBm						Paging Service			
							RB Test Mode			
Uplink Parameters	Uplink Parameters					Value	HSPA Parameters 34,121 Preset Call Configs			
	PRACH Preambles					64				
	PRACH Ramping Cycles(MMAX)					2				
	Available Subchannels (Bit Mask)					000000000001				
	Uplink DPCH Scrambling Code					0				
UE Rep Neas	Uplink DPCH Bc/Bd Control					Auto	Channel (UARFCH) Parm			
	Manual Uplink DPCH Bc					8				
Close Menu	Manual Uplink DPCH Bd					15	1 of 3			
	Maximum Uplink Transmit Power Level					24 dBm				
		Active Cell			Sys Type: UTRA FDD					
		Idle								
2 of 5				IntRef						

Figure 6: Uplink Parameters

- On page 3 under Call Control, for the RB Test Mode setup, Asymmetric RMC CN Domain is ensured to be in CS Domain for RMC call.

Call Setup Screen										
Call Control	Active Cell Operating Mode						Call Parm			
	UE Information						Cell Power	-35.00		
	INSI: INEI(SU): (--) Power Class:						dBm/3.84 MHz	Channel Type		
	UE Expected Open Loop Transmit Power						12.2k RNC			
	Initial PRACH TX Power: -60.00 dBm Initial DPCCH TX Power: -11.55 dBm						Paging Service			
Voice Call	RB Test Mode Settings					Value	RB Test Mode			
	Uplink DTCH RNC CRC Presence					Present	HSPA Parameters 34,121 Preset Call Configs			
	Uplink Dummy DCCH Data					Off				
	UE Loopback Type					Type 1				
	Asymmetric RNC Loopback Messaging					Close/Open				
Asymmetric RNC CN Domain					CS Domain					
Close Menu							Channel (UARFCH) Parm			
		Active Cell			Sys Type: UTRA FDD					
		Idle								
3 of 5				IntRef						

Figure 7: RB Test Mode Settings

- After the test set has been set up, change the cell Operating Mode to Active Cell and originate a call.

8.2. Steps for 12.2k RMC + HSDPA/HSUPA

1. Most of the steps to be followed are as in the case of 12.2k RMC however, some of the settings need to be changed. The Channel Type is changed to 12.2k RMC+HSDPA or 12.2k RMC+HSUPA as required.
2. For HSDPA and HSUPA, the settings remain same as the case for RMC but the PS Domain is made Present for Cell Parameters (Figure 5) and RB Test Mode Setup (Figure 7).
3. The following tables taken from FCC 3G SAR procedures (KDB 941225 D01 SAR test for 3G devices v02) below were applied to the Agilent 8960 series 10 wireless communications test set which supports 3G / HSDPA release 5 / HSUPA release 6.

Sub-test 1 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 5 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 MPR is based on the relative CM difference.

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

- For HSUPA the Serving Grant Parameter needs to be set. On the Call Setup Screen, under Call Parameters, press the button against HSPA Parameters. On the new screen that pops up, press HSUPA and Serving Grant. The Serving Grant is set according to the table for HSPA in the KDB (AG Index). The correct AG is chosen from the Single Shot AG. Consecutively, the RG Setup AG is set as per the ratio set on Single Shot AG.

Call Setup Screen																													
Call Control	Active Cell Operating Mode							Serving Grant																					
Operating Mode	<table border="1"> <thead> <tr> <th colspan="4">UE Information</th> </tr> </thead> <tbody> <tr> <td>INSI:</td> <td colspan="3"></td> </tr> <tr> <td>INEI(SU):</td> <td colspan="3">(--)</td> </tr> <tr> <td>Power Class:</td> <td colspan="3"></td> </tr> </tbody> </table>							UE Information				INSI:				INEI(SU):	(--)			Power Class:				AG Mode					
UE Information																													
INSI:																													
INEI(SU):	(--)																												
Power Class:																													
Active Cell								Single Shot																					
								Single Shot AG																					
								31: 6(168/15)^2																					
Originate Call	<table border="1"> <thead> <tr> <th colspan="4">UE Expected Open Loop Transmit Power</th> </tr> </thead> <tbody> <tr> <td>Initial PRACH TX Power:</td> <td colspan="3">-60.00 dBm</td> </tr> <tr> <td>Initial DPCH TX Power:</td> <td colspan="3">-11.55 dBm</td> </tr> </tbody> </table>							UE Expected Open Loop Transmit Power				Initial PRACH TX Power:	-60.00 dBm			Initial DPCH TX Power:	-11.55 dBm			Send Single Shot Absolute Grant									
UE Expected Open Loop Transmit Power																													
Initial PRACH TX Power:	-60.00 dBm																												
Initial DPCH TX Power:	-11.55 dBm																												
								RB Setup AG																					
Paging Parameters	<table border="1"> <thead> <tr> <th colspan="4">Call Processing Status</th> </tr> </thead> <tbody> <tr> <td>Current Service Type:</td> <td colspan="3">None</td> </tr> <tr> <td>MM Status:</td> <td colspan="3">None</td> </tr> <tr> <td>GMN State:</td> <td colspan="3">None</td> </tr> <tr> <td>Current DPCH Offset:</td> <td colspan="3">0 chips</td> </tr> </tbody> </table>							Call Processing Status				Current Service Type:	None			MM Status:	None			GMN State:	None			Current DPCH Offset:	0 chips			37: 6(168/15)^2	
Call Processing Status																													
Current Service Type:	None																												
MM Status:	None																												
GMN State:	None																												
Current DPCH Offset:	0 chips																												
Handovers	<table border="1"> <thead> <tr> <th colspan="2">HSUPA Information</th> <th colspan="2">HSDPA Information</th> </tr> </thead> <tbody> <tr> <td>Rep EDCH Cat/Ext:</td> <td>Unrep/Unrep</td> <td>Cur UE HS-DSCH Cat:</td> <td>----</td> </tr> <tr> <td>Last received E-TFCI:</td> <td>----</td> <td>Block Error Ratio:</td> <td>---- %</td> </tr> <tr> <td>Throughput:</td> <td>---- kbps</td> <td>Throughput:</td> <td>---- kbps</td> </tr> <tr> <td>Acks Transmitted:</td> <td>----</td> <td>Blocks Transmitted:</td> <td>----</td> </tr> </tbody> </table>				HSUPA Information		HSDPA Information		Rep EDCH Cat/Ext:	Unrep/Unrep	Cur UE HS-DSCH Cat:	----	Last received E-TFCI:	----	Block Error Ratio:	---- %	Throughput:	---- kbps	Throughput:	---- kbps	Acks Transmitted:	----	Blocks Transmitted:	----	AG Pattern Parameters		Return		
HSUPA Information		HSDPA Information																											
Rep EDCH Cat/Ext:	Unrep/Unrep	Cur UE HS-DSCH Cat:	----																										
Last received E-TFCI:	----	Block Error Ratio:	---- %																										
Throughput:	---- kbps	Throughput:	---- kbps																										
Acks Transmitted:	----	Blocks Transmitted:	----																										
Clear UE Info					Active Cell		Sys Type: UTRA FDD																						
					Idle																								
1 of 5					IntRef		1 of 2																						

Figure 8: Serving Grant Example

Appendix 9. 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 Parm
Operating Mode	UE Information		Cell Power
Cell Off	INSI:	Power Class:	-75.00
	INEL(SU):	(--)	dBm/3.84 MHz
	Detected PRACH Sig: ----		Channel Type
	Called Party Number:		12.2k RMC
	UE Expected Open Loop Transmit Power		Paging Service
	Init PRACH TX Pou: -22.70 dBm	Init DPCCCH TX Pou: -11.55 dBm	RB Test Mode
Originate Call	Current Service Type		
	None		
Paging Parameters	Call Processing Status		HSPA Parameters
	RRC State:	Operating Mode	
	MM Status:	Active Cell	Power State: Off
	GMN State:	FDD Test	Mode State: Off
Handovers	HSUPA In CU		Offset: 0 chips
	UE Rep E-DCH	Cell Off	
	Last Happy Bit		34.121 Preset Call Configs
	Throughput:		
Clear UE Info	ACKs Transmitt		Channel (UARFCH) Parm
	Background	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 Parms	
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	
	Channel	Level (dB)		Chan	Level (dB)		Chan			
OCNS Info Screen		Current	Desired	QVSF	Code	Current	Desired	QVSF	Code	
	CPICH:	Off	-3.30	256	0	Off	Off	256	0	
DC-HSDPA DL Code Chan Info	P-CCPCH/SCH:	Off	-5.30	256	1	Off	Off	256	1	
	S-CCPCH:	Off	-10.30	64	2					
Return	FICH:	Off	-8.30	256	2	Off	Off	256	2	
	AICH:	Off	-9.90	256	3					
	(F-)DPCH:	Off	Off	128	7					
	E-AGCH:	Off	Off	256	42					
	E-HICH:	Off	Off	128	22					
	E-RGCH:	Off	Off	128	22					
	HS-SCCH 1:	Off	Off	128	2	Off	Off	128	2	
	HS-SCCH 2:	Off	Off	128	3	Off	Off	128	3	
	HS-SCCH 3:									
	HS-SCCH 4:									
	HS-PDSCHs:	Off	Off	16	1-15	Off	Off	16	1-15	
	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 Parms 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 Params 2 of 2 -> Secondary Serv Cell Params (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 Parms		
Operating Mode	UE Information						Cell Power		
Active Cell	IMSI: 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		
Originate Call	Current Service Type						RB Test Mode		
	None								
	Call Processing Status						HSPA Parameters		
Paging Parameters	RRC State: Idle		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			Channel (UARFCN) Parms		
	Rep EDCH Cat/Ext: 6/Unrep		Cur UE HS-DSCH Cat: 24		Block Error Ratio: ---- %				
	Last Happy Bit: None		Throughput: ---- kbps		Throughput: ---- kbps				
	Throughput: ---- kbps		ACKs Transmitted: ----		Blocks Transmitted: ----				
Clear UE Info			Active Cell		Sys Type: UTRA FDD				
			Idle		Logging: No Conn				
1 of 6		DBUS-INT		IntRef	Offset				1 of 3

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 Parms		
Operating Mode	UE Information						Cell Power		
Active Cell	IMSI: 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			Channel (UARFCN) Parms		
	Rep EDCH Cat/Ext: 6/Unrep		Cur UE HS-DSCH Cat: 24		Block Error Ratio: 0 %				
	Last Happy Bit: None		Throughput: 42101 kbps		Throughput: ---- kbps				
	Throughput: ---- kbps		ACKs Transmitted: ----		Blocks Transmitted: 115500				
Clear UE Info			Active Cell		Sys Type: UTRA FDD				
			Connected		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 Parms	
DL Code Channel Info Screen	Serving Cell Primary Scrambling Code:				0				Cell Power	
	Secondary Serving Cell Primary Scrambling Code:				2				-25.00	
Generated Power Info Screen	Channel	Serving Cell DL Chan Info				Sec Cell DL Chan Info				dBm/3.84 MHz
		Level (dB) Current	Level (dB) Desired	Chan OVSF	Chan Code	Level (dB) Current	Level (dB) Desired	Chan OVSF	Chan Code	Channel Type
OCNS Info Screen	CPICH:	-8.00	-8.00	256	0	-8.00	-8.00	256	0	12.2k + HSDPA
DC-HSDPA DL Code Chan Info	P-CCPCH/SCH:	-20.00	-20.00	256	1	-20.00	-20.00	256	1	Paging Service
	S-CCPCH:	Off	Off	64	2					RB Test Mode
Return	PICH:	Off	Off	256	2	Off	Off	256	2	
	AICH:									
Return	(F-)DPCH:	-30.00	-30.00	128	7					HSPA Parameters
	E-AGCH:	Off	Off	256	42					
Return	E-HICH:	Off	Off	128	22					
	E-RGCH:	Off	Off	128	22					
Return	HS-SCCH 1:	-20.00	-20.00	128	2	-20.00	-20.00	128	2	34,121 Preset Call Configs
	HS-SCCH 2:	-20.00	-20.00	128	3	-20.00	-20.00	128	3	
Return	HS-SCCH 3:									
	HS-SCCH 4:									
Return	HS-PDSCHs:	-1.00	-1.00	16	1-15	-1.00	-1.00	16	1-15	Channel (UARFCN) Parms
	Comp OCNS:	-17.91	-17.91	128	HSDPA	-17.65	-17.65	128	HSDPA	
		Active Cell Connected				Sys Type: UTRA FDD				1 of 3
						Logging: No Conn				
		DBUS-INT		IntRef	Offset					

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	Active Cell						Cell Power																										
	<table border="1"> <thead> <tr> <th colspan="4">UE Information</th> </tr> </thead> <tbody> <tr> <td>IMSI:</td> <td>001012345678901</td> <td>Power Class:</td> <td>4</td> </tr> <tr> <td>IMEI(SU):</td> <td>352358040214948 (--)</td> <td>Detected PRACH Sig:</td> <td>0</td> </tr> <tr> <td colspan="4">Called Party Number:</td> </tr> <tr> <th colspan="4">UE Expected Open Loop Transmit Power</th> </tr> <tr> <td>Init PRACH TX Pou:</td> <td>-60.00 dBm</td> <td>Init DPCH TX Pou:</td> <td>-11.55 dBm</td> </tr> </tbody> </table>						UE Information				IMSI:	001012345678901	Power Class:	4	IMEI(SU):	352358040214948 (--)	Detected PRACH Sig:	0	Called Party Number:				UE Expected Open Loop Transmit Power				Init PRACH TX Pou:	-60.00 dBm	Init DPCH TX Pou:	-11.55 dBm	-25.00		
UE Information																																	
IMSI:	001012345678901	Power Class:	4																														
IMEI(SU):	352358040214948 (--)	Detected PRACH Sig:	0																														
Called Party Number:																																	
UE Expected Open Loop Transmit Power																																	
Init PRACH TX Pou:	-60.00 dBm	Init DPCH TX Pou:	-11.55 dBm																														
							dBm/3.84 MHz																										
							Channel Type																										
							12.2k + HSDPA																										
End Call	Current Service Type						Paging Service																										
	RB Test Mode - HSDPA						RB Test Mode																										
	Call Processing Status						HSPA Parameters																										
Paging Parameters	RRC State:	CELL_DCH	Soft Handover State:	Off																													
	MM Status:	None	Compressed Mode State:	Off																													
	MM 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																													
	Active Cell			Sys Type: UTRA FDD																													
	Connected			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 (UARFCN) Info	Secondary Serving Cell Status						Cell Power																																																						
	Current Secondary Serving Cell Status: Configured-Inactive						-25.00																																																						
							dBm/3.84 MHz																																																						
HSPA Information	DC-HSDPA Information						Channel Type																																																						
	<table border="1"> <thead> <tr> <th></th> <th>Summary</th> <th>Serving Cell</th> <th>Secondary Serving Cell</th> </tr> </thead> <tbody> <tr> <td>Block Error Ratio:</td> <td>0 %</td> <td>0 %</td> <td>---- %</td> </tr> <tr> <td>Throughput (kbps):</td> <td>21082</td> <td>21082</td> <td>0</td> </tr> <tr> <td>Blocks Transmitted:</td> <td>66000</td> <td>66000</td> <td>0</td> </tr> <tr> <td>ACKs Received:</td> <td>65958</td> <td>65958</td> <td>0</td> </tr> <tr> <td>NACKs Received:</td> <td>42</td> <td>42</td> <td>0</td> </tr> <tr> <td>statDTXs Received:</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Count of Rep CQI Lim:</td> <td>----</td> <td>----</td> <td>----</td> </tr> <tr> <td>Last Received CQI:</td> <td></td> <td>30</td> <td>30</td> </tr> <tr> <td>Max Allowed CQI:</td> <td></td> <td>----</td> <td>----</td> </tr> <tr> <td>Test Mode User Def TBS:</td> <td></td> <td>42192</td> <td>42192</td> </tr> <tr> <td>PS Data User Def TBS:</td> <td></td> <td>7298</td> <td>7298</td> </tr> <tr> <td>Last Sig Meas Pur Offs (dB):</td> <td></td> <td>6.0</td> <td>6.0</td> </tr> </tbody> </table>							Summary	Serving Cell	Secondary Serving Cell	Block Error Ratio:	0 %	0 %	---- %	Throughput (kbps):	21082	21082	0	Blocks Transmitted:	66000	66000	0	ACKs Received:	65958	65958	0	NACKs Received:	42	42	0	statDTXs Received:	0	0	0	Count of Rep CQI Lim:	----	----	----	Last Received CQI:		30	30	Max Allowed CQI:		----	----	Test Mode User Def TBS:		42192	42192	PS Data User Def TBS:		7298	7298	Last Sig Meas Pur Offs (dB):		6.0	6.0	12.2k + HSDPA		
	Summary	Serving Cell	Secondary Serving Cell																																																										
Block Error Ratio:	0 %	0 %	---- %																																																										
Throughput (kbps):	21082	21082	0																																																										
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statDTXs Received:	0	0	0																																																										
Count of Rep CQI Lim:	----	----	----																																																										
Last Received CQI:		30	30																																																										
Max Allowed CQI:		----	----																																																										
Test Mode User Def TBS:		42192	42192																																																										
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	Active Cell			Sys Type: UTRA FDD																																																									
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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 Parms			
Channel (UARFCN) Info	Secondary Serving Cell Status						Cell Power	-25.00		
	Current Secondary Serving Cell Status: Configured-Active						dBm/3.84 MHz	Channel Type		
HSPA Information	DC-HSDPA Information						12.2k + HSDPA			
		Summary	Serving Cell	Secondary Serving Cell				Paging Service		
E-TFCI Recording Information	Block Error Ratio:	0 %	0 %	0 %				RB Test Mode		
	Throughput (kbps):	41996	21064	20941				HSPA Parameters		
HSDPA Information	Blocks Transmitted:	11000	6000	6000				34,121 Preset Call Configs ▾		
	ACKs Received:	10949	5991	5956				Channel (UARFCN) Parms		
Clear UE Info	NACKs Received:	51	9	44						
	statDTXs Received:	0	0	0						
Return	Count of Rep CQI Lim:	----	----	----						
	Last Received CQI:		30	30						
1 of 2	Max Allowed CQI:		----	----						
	Test Node User Def TBS:		42192	42192						
DBUS-INT	PS Data User Def TBS:		7298	7298						
	Last Sig Meas Pur Offs (dB):		6.0	6.0						
		Active Cell Connected			Sys Type: UTRA FDD					
					Logging: No Conn					
		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.