

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, 2600 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, 2600 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: 17/06/2013

Validation Dipole and Serial Number: D900V2; SN: 035

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Head	900	23.0 °C	21.6 °C	ϵ_r	41.50	40.95	-1.33	5.00
				σ	0.97	0.95	-1.80	5.00
				1g SAR	10.50	10.16	-3.24	5.00
				10g SAR	6.74	6.60	-2.08	5.00

Date: 21/06/2013

Validation Dipole and Serial Number: D900V2; SN: 035

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Head	900	23.0 °C	21.8 °C	ϵ_r	41.50	41.20	-0.72	5.00
				σ	0.97	0.98	1.03	5.00
				1g SAR	10.50	10.72	2.10	5.00
				10g SAR	6.74	6.96	3.26	5.00

Date: 24/06/2013

Validation Dipole and Serial Number: D900V2; SN: 035

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Head	900	23.0 °C	22.5 °C	ϵ_r	41.50	40.40	-2.65	5.00
				σ	0.97	0.97	-0.36	5.00
				1g SAR	10.50	10.80	2.86	5.00
				10g SAR	6.74	7.04	4.45	5.00

System Check 900 Head (Continued):**Date: 25/06/2013****Validation Dipole and Serial Number: D900V2; SN: 035**

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Head	900	23.0°C	22.5°C	ϵ_r	41.50	40.40	-2.65	5.00
				σ	0.97	0.97	-0.36	5.00
				1g SAR	10.50	10.52	0.19	5.00
				10g SAR	6.74	6.84	-1.48	5.00

System Check 900 Body

Date: 18/06/2013

Validation Dipole and Serial Number: D900V2; SN: 035

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	900	23.0°C	21.5°C	ϵ_r	55.00	53.46	-2.80	5.00
				σ	1.05	1.04	-1.33	5.00
				1g SAR	10.80	10.68	-1.11	5.00
				10g SAR	6.96	7.04	1.15	5.00

Date: 18/06/2013

Validation Dipole and Serial Number: D900V2; SN: 035

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	900	23.0°C	21.7°C	ϵ_r	55.00	53.75	-2.27	5.00
				σ	1.05	1.04	-1.43	5.00
				1g SAR	10.80	11.04	2.22	5.00
				10g SAR	6.96	7.20	3.45	5.00

Date: 19/06/2013

Validation Dipole and Serial Number: D900V2; SN: 035

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	900	23.0 °C	21.5 °C	ϵ_r	55.00	53.46	-2.80	5.00
				σ	1.05	1.04	-1.33	5.00
				1g SAR	10.80	10.44	-3.33	5.00
				10g SAR	6.96	6.84	-1.72	5.00

Date: 26/06/2013

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	22.0 °C	ϵ_r	55.00	53.80	-2.18	5.00
				σ	1.05	1.04	-1.10	5.00
				1g SAR	10.80	10.68	-1.11	5.00
				10g SAR	6.96	7.00	0.57	5.00

System Check 1800 Head

Date: 19/06/2013

Validation Dipole and Serial Number: D1800V2; SN: 264

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Head	1800	23.0°C	22.2°C	ϵ_r	40.00	38.61	-3.48	5.00
				σ	1.40	1.41	0.57	5.00
				1g SAR	37.20	35.52	-4.52	5.00
				10g SAR	19.60	19.00	-3.06	5.00

Date: 20/06/2013

Validation Dipole and Serial Number: D1800V2; SN: 264

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Head	1800	23.0°C	22.2°C	ϵ_r	40.00	39.18	-2.05	5.00
				σ	1.40	1.44	2.79	5.00
				1g SAR	37.20	37.60	-1.08	5.00
				10g SAR	19.60	19.72	0.61	5.00

System Check 1800 Body**Date: 17/06/2013****Validation Dipole and Serial Number: D1800V2; SN: 264**

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	1800	23.0 °C	22.2 °C	ϵ_r	53.30	51.84	-2.74	5.00
				σ	1.52	1.56	2.70	5.00
				1g SAR	37.80	37.32	-1.27	5.00
				10g SAR	20.10	20.16	0.30	5.00

Date: 18/06/2013**Validation Dipole and Serial Number: D1800V2; SN: 264**

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	1800	23.0 °C	22.2 °C	ϵ_r	53.30	51.84	-2.74	5.00
				σ	1.52	1.56	2.70	5.00
				1g SAR	37.80	37.04	-2.01	5.00
				10g SAR	20.10	19.92	-0.90	5.00

Date: 19/06/2013**Validation Dipole and Serial Number: D1800V2; SN: 264**

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	1800	23.0 °C	23.7 °C	ϵ_r	53.30	52.61	-1.29	5.00
				σ	1.52	1.49	-1.71	5.00
				1g SAR	37.80	37.96	0.42	5.00
				10g SAR	20.10	20.40	1.49	5.00

System Check 1900 Head**Date: 20/06/2013****Validation Dipole and Serial Number: D1900V2; SN: 537**

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Head	1900	24.0°C	23.0°C	ϵ_r	40.00	38.50	-3.75	5.00
				σ	1.40	1.45	3.60	5.00
				1g SAR	39.40	39.72	0.81	5.00
				10g SAR	20.70	20.84	0.68	5.00

Date: 20/06/2013**Validation Dipole and Serial Number: D1900V2; SN: 537**

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Head	1900	24.0°C	23.0°C	ϵ_r	40.00	39.36	-1.60	5.00
				σ	1.40	1.45	3.22	5.00
				1g SAR	39.40	40.80	3.55	5.00
				10g SAR	20.70	20.60	-0.48	5.00

Date: 21/06/2013**Validation Dipole and Serial Number: D1900V2; SN: 537**

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Head	1900	24.0°C	23.0°C	ϵ_r	40.00	38.50	-3.75	5.00
				σ	1.40	1.45	3.60	5.00
				1g SAR	39.40	39.56	0.41	5.00
				10g SAR	20.70	20.80	0.48	5.00

Date: 24/06/2013**Validation Dipole and Serial Number: D1900V2; SN: 537**

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Head	1900	24.0 °C	23.0 °C	ϵ_r	40.00	38.82	-2.95	5.00
				σ	1.40	1.41	0.43	5.00
				1g SAR	39.40	38.80	-1.52	5.00
				10g SAR	20.70	20.80	0.48	5.00

System Check 1900 Body**Date: 20/06/2013****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 °C	22.5 °C	ϵ_r	53.30	54.13	1.56	5.00
				σ	1.52	1.53	0.63	5.00
				1g SAR	40.50	39.28	-3.01	5.00
				10g SAR	21.40	21.04	-1.68	5.00

Date: 21/06/2013**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 °C	22.5 °C	ϵ_r	53.30	54.13	1.56	5.00
				σ	1.52	1.53	0.63	5.00
				1g SAR	40.50	39.40	-2.72	5.00
				10g SAR	21.40	21.16	-1.12	5.00

Date: 21/06/2013**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 °C	23.5 °C	ϵ_r	53.30	52.17	-2.12	5.00
				σ	1.52	1.57	3.33	5.00
				1g SAR	40.50	40.00	-1.23	5.00
				10g SAR	21.40	21.08	-1.50	5.00

Date: 22/06/2013**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 °C	23.5 °C	ϵ_r	53.30	52.17	-2.12	5.00
				σ	1.52	1.57	3.33	5.00
				1g SAR	40.50	40.00	-1.23	5.00
				10g SAR	21.40	21.16	-1.12	5.00

System Check 1900 Body (Continued):**Date: 24/06/2013****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 °C	23.8 °C	ϵ_r	53.30	50.90	-4.50	5.00
				σ	1.52	1.57	3.33	5.00
				1g SAR	40.50	38.72	-4.40	5.00
				10g SAR	21.40	20.56	-3.93	5.00

System Check 2450 Head**Date: 17/06/2013****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	40.06	2.19	5.00
				σ	1.80	1.85	2.54	5.00
				1g SAR	52.30	50.80	-2.87	5.00
				10g SAR	24.20	23.88	-1.32	5.00

Date: 18/06/2013**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	40.06	2.19	5.00
				σ	1.80	1.85	2.54	5.00
				1g SAR	52.30	50.80	-2.87	5.00
				10g SAR	24.20	23.72	-1.98	5.00

System Check 2450 Body

Date: 18/06/2013

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	22.8 °C	ϵ_r	52.70	52.55	-0.28	5.00
				σ	1.95	2.00	2.61	5.00
				1g SAR	52.00	52.40	0.77	5.00
				10g SAR	24.10	24.00	-0.41	5.00

Date: 19/06/2013

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	22.8°C	ϵ_r	52.70	52.55	-0.28	5.00
				σ	1.95	2.00	2.61	5.00
				1g SAR	52.00	52.80	1.54	5.00
				10g SAR	24.10	24.12	0.08	5.00

System Check 2600 Head

Date: 27/06/2013

Validation Dipole and Serial Number: D26000V2; SN: 1046

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Head	2600	24.0 °C	22.9 °C	ϵ_r	39.00	38.96	-0.10	5.00
				σ	1.96	2.04	4.06	5.00
				1g SAR	58.20	60.40	3.78	5.00
				10g SAR	26.20	26.48	1.07	5.00

System Check 2600 Body

Date: 27/06/2013

Validation Dipole and Serial Number: D26000V2; SN: 1046

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	2600	24.0 °C	23.5 °C	ϵ_r	52.50	52.77	0.51	5.00
				σ	2.16	2.18	0.71	5.00
				1g SAR	55.50	56.00	0.90	5.00
				10g SAR	25.00	24.36	-2.56	5.00

System Check 5200/5500/5800 Head

Date: 20/06/2013

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	24.0 °C	ϵ_r	36.00	34.81	-3.31	5.00
				σ	4.66	4.65	2.10	5.00
				1g SAR	78.10	75.00	-3.97	5.00
				10g SAR	23.00	21.90	-1.79	5.00

Date: 21/06/2013

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	24.0 °C	ϵ_r	36.00	34.81	-3.31	5.00
				σ	4.66	4.65	2.10	5.00
				1g SAR	78.10	80.30	2.82	5.00
				10g SAR	23.00	23.10	3.59	5.00

Date: 21/06/2013

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	24.0 °C	ϵ_r	35.60	34.23	-3.85	5.00
				σ	4.96	5.06	2.02	5.00
				1g SAR	82.50	86.20	4.48	5.00
				10g SAR	23.50	24.20	2.98	5.00

Date: 21/06/2013

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	24.0 °C	ϵ_r	35.30	33.77	-4.33	5.00
				σ	5.27	5.38	2.11	5.00
				1g SAR	77.00	80.40	4.42	5.00
				10g SAR	21.90	22.60	3.20	5.00

System Check 5200/5500/5800 Body

Date: 24/06/2013

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 °C	24.0 °C	ϵ_r	49.00	47.89	-2.27	5.00
				σ	5.30	5.42	2.20	5.00
				1g SAR	75.10	78.00	3.86	5.00
				10g SAR	21.10	20.10	-4.74	5.00

Date: 25/06/2013

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 °C	24.0 °C	ϵ_r	49.00	47.89	-2.27	5.00
				σ	5.30	5.42	2.20	5.00
				1g SAR	75.10	74.40	-0.93	5.00
				10g SAR	21.10	20.50	-2.84	5.00

Date: 25/06/2013

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 °C	24.0 °C	ϵ_r	48.60	47.36	-2.55	5.00
				σ	5.65	5.80	2.59	5.00
				1g SAR	79.00	82.90	4.94	5.00
				10g SAR	22.00	21.50	-2.27	5.00

Date: 25/06/2013

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 °C	24.0 °C	ϵ_r	48.20	46.86	-2.78	5.00
				σ	6.00	6.19	3.11	5.00
				1g SAR	74.40	72.10	-3.09	5.00
				10g SAR	20.60	19.80	-3.88	5.00

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

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):

- 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:417
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 bit A/D converter for surface detection system serial link to robot direct emergency stop output for robot.
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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:	1528;1529
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 RIM Status: None GMM State: None Current DPCCH Offset: 0 chips						RB Test Mode	
Paging Parameters		HSUPA Information						HSPA Parameters	
		Rep EDCH Cat/Ext: Unrep/Unrep Last received E-TFCI: ---- Throughput: ---- kbps Acks Transmitted: ----						34,121 Preset Call Configs	
Handovers		HSDPA Information							
		Cur UE HS-DSCH Cat: ---- Block Error Ratio: ---- % Throughput: ---- kbps Blocks Transmitted: ----						Channel (UARFCN) Parms	
Clear UE Info		Active Cell						Sys Type: UTRA FDD	
		Idle							
1 of 5		IntRef						1 of 3	

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																						
	HSDPA Uplink Parameters <table border="1"> <thead> <tr> <th></th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>DeltaACK</td> <td>8</td> </tr> <tr> <td>DeltaNACK</td> <td>8</td> </tr> <tr> <td>DeltaCQI</td> <td>8</td> </tr> <tr> <td>Ack-Nack Repetition Factor</td> <td>1</td> </tr> <tr> <td>CQI Feedback Cycle (k)</td> <td>2 ms</td> </tr> <tr> <td>CQI Repetition Factor</td> <td>1</td> </tr> </tbody> </table>							Value	DeltaACK	8	DeltaNACK	8	DeltaCQI	8	Ack-Nack Repetition Factor	1	CQI Feedback Cycle (k)	2 ms	CQI Repetition Factor	1	UE Category Parameters		
		Value																					
	DeltaACK	8																					
	DeltaNACK	8																					
	DeltaCQI	8																					
	Ack-Nack Repetition Factor	1																					
	CQI Feedback Cycle (k)	2 ms																					
	CQI Repetition Factor	1																					
						MAC-(e)hs Parameters																	
						HSDPA Uplink Parameters																	
						Return																	
Close Menu																							
		Active Cell		Sys Type: UTRA FDD																			
		Idle																					
		IntRef				1 of 2																	

Figure 2: HSDPA Parameters

5. 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							All Ones		
Originate Call	UE Expected Open Loop Transmit Power Initial PRACH TX Power: -60.00 dBm Initial DPCCH TX Power: -11.55 dBm						RLC Reestablish		
							Auto		
Paging Parameters	Call Processing Status Current Service Type: None MM Status: None GMM State: None Current DPCCH Offset: 0 chips						Call Limit State		
							Off		
Handovers	HSUPA Information Rep EDCH Cat/Ext: Unrep/Unrep Last received E-TFCI: ---- Throughput: ---- kbps Acks Transmitted: ----						Call Drop Timer		
	HSUPA Information Cur UE HS-DSCH Cat: ---- Block Error Ratio: ---- % Throughput: ---- kbps Blocks Transmitted: ----						On		
Clear UE Info							SRB Parameters		
		Active Cell		Sys Type: UTRA FDD					
		Idle							
		IntRef				2 of 3			
1 of 5									

Figure 3: DL DTCH Data Parm

Call Setup Screen									
Call Control		Active Cell Operating Mode						Call Params	
	UE Information IMSI: IMEI(SV): Power Class:						UE Target Power -5 dBm		
	UE Expected Open Loop Transmit Power Initial PRACH TX Power: -60.00 dBm Initial DPCH TX Power: -11.55 dBm						UL CL Power Ctrl Parameters		
	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		
Close Menu		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 IMSI: IMEI(SV): Power Class:						Cell Power -35.00		
							dBm/3.84 MHz		
							Channel Type 12.2k RMC		
							Paging Service RB Test Mode		
Cell Parameters		Value							
BCCH Update Page		Inhibit							
PS Domain Information		Absent						HSPA Parameters	
MCC (Mobile Country Code)		1							
MNC (Mobile Network Code)		1							
MNC (Mobile Network Code) Length		Auto						34.121 Preset Call Configs	
LAC (Local Area Code)		1							
RAC (Routing Area Code)		1							
Cell Identity		1						Channel (UARFCN) Params	
		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 Params		
Additional Screens	UE Information						Cell Power		
	INSI: INEI(SU): (--) Power Class:						-35.00		
Cell Parameters	UE Expected Open Loop Transmit Power						dBm/3.84 MHz		
	Initial PRACH TX Power: -60.00 dBm Initial DPCCH TX Power: -11.55 dBm						Channel Type		
Generator Info	Uplink Parameters						12.2k RNC		
	Value						Paging Service		
Uplink Parameters	PRACH Preambles						RB Test Mode		
	64						HSPA Parameters		
UE Rep Meas	PRACH Ramping Cycles(MMAX)						34.121 Preset Call Configs		
	2						Channel (UARFCN) Params		
Close Menu	Available Subchannels (Bit Mask)						000000000001		
	Uplink DPCH Scrambling Code						0		
Close Menu	Uplink DPCH Bc/Bd Control						Auto		
	Manual Uplink DPCH Bc						8		
Close Menu	Manual Uplink DPCH Bd						15		
	Maximum Uplink Transmit Power Level						24 dBm		
2 of 5	Active Cell						Sys Type: UTRA FDD		
	Idle						1 of 3		

Figure 6: Uplink Parameters

8. 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 Params		
	UE Information						Cell Power		
	INSI: INEI(SU): (--) Power Class:						-35.00		
	UE Expected Open Loop Transmit Power						dBm/3.84 MHz		
	Initial PRACH TX Power: -60.00 dBm Initial DPCCH TX Power: -11.55 dBm						Channel Type		
	RB Test Mode Settings						12.2k RNC		
	Value						Paging Service		
Voice Call	Uplink DTCH RNC CRC Presence						RB Test Mode		
	Present						HSPA Parameters		
	Uplink Dummy DCCH Data						34.121 Preset Call Configs		
	Off						Channel (UARFCN) Params		
	UE Loopback Type						Type 1		
	Asymmetric RNC Loopback Messaging						Close/Open		
Close Menu	Asymmetric RNC CN Domain						CS Domain		
3 of 5	Active Cell						Sys Type: UTRA FDD		
	Idle						1 of 3		

Figure 7: RB Test Mode Settings

9. 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: Δ_{ACK} , Δ_{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_{alt1} : 47/15 B_{alt2} : 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: Δ_{ACK} , Δ_{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 Table 5.1g.

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

Call Setup Screen									
Call Control	Active Cell Operating Mode							Serving Grant	
Operating Mode	UE Information INSI: IMEI(SV): (---) Power Class: UE Expected Open Loop Transmit Power Initial PRACH TX Power: -60.00 dBm Initial DPCCH TX Power: -11.55 dBm Call Processing Status Current Service Type: None MM Status: Abs Single Shot AG GMM State: Index 18: (95/15)^2 Current DPCCH: Index 19: (106/15)^2 Index 20: (119/15)^2 Index 21: (134/15)^2 Index 22: (150/15)^2 Index 23: (168/15)^2 HSUPA Information Rep EDCH Cat: ---- Last received: ---- Throughput: ---- kbps Acks Transmitted: ----							AG Mode	
Active Cell								Single Shot	
								Single Shot AG	
								21: (134/15)^2	
Originate Call								Send Single Shot Absolute Grant	
								RB Setup AG	
Paging Parameters								33: 4(134/15)^2	
								AG Pattern Parameters	
Handovers								Return	
Clear UE Info									
	Active Cell Idle Sys Type: UTRA FDD								
1 of 5	IntRef							1 of 2	

Call Setup Screen									
Call Control	Active Cell Operating Mode							Call Parms	
Additional Screens	UE Information INSI: IMEI(SV): (---) Power Class: UE Expected Open Loop Transmit Power Initial PRACH TX Power: -60.00 dBm Initial DPCCH TX Power: -22.58 dBm Uplink Parameters PRACH Preambles: 64 PRACH Ramping Cycles(MAX): 2 Available Subchannels (Bit Mask): 000000000001 Uplink DPCCH Scrambling Code: 0 Uplink DPCCH Bc/Bd Control: Manual Manual Uplink DPCCH Bc: 2 Manual Uplink DPCCH Bd: 15 Maximum Uplink Transmit Power Level: 24 dBm							Cell Power	
Cell Parameters								-35.00	
								dBm/3.84 MHz	
Generator Info								Channel Type	
								12.2k + HSDPA	
Uplink Parameters								Paging Service	
								RB Test Mode	
UE Rep Meas								HSPA Parameters	
								34.121 Preset Call Configs	
Close Menu								Channel (UARFCN) Parms	
	Cell Off Sys Type: UTRA FDD								
2 of 5	IntRef							1 of 3	

4. 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	UE Information INSI: INEI(SU): Power Class: (--)							AG Mode	
Active Cell								Single Shot	
								Single Shot AG	
								31: 6(168/15)^2	
Originate Call	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	
Paging Parameters ▾	Call Processing Status Current Service Type: None RIM Status: None GMM State: None Current DPCH Offset: 0 chips							RB Setup AG	
								37: 6(168/15)^2	
Handovers	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: ----			AG Pattern Parameters ▾	
Clear UE Info								Return	
1 of 5								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 Params	
Operating Mode		UE Information						Cell Power	
Cell Off		INSL:		Power Class:				-75.00	
		INEL(SU):		(--)		Detected PRACH Sig:		----	
		Called Party Number:						Channel Type	
								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		Power State: Off			
		MM Status:		Active Cell		Mode State: Off			
		GMM State:		FDD Test		Offset: 0 chips			
Handovers		HSUPA In CU				Information		34.121 Preset Call Configs	
		UE Rep E-DCH		Cell Off		DSCH Cat: 14			
		Last Happy Bit				Ratio: ---- %			
		Throughput:				---- kbps			
Clear UE Info		ACKs Transmitt				Transmitted: ----		Channel (UARFCH) Params	
		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				dBm/3.84 MHz
	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	Channel Type
	P-CCPCH/SCH:	Off	-5.30	256	1	Off	Off	256	1	12.2k + HSDPA
DC-HSDPA DL Code Chan Info	S-CCPCH:	Off	-10.30	64	2	Off	Off	256	2	Paging Service
	PICH:	Off	-8.30	256	2	Off	Off	256	2	RB Test Mode
Return	AICH:	Off	-9.30	256	3					
	(F-)DPCH:	Off	Off	128	7					
	E-AGCH:	Off	Off	256	42					HSPA Parameters
	E-HICH:	Off	Off	128	22					
	E-RGCH:	Off	Off	128	22					
	HS-SCCH 1:	Off	Off	128	2	Off	Off	128	2	34.121 Preset Call Configs
	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	Channel (UARFCN) Parms
	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 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 Parms	
Operating Mode		UE Information IMSI: 001012345678901 Power Class: 4 IMEI(SV):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						Cell Power	
Active Cell								-25.00	
								dBm/3.84 MHz	
								Channel Type	
								12.2k + HSDPA	
Originate Call		Current Service Type						Paging Service	
		None						RB Test Mode	
Paging Parameters		Call Processing Status						HSPA Parameters	
		RRC State: Idle MM Status: None GMM State: Attached						Soft Handover State: Off Compressed Mode State: Off Cur DPCH Offset: 0 chips	
Handovers		HSUPA Information				HSDPA Information		34.121 Preset Call Configs	
		Rep EDCH Cat/Ext: 6/Unrep Last Happy Bit: None Throughput: ---- kbps ACKs Transmitted: ----				Cur UE HS-DSCH Cat: 24 Block Error Ratio: ---- % Throughput: ---- kbps Blocks Transmitted: ----			
Clear UE Info								Channel (UARFCN) Parms	
		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 IMSI: 001012345678901 Power Class: 4 IMEI(SV):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						Cell Power	
Active Cell								-25.00	
								dBm/3.84 MHz	
								Channel Type	
								12.2k + HSDPA	
End Call		Current Service Type						Paging Service	
		RB Test Mode - HSDPA						RB Test Mode	
Paging Parameters		Call Processing Status						HSPA Parameters	
		RRC State: CELL_DCH MM Status: None GMM State: Attached						Soft Handover State: Off Compressed Mode State: Off Cur DPCH Offset: 0 chips	
Handovers		HSUPA Information				HSDPA Information		34.121 Preset Call Configs	
		Rep EDCH Cat/Ext: 6/Unrep Last Happy Bit: None Throughput: ---- kbps ACKs Transmitted: ----				Cur UE HS-DSCH Cat: 24 Block Error Ratio: 0 % Throughput: 42101 kbps Blocks Transmitted: 115500			
Clear UE Info								Channel (UARFCN) Parms	
		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	
	Channel	Serving Cell DL Chan Info				Sec Cell DL Chan Info				dBm/3.84 MHz	
Generated Power Info Screen	Channel	Level (dB)		Chan		Level (dB)		Chan		Channel Type	
		Current	Desired	OVSF	Code	Current	Desired	OVSF	Code	12.2k + HSDPA	
	CPICH:	-8.00	-8.00	256	0	-8.00	-8.00	256	0	Paging Service	
OCNS Info Screen	P-CCPCH/SCH:	-20.00	-20.00	256	1	-20.00	-20.00	256	1	RB Test Mode	
	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					HSPA Parameters	
	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	34.121 Preset Call Configs	
	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	Channel (UARFCN) Parms	
	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 Parns	
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 DPCCX TX Pou: -11.55 dBm					
End Call		Current Service Type							Paging Service	
		RB Test Mode - HSDPA							RB Test Mode	
		Call Processing Status								
Paging Parameters ▾		RRC State: CELL_DCH		Soft Handover State: Off					HSPA Parameters	
		MM Status: None		Compressed Mode State: Off						
		GMM 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 (UARFCN) Parns	
					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 (UARFCN) 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	
		Summary	Serving Cell		Secondary Serving Cell		Channel Type		
E-TFCI Recording Information	Block Error Ratio:	0 %	0 %		----		12.2k + HSDPA		
	Throughput (kbps):	21082	21082		0		Paging Service		
	Blocks Transmitted:	66000	66000		0		RB Test Mode		
	ACKs Received:	65958	65958		0				
	NACKs Received:	42	42		0				
HSDPA Information	statDTXs Received:	0	0		0		HSPA Parameters		
	Count of Rep CQI Lim:	----	----		----				
	Last Received CQI:		30		30				
	Max Allowed CQI:		----		----		34.121 Preset Call Configs		
	Test Mode User Def TBS:		42192		42192				
Clear UE Info	PS Data User Def TBS:		7298		7298				
	Last Sig Meas Pur Offs (dB):		6.0		6.0		Channel (UARFCN) Parm		
Return									
			Active Cell			Sys Type: UTRA FDD			
			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 Parms		
Channel (UARFCN) 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		
							Channel Type		
E-TFCI Recording Information							12.2k + HSDPA		
							Paging Service		
HSDPA Information							RB Test Mode		
							HSPA Parameters		
Clear UE Info							34.121 Preset Call Configs		
Return							Channel (UARFCN) Parms		
1 of 2	Active Cell Connected						Sys Type: UTRA FDD		
							Logging: No Conn		
		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.