## 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 ±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 ºC | 21.6 ºC | $\varepsilon_r$ | 41.50 | 40.95 | -1.33 | 5.00 |
| | | | | $\sigma$ | 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 ºC | 21.8 ºC | $\varepsilon_r$ | 41.50 | 41.20 | -0.72 | 5.00 |
| | | | | $\sigma$ | 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 ºC | 22.5 ºC | $\varepsilon_r$ | 41.50 | 40.40 | -2.65 | 5.00 |
| | | | | $\sigma$ | 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 | 23.0ºC | 22.5ºC | $\varepsilon_r$ | 41.50 | 40.40 | -2.65 | 5.00 |
| | | | | $\sigma$ | 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 | 23.0ºC | 21.5ºC | $\varepsilon_r$ | 55.00 | 53.46 | -2.80 | 5.00 |
| | | | | $\sigma$ | 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 | 23.0ºC | 21.7ºC | $\varepsilon_r$ | 55.00 | 53.75 | -2.27 | 5.00 |
| | | | | $\sigma$ | 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 ºC | 21.5 ºC | $\varepsilon_r$ | 55.00 | 53.46 | -2.80 | 5.00 |
| | | | | $\sigma$ | 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 | 24.0ºC | 22.0 ºC | $\varepsilon_r$ | 55.00 | 53.80 | -2.18 | 5.00 |
| | | | | $\sigma$ | 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 | 23.0ºC | 22.2ºC | $\varepsilon_r$ | 40.00 | 38.61 | -3.48 | 5.00 |
| | | | | $\sigma$ | 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 | 23.0ºC | 22.2ºC | $\varepsilon_r$ | 40.00 | 39.18 | -2.05 | 5.00 |
| | | | | $\sigma$ | 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 ºC | 22.2 ºC | $\varepsilon_r$ | 53.30 | 51.84 | -2.74 | 5.00 |
| | | | | $\sigma$ | 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 ºC | 22.2 ºC | $\varepsilon_r$ | 53.30 | 51.84 | -2.74 | 5.00 |
| | | | | $\sigma$ | 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 ºC | 23.7 ºC | $\varepsilon_r$ | 53.30 | 52.61 | -1.29 | 5.00 |
| | | | | $\sigma$ | 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 | 24.0ºC | 23.0ºC | $\varepsilon_r$ | 40.00 | 38.50 | -3.75 | 5.00 |
| | | | | $\sigma$ | 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 | 24.0ºC | 23.0ºC | $\varepsilon_r$ | 40.00 | 39.36 | -1.60 | 5.00 |
| | | | | $\sigma$ | 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 | 24.0ºC | 23.0ºC | $\varepsilon_r$ | 40.00 | 38.50 | -3.75 | 5.00 |
| | | | | $\sigma$ | 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 ºC | 23.0 ºC | $\varepsilon_r$ | 40.00 | 38.82 | -2.95 | 5.00 |
| | | | | $\sigma$ | 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 ºC | 22.5 ºC | $\varepsilon_r$ | 53.30 | 54.13 | 1.56 | 5.00 |
| | | | | $\sigma$ | 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 ºC | 22.5 ºC | $\varepsilon_r$ | 53.30 | 54.13 | 1.56 | 5.00 |
| | | | | $\sigma$ | 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 ºC | 23.5 ºC | $\varepsilon_r$ | 53.30 | 52.17 | -2.12 | 5.00 |
| | | | | $\sigma$ | 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 ºC | 23.5 ºC | $\varepsilon_r$ | 53.30 | 52.17 | -2.12 | 5.00 |
| | | | | $\sigma$ | 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 ºC | 23.8 ºC | $\varepsilon_r$ | 53.30 | 50.90 | -4.50 | 5.00 |
| | | | | $\sigma$ | 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 ºC | 24.0 ºC | $\varepsilon_r$ | 39.20 | 40.06 | 2.19 | 5.00 |
| | | | | $\sigma$ | 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 ºC | 24.0 ºC | $\varepsilon_r$ | 39.20 | 40.06 | 2.19 | 5.00 |
| | | | | $\sigma$ | 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 ºC | 22.8 ºC | $\varepsilon_r$ | 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 | 24.0ºC | 22.8ºC | $\varepsilon_r$ | 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 ºC | 22.9 ºC | $\varepsilon_r$ | 39.00 | 38.96 | -0.10 | 5.00 |
| | | | | $\sigma$ | 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 ºC | 23.5 ºC | $\varepsilon_r$ | 52.50 | 52.77 | 0.51 | 5.00 |
| | | | | $\sigma$ | 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 ºC | 24.0 ºC | $\varepsilon_r$ | 36.00 | 34.81 | -3.31 | 5.00 |
| | | | | $\sigma$ | 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 ºC | 24.0 ºC | $\varepsilon_r$ | 36.00 | 34.81 | -3.31 | 5.00 |
| | | | | $\sigma$ | 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 ºC | 24.0 ºC | $\varepsilon_r$ | 35.60 | 34.23 | -3.85 | 5.00 |
| | | | | $\sigma$ | 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 ºC | 24.0 ºC | $\varepsilon_r$ | 35.30 | 33.77 | -4.33 | 5.00 |
| | | | | $\sigma$ | 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 ºC | 24.0 ºC | $\varepsilon_r$ | 49.00 | 47.89 | -2.27 | 5.00 |
| | | | | $\sigma$ | 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 ºC | 24.0 ºC | $\varepsilon_r$ | 49.00 | 47.89 | -2.27 | 5.00 |
| | | | | $\sigma$ | 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 ºC | 24.0 ºC | $\varepsilon_r$ | 48.60 | 47.36 | -2.55 | 5.00 |
| | | | | $\sigma$ | 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 ºC | 24.0 ºC | $\varepsilon_r$ | 48.20 | 46.86 | -2.78 | 5.00 |
| | | | | $\sigma$ | 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):

1. As per the recipe provided by National Physical Laboratory, the 2450 MHz Head Fluid reciepe 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 mulitplexer, 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)<br>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.<br>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:** | $\pm 0.2$ 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:** | $\pm 0.2$ 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:** | $\pm$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 $\pm$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.



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 (VARFCN) 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.

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.



Figure 3: DL DTCH Data Parms

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.



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.

**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.



**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 | $\beta_c$ | $\beta_d$ | $B_d$ (SF) | $\beta_c/\beta_d$ | $\beta_{hs}$[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 ⇔ $A_{hs}$ = $\beta_{hs}/\beta_c$ = 30/15 ⇔ $\beta_{hs}$ = 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 $\beta_c/\beta_d$ 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 | $\beta_c$ | $\beta_d$ | $B_d$ (SF) | $\beta_c/\beta_d$ | $\beta_{hs}$[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 | $B_{al1}$: 47/15 $B_{al2}$: 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 ⇔ $A_{hs}$ = $\beta_{hs}/\beta_c$ = 30/15 ⇔ $\beta_{hs}$ = 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 $\beta_c/\beta_d$ 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 $\beta_c/\beta_d$ 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.

## Call Setup Screen

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

## Call Setup Screen

| Call Control | Active Cell Operating Mode | Call Parms |
|---|---|---|
| Additional Screens | **UE Information** | Cell Power |
| | | **-35.00** |
| | IMSI: | dBm/3.84 MHz |
| | IMEI(SV):　　　　　　　　　(--) | Channel Type |
| Cell Parameters ▽ | Power Class: | **12.2k + HSDPA** |
| | **UE Expected Open Loop Transmit Power** | |
| Generator Info | Initial PRACH TX Power:　　　-60.00 dBm | Paging Service |
| | Initial DPCCH TX Power:　　　-22.58 dBm | **RB Test Mode** |

| Uplink Parameters | Value |
|---|---|
| PRACH Preambles | 64 |
| PRACH Ramping Cycles(MMAX) | 2 |
| Available Subchannels (Bit Mask) | 000000000001 |
| Uplink DPCH Scrambling Code | 0 |
| Uplink DPCH Bc/Bd Control | Manual |
| Manual Uplink DPCH Bc | 2 |
| Manual Uplink DPCH Bd | 15 |
| Maximum Uplink Transmit Power Level | 24 dBm |

| Call Control (continued) |
|---|
| Uplink Parameters ▽ |
| UE Rep Meas |
| Close Menu |

| Call Parms (continued) |
|---|
| HSPA Parameters |
| 34.121 Preset Call Configs ▽ |
| 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.



**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.



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  │
├──────────────┼──────────────────────────────────────┼──────────────┤
│              │  Serving Cell Primary Scrambling Code:  0  │ Cell Power   │
│ DL Code Channel│ Secondary Serving Cell Primary Scrambling Code: 2 │ -75.00  │
│ Info Screen  │                                          │ dBm/3.84 MHz │
│              │ Channel │ Serving Cell DL Chan Info │ Sec Cell DL Chan Info │ Channel Type │
```

| Channel | Serving Cell DL Chan Info | | | Sec Cell DL Chan Info | | | |
|---|---|---|---|---|---|---|---|
| | Level (dB) Current | Desired | OVSF | Chan Code | Level (dB) Current | Desired | OVSF | Chan Code |

Screen Controls (left column): DL Code Channel Info Screen, Generated Power Info Screen, OCNS Info Screen, DC-HSDPA DL Code Chan Info, Return

Call Parms (right column): Cell Power −75.00 dBm/3.84 MHz, Channel Type 12.2k + HSDPA, Paging Service RB Test Mode, HSPA Parameters, 34.121 Preset Call Configs, Channel (UARFCN) Parms, 1 of 3

| Channel | Current | Desired | OVSF | Chan Code | Current | Desired | OVSF | Chan Code |
|---|---|---|---|---|---|---|---|---|
| CPICH: | Off | -3.30 | 256 | 0 | Off | Off | 256 | 0 |
| P-CCPCH/SCH: | Off | -5.30 | 256 | 1 | Off | Off | 256 | 1 |
| S-CCPCH: | Off | -10.30 | 64 | 2 | | | | |
| PICH: | 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 date 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 Parms 2 of 2 -> Secondary Serv Cell Parms (**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  ┌──────────────────────────────────┐    Cell Power
  Active Cell   │          UE Information           │       -25.00
                │ IMSI:       001012345678901 Power Class:      4    dBm/3.84 MHz
                │ IMEI(SV):352358040214948(--) Detected PRACH Sig:  0
                │      Called Party Number:         │    Channel Type
                ├──────────────────────────────────┤     12.2k + HSDPA
                │   UE Expected Open Loop Transmit Power
                │ Init PRACH TX Pow: -60.00 dBm │ Init DPCCH TX Pow: -11.55 dBm
  Originate     ├──────────────────────────────────┤    Paging Service
    Call        │        Current Service Type       │     RB Test Mode
                │              None                 │
                ├──────────────────────────────────┤
  Paging        │        Call Processing Status     │       HSPA
 Parameters  ▽  │ RRC State:        Idle  Soft Handover State:   Off  Parameters
                │ MM Status:        None  Compressed Mode State: Off
                │ GMM State:    Attached  Cur DPCH Offset:   0 chips
  Handovers     ├────────────────┬─────────────────┤    34.121 Preset
                │ HSUPA Information│ HSDPA Information│   Call Configs  ▽
                │ Rep EDCH Cat/Ext: 6/Unrep│ Cur UE HS-DSCH Cat:  24
                │ Last Happy Bit:   None│ Block Error Ratio: ---- %
  Clear         │ Throughput:   ---- kbps│ Throughput:    ---- kbps   Channel
  UE Info       │ ACKs Transmitted: ----│ Blocks Transmitted:  ----  (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  ┌──────────────────────────────────┐    Cell Power
  Active Cell   │          UE Information           │       -25.00
                │ IMSI:       001012345678901 Power Class:      4    dBm/3.84 MHz
                │ IMEI(SV):352358040214948(--) Detected PRACH Sig:  0
                │      Called Party Number:         │    Channel Type
                ├──────────────────────────────────┤     12.2k + HSDPA
                │   UE Expected Open Loop Transmit Power
                │ Init PRACH TX Pow: -60.00 dBm │ Init DPCCH TX Pow: -11.55 dBm
    End         ├──────────────────────────────────┤    Paging Service
    Call        │        Current Service Type       │     RB Test Mode
                │        RB Test Mode - HSDPA       │
                ├──────────────────────────────────┤
  Paging        │        Call Processing Status     │       HSPA
 Parameters  ▽  │ RRC State:    CELL_DCH  Soft Handover State:   Off  Parameters
                │ MM Status:        None  Compressed Mode State: Off
                │ GMM State:    Attached  Cur DPCH Offset:   0 chips
  Handovers     ├────────────────┬─────────────────┤    34.121 Preset
                │ HSUPA Information│ HSDPA Information│   Call Configs  ▽
                │ Rep EDCH Cat/Ext: 6/Unrep│ Cur UE HS-DSCH Cat:  24
                │ Last Happy Bit:   None│ Block Error Ratio:  0 %
  Clear         │ Throughput:   ---- kbps│ Throughput:   42101 kbps   Channel
  UE Info       │ ACKs Transmitted: ----│ Blocks Transmitted: 115500  (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
                 Serving Cell Primary Scrambling Code:     0  Cell Power
 DL Code Channel Secondary Serving Cell Primary Scrambling Code:  2   -25.00
  Info Screen    Channel  Serving Cell DL Chan Info  Sec Cell DL Chan Info  dBm/3.84 MHz
                          Level (dB)        Chan    Level (dB)        Chan  Channel Type
 Generated Power Channel  Current Desired OVSF Code  Current Desired OVSF Code  12.2k + HSDPA
  Info Screen    CPICH:   -8.00  -8.00  256    0   -8.00  -8.00  256    0
                 P-CCPCH/
                 SCH:    -20.00 -20.00  256    1  -20.00 -20.00  256    1  Paging Service
     OCNS       S-CCPCH:   Off    Off   64    2                            RB Test Mode
  Info Screen   PICH:      Off    Off  256    2    Off    Off   256    2
                AICH:
                (F-)DPCH: -30.00 -30.00 128    7
 DC-HSDPA DL    E-AGCH:    Off    Off  256   42                              HSPA
 Code Chan Info E-HICH:    Off    Off  128   22                            Parameters
                E-RGCH:    Off    Off  128   22
                HS-SCCH 1: -20.00 -20.00 128   2  -20.00 -20.00 128    2
                HS-SCCH 2: -20.00 -20.00 128   3  -20.00 -20.00 128    3  34.121 Preset
                HS-SCCH 3:                                                 Call Configs ▽
                HS-SCCH 4:
    Return      HS-PDSCHs: -1.00  -1.00   16 1-15  -1.00  -1.00   16 1-15   Channel
                Comp OCNS: -17.91 -17.91 128 HSDPA -17.65 -17.65 128 HSDPA (UARFCN) Parms

                        Active Cell            Sys Type: UTRA FDD
                        Connected              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 Parms   │
├────────────────┤  ┌───────────────────────────────┐  ├────────────────┤
│ Operating Mode │  │         UE Information         │  │ Cell Power     │
│  Active Cell   │  ├───────────────────────────────┤  │    -25.00      │
│                │  │ IMSI:      001012345678901 │Power Class:        4 │ dBm/3.84 MHz   │
│                │  │ IMEI(SV):352358040214948(--)│Detected PRACH Sig: 0 │ Channel Type   │
│                │  ├───────────────────────────────┤  │ 12.2k + HSDPA  │
│                │  │      Called Party Number:     │  │                │
│                │  ├───────────────────────────────┤  │                │
│     End        │  │ UE Expected Open Loop Transmit Power │ Paging Service │
│    Call        │  │ Init PRACH TX Pow: -60.00 dBm │ Init DPCCH TX Pow: -11.55 dBm │ RB Test Mode │
│                │  ├───────────────────────────────┤  │                │
│   Paging       │  │       Current Service Type    │  │                │
│  Parameters ▽  │  │      RB Test Mode - HSDPA     │  │     HSPA       │
│                │  ├───────────────────────────────┤  │  Parameters    │
│                │  │      Call Processing Status   │  │                │
│  Handovers     │  │ RRC State:      CELL_DCH  Soft Handover State:  Off │ 34.121 Preset │
│                │  │ MM Status:      None  Compressed Mode State: Off │ Call Configs ▽ │
│                │  │ GMM State:      Attached  Cur DPCH Offset:  0 chips │              │
│   Clear        │  │ HSUPA Information │ HSDPA Information │              │
│  UE Info       │  │ Rep EDCH Cat/Ext: 6/Unrep │ Cur UE HS-DSCH Cat: 24 │ Channel │
│                │  │ Last Happy Bit: None │ Block Error Ratio: 0 % │ (UARFCN) Parms │
│                │  │ Throughput: ---- kbps │ Throughput: 21088 kbps │ │
│                │  │ 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 Parms   │
├────────────────┤                                     ├────────────────┤
│   Channel      │  ┌───────────────────────────────┐  │ Cell Power     │
│ (UARFCN) Info  │  │   Secondary Serving Cell Status │  │    -25.00      │
│                │  │ Current Secondary Serving Cell Status: Configured-Inactive │ dBm/3.84 MHz │
│                │  ├───────────────────────────────┤  │ Channel Type   │
│    HSPA        │  │       DC-HSDPA Information     │  │ 12.2k + HSDPA  │
│ Information     │  │                    Secondary  │  │                │
│                │  │          Summary Serving Cell Serving Cell │           │
│ E-TFCI Recording │ Block Error Ratio: 0%   0 %   ---- % │ Paging Service │
│  Information    │ Throughput (kbps): 21082  21082   0  │ RB Test Mode │
│                │  │ Blocks Transmitted: 66000 66000   0  │              │
│                │  │ ACKs Received:     65958  65958   0  │              │
│   HSDPA        │  │ NACKs Received:    42    42      0  │     HSPA       │
│ Information     │  │ statDTXs Received: 0     0       0  │  Parameters    │
│                │  │ Count of Rep CQI Lim: ----  ----  ---- │           │
│                │  │ Last Received CQI:       30      30  │               │
│   Clear        │  │ Max Allowed CQI:        ----  ---- │ 34.121 Preset │
│  UE Info       │  │ Test Mode User Def TBS: 42192 42192 │ Call Configs ▽ │
│                │  │ PS Data User Def TBS:   7298  7298  │               │
│   Return       │  │ Last Sig Meas Pwr Offs (dB): 6.0  6.0 │ Channel │
│                │  └───────────────────────────────┘  │ (UARFCN) Parms │
├────────────────┼───────┬──────────────┬─────────────────┼────────────────┤
│                │       │ 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
                                                           Cell Power
   Channel              Secondary Serving Cell Status         -25.00
 (UARFCN) Info    Current Secondary Serving Cell Status:  Configured-Active
                                                          dBm/3.84 MHz

    HSPA                   DC-HSDPA Information            Channel Type
  Information                                              12.2k + HSDPA
                                          Secondary
                       Summary  Serving Cell Serving Cell
E-TFCI Recording  Block Error Ratio:     0 %    0 %    0 %   Paging Service
  Information     Throughput (kbps):    41996  21064  20941    RB Test Mode
                  Blocks Transmitted:   11000   6000   6000
                  ACKs Received:        10949   5991   5956
    HSDPA         NACKs Received:          51      9     44      HSPA
  Information      statDTXs Received:       0      0      0   Parameters
                  Count of Rep CQI Lim:  ----   ----   ----
                  Last Received CQI:              30     30
    Clear         Max Allowed CQI:              ----   ----   34.121 Preset
   UE Info        Test Mode User Def TBS:      42192  42192   Call Configs ▽
                  PS Data User Def TBS:         7298   7298
                  Last Sig Meas Pwr Offs (dB):   6.0    6.0
    Return                                                      Channel
                                                             (UARFCN) Parms

                      Active Cell       Sys Type: UTRA FDD
                       Connected        Logging: No Conn
    1 of 2       DBUS-INT  IntRef Offset                      1 of 3
```

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