FCC SAR Test Report

APPLICANT	:	D-Link Co.
EQUIPMENT	:	4G LTE USB Adapter
BRAND NAME	:	D-Link
MODEL NAME	:	DWM-221
FCC ID	:	KA2WM221B1
STANDARD	:	FCC 47 CFR Part 2 (2.1093) ANSI/IEEE C95.1-1992 IEEE 1528-2003

We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures and shown the compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by: Eric Huang / Deputy Manager

Approved by: Jones Tsai / Manager

Testing Laboratory
1190

SPORTON INTERNATIONAL INC.
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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA431502	Rev. 01	Initial issue of report	Apr. 25, 2014

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **D-Link Co., 4G LTE USB Adapter, DWM-221**, are as follows.

Equipment Class	Frequency Band	Operating Mode	Highest SAR Summary
			Body 1g SAR (W/kg)
PCB	GSM850	Data	**0.99**
	GSM1900	Data	0.36
	WCDMA Band V	Data	0.62
	LTE Band 5	Data	0.47
	LTE Band 7	Data	0.12
Date of Testing:		04/10/2014 ~ 04/11/2014	

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2003.

2. Administration Data

Testing Laboratory	
Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL: +886-3-327-3456 FAX: +886-3-328-4978

Applicant	
Company Name	D-Link Co.
Address	No.289, Sinhu 3rd Rd, Neihu District Taipei City 114 Taiwan

Manufacturer	
Company Name	Shanghai BroadMobi Communication Technology Co., Ltd.
Address	Rm.1501, Building9, No.1515 Gumei Rd., Xuhui District, Shanghai, P.R. China

3. Guidance Standard

The Specific Absorption Rate (SAR) testing specification, method, and procedure for this device is in accordance with the following standards:

- FCC 47 CFR Part 2 (2.1093)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2003
- FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r03
- FCC KDB 865664 D02 SAR Reporting v01r01
- FCC KDB 447498 D01 General RF Exposure Guidance v05r02
- FCC KDB 447498 D02 SAR Procedures for Dongle Xmtr v02
- FCC KDB 941225 D01 SAR test for 3G devices v02
- FCC KDB 941225 D02 HSPA and 1x Advanced v02r02
- FCC KDB 941225 D03 SAR Test Reduction GSM GPRS EDGE v01
- FCC KDB 941225 D05 SAR for LTE Devices v02r03

4. Equipment Under Test (EUT)

4.1 General Information

Product Feature & Specification	
Equipment Name	4G LTE USB Adapter
Brand Name	D-Link
Model Name	DWM-221
FCC ID	KA2WM221B1
Wireless Technology and Frequency Range	GSM850: 824.2 MHz ~ 848.8 MHz GSM1900: 1850.2 MHz ~ 1909.8 MHz WCDMA Band V: 826.4 MHz ~ 846.6 MHz LTE Band 5: 824 MHz ~ 849 MHz LTE Band 7: 2500 MHz ~ 2570 MHz
Mode	• GPRS/EGPRS • RMC 12.2Kbps • HSDPA • HSUPA • DC-HSDPA • LTE: QPSK, 16QAM
HW Version	B1
SW Version	1.0.2

4.2 Maximum Tune-up Limit

Mode	Burst average power(dBm)	
	GSM 850	GSM 1900
GPRS (GMSK, 1 Tx slot)	33.00	30.00
GPRS (GMSK, 2 Tx slots)	30.00	27.00
GPRS (GMSK, 3 Tx slots)	28.50	25.50
GPRS (GMSK, 4 Tx slots)	27.50	24.50
EDGE (8PSK, 1 Tx slot)	26.50	25.00
EDGE (8PSK, 2 Tx slots)	26.50	25.00
EDGE (8PSK, 3 Tx slots)	26.50	25.00
EDGE (8PSK, 4 Tx slots)	26.50	24.00

Mode	Average power(dBm)
	WCDMA Band V
RMC 12.2K	23.00
HSDPA Subtest-1	22.50
DC-HSDPA Subtest-1	22.50
HSUPA Subtest-5	22.50

LTE Band 5				
Modulation	BW (MHz)	RB size	Target MPR	Average power(dBm)
QPSK	10	≤ 12	0	23.00
QPSK	10	> 12	1	22.00
16QAM	10	≤ 12	1	22.00
16QAM	10	> 12	2	21.00
QPSK	5	≤ 8	0	23.00
QPSK	5	> 8	1	22.00
16QAM	5	≤ 8	1	22.00
16QAM	5	> 8	2	21.00
QPSK	3	≤ 4	0	23.00
QPSK	3	> 4	1	22.00
16QAM	3	≤ 4	1	22.00
16QAM	3	> 4	2	21.00
QPSK	1.4	≤ 5	0	23.00
QPSK	1.4	> 5	1	22.00
16QAM	1.4	≤ 5	1	22.00
16QAM	1.4	> 5	2	21.00

LTE Band 7				
Modulation	BW (MHz)	RB size	Target MPR	Average power(dBm)
QPSK	20	≤ 18	0	22.5
QPSK	20	> 18	1	21.5
16QAM	20	≤ 18	1	21.5
16QAM	20	> 18	2	20.5
QPSK	15	≤ 16	0	22.5
QPSK	15	> 16	1	21.5
16QAM	15	≤ 16	1	21.5
16QAM	15	> 16	2	20.5
QPSK	10	≤ 12	0	22.5
QPSK	10	> 12	1	21.5
16QAM	10	≤ 12	1	21.5
16QAM	10	> 12	2	20.5
QPSK	5	≤ 8	0	22.5
QPSK	5	> 8	1	21.5
16QAM	5	≤ 8	1	21.5
16QAM	5	> 8	2	20.5

4.3 General LTE SAR Test and Reporting Considerations

Summarized necessary items addressed in KDB 941225 D05 v02r03	
FCC ID	KA2WM221B1
Equipment Name	4G LTE USB Adapter
Operating Frequency Range of each LTE transmission band	LTE Band 5: 824 MHz ~ 849 MHz LTE Band 7: 2500 MHz ~ 2570 MHz
Channel Bandwidth	LTE Band 5: 1.4MHz, 3MHz, 5MHz, 10MHz LTE Band 7: 5MHz, 10MHz, 15MHz, 20MHz
uplink modulations used	QPSK, and 16QAM
LTE transmitter and antenna implementation (standalone or sharing hardware components / antennas)	A primary antenna is used for LTE and other wireless interfaces (GSM/WCDMA) for transmitting and receiving. LTE and other wireless interfaces (GSM/WCDMA) share the same antenna, and cannot transmit simultaneously
LTE Voice / Data requirements	Data only
LTE MPR permanently built-in by design	Yes, per 3GPP TS 36.101

Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3

Modulation	Channel bandwidth / Transmission bandwidth (RB)						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2

LTE A-MPR	In the base station simulator configuration, Network Setting value is set to NS_01 to disable A-MPR during SAR testing and the LTE SAR tests was transmitting on all TTI frames (Maximum TTI)
Spectrum plots for RB configuration	A properly configured base station simulator was used for the SAR and power measurement; therefore, spectrum plots for each RB allocation and offset configuration are not included in the SAR report.
Power reduction applied to satisfy SAR compliance	No

Transmission (H, M, L) channel numbers and frequencies in each LTE band

LTE Band 5

	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	20407	824.7	20415	825.5	20425	826.5	20450	829
M	20525	836.5	20525	836.5	20525	836.5	20525	836.5
H	20643	848.3	20635	847.5	20625	846.5	20600	844

LTE Band 7

	Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	20775	2502.5	20800	2505	20825	2507.5	20850	2510
M	21100	2535	21100	2535	21100	2535	21100	2535
H	21425	2567.5	21400	2565	21375	2562.5	21350	2560

5. RF Exposure Limits

5.1 Uncontrolled Environment

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

5.2 Controlled Environment

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. The exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Limits for Occupational/Controlled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.4	8.0	20.0

Limits for General Population/Uncontrolled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.08	1.6	4.0

1. Whole-Body SAR is averaged over the entire body, partial-body SAR is averaged over any 1gram of tissue defined as a tissue volume in the shape of a cube. SAR for hands, wrists, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

6. Specific Absorption Rate (SAR)

6.1 Introduction

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

6.2 SAR Definition

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). The equation description is as below:

$$\mathbf{SAR} = \frac{\mathbf{d}}{\mathbf{dt}}\left(\frac{\mathbf{dW}}{\mathbf{dm}}\right) = \frac{\mathbf{d}}{\mathbf{dt}}\left(\frac{\mathbf{dW}}{\boldsymbol{\rho}\mathbf{dv}}\right)$$

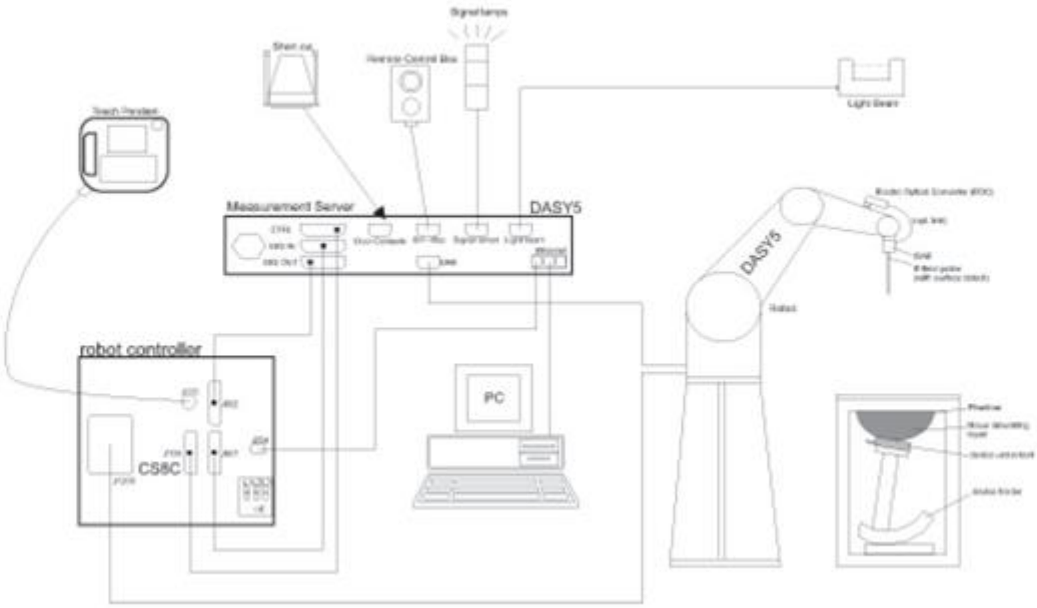
SAR is expressed in units of Watts per kilogram (W/kg)

$$\mathbf{SAR} = \frac{\boldsymbol{\sigma}|\mathbf{E}|^2}{\boldsymbol{\rho}}$$

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical field strength.

7. System Description and Setup

The DASY system used for performing compliance tests consists of the following items:



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP or Win7 and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

8. Measurement Procedures

The measurement procedures are as follows:

<Conducted power measurement>

(a) For WWAN power measurement, use base station simulator to configure EUT WWAN transmission in conducted connection with RF cable, at maximum power in each supported wireless interface and frequency band.
(b) Read the WWAN RF power level from the base station simulator.
(c) For WLAN/BT power measurement, use engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power in each supported wireless interface and frequency band
(d) Connect EUT RF port through RF cable to the power meter, and measure WLAN/BT output power

<SAR measurement>

(a) Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power, in the highest power channel.
(b) Place the EUT in the positions as Appendix D demonstrates.
(c) Set scan area, grid size and other setting on the DASY software.
(d) Measure SAR results for the highest power channel on each testing position.
(e) Find out the largest SAR result on these testing positions of each band
(f) Measure SAR results for other channels in worst SAR testing position if the reported SAR of highest power channel is larger than 0.8 W/kg

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

(a) Power reference measurement
(b) Area scan
(c) Zoom scan
(d) Power drift measurement

8.1 Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

(a) Extraction of the measured data (grid and values) from the Zoom Scan
(b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
(c) Generation of a high-resolution mesh within the measured volume
(d) Interpolation of all measured values form the measurement grid to the high-resolution grid
(e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
(f) Calculation of the averaged SAR within masses of 1g and 10g

8.2 Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

8.3 Area Scan

The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum found in the scanned area, within a range of the global maximum. The range (in dB0 is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan), if only one zoom scan follows the area scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of zoom scans has to be increased accordingly.

Area scan parameters extracted from FCC KDB 865664 D01v01r03 SAR measurement 100 MHz to 6 GHz v01r01.

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}	≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

8.4 Zoom Scan

Zoom scans are used assess the peak spatial SAR values within a cubic averaging volume containing 1 gram and 10 gram of simulated tissue. The zoom scan measures points (refer to table below) within a cube shoes base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the zoom scan evaluates the averaged SAR for 1 gram and 10 gram and displays these values next to the job's label.

Zoom scan parameters extracted from FCC KDB 865664 D01v01r03 SAR measurement 100 MHz to 6 GHz v01r01.

<table>
<tr><th colspan="3"></th><th>≤ 3 GHz</th><th>> 3 GHz</th></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>≤ 2 GHz: ≤ 8 mm
2 – 3 GHz: ≤ 5 mm*</td><td>3 – 4 GHz: ≤ 5 mm*
4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm
4 – 5 GHz: ≤ 3 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm
4 – 5 GHz: ≤ 2.5 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">≤ $1.5 \cdot \Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>≥ 30 mm</td><td>3 – 4 GHz: ≥ 28 mm
4 – 5 GHz: ≥ 25 mm
5 – 6 GHz: ≥ 22 mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.
* When zoom scan is required and the <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

8.5 Volume Scan Procedures

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

8.6 Power Drift Monitoring

All SAR testing is under the EUT install full charged battery and transmit maximum output power. In DASY measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of EUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drifts more than 5%, the SAR will be retested.

9. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	835MHz System Validation Kit	D835V2	4d162	Nov. 11, 2013	Nov. 10, 2014
SPEAG	1900MHz System Validation Kit	D1900V2	5d142	Jun. 10, 2013	Jun. 09, 2014
SPEAG	2600MHz System Validation Kit	D2600V2	1070	Nov. 13, 2013	Nov. 12, 2014
SPEAG	Data Acquisition Electronics	DAE4	1399	Nov. 07, 2013	Nov. 06, 2014
SPEAG	Dosimetric E-Field Probe	EX3DV4	3955	Nov. 12, 2013	Nov. 11, 2014
WonDer	Thermometer	WD-5015	TM225	Dec. 02, 2013	Dec. 01, 2014
Anritsu	Radio Communication Analyzer	MT8820C	6201074414	Feb. 11, 2014	Feb. 10, 2015
SPEAG	Device Holder	N/A	N/A	NCR	NCR
Agilent	Signal Generator	E4438C	MY49070755	Oct. 08, 2013	Oct. 07, 2014
SPEAG	Dielectric Probe Kit	DAK-3.5	1126	Jul. 23, 2013	Jul. 22, 2014
Agilent	ENA Network Analyzer	E5071C	MY46316648	Feb. 07, 2014	Feb. 06, 2015
Anritsu	Power Meter	ML2495A	1349001	Dec. 04, 2013	Dec. 03, 2014
Anritsu	Power Sensor	MA2411B	1306099	Dec. 03, 2013	Dec. 02, 2014
R&S	Spectrum Analyzer	FSP 7	101131	Jul. 09, 2013	Jul. 08, 2014
Agilent	Dual Directional Coupler	778D	50422	*CBT	
Woken	Attenuator	WK0602-XX	N/A	*CBT	
PE	Attenuator	PE7005-10	N/A	*CBT	
PE	Attenuator	PE7005- 3	N/A	*CBT	
AR	Power Amplifier	5S1G4M2	0328767	*CBT	
Mini-Circuits	Power Amplifier	ZVE-3W	162601250	*CBT	
Mini-Circuits	Power Amplifier	ZHL-42W+	13440021344	*CBT	

General Note:

1. The calibration certificate of DASY can be referred to appendix C of this report.
2. *CBT (Calibrated Before Testing). Prior to testing, the measurement paths containing an amplifier, coupler and attenuator were connected to a calibrated source (i.e. a signal generator) to determine the losses of the measurement path. The power meter offset was then adjusted to compensate for the measurement system losses. This level offset is stored within the power meter before measurements are made. The calibrated reading is then taken directly from the power meter after compensation of the losses for all final power measurement.

10. System Verification

10.1 Tissue Verification

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (εr)
For Head								
750	41.1	57.0	0.2	1.4	0.2	0	0.89	41.9
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
900	40.3	57.9	0.2	1.4	0.2	0	0.97	41.5
1800, 1900, 2000	55.2	0	0	0.3	0	44.5	1.40	40.0
2450	55.0	0	0	0	0	45.0	1.80	39.2
2600	54.8	0	0	0.1	0	45.1	1.96	39.0
For Body								
750	51.7	47.2	0	0.9	0.1	0	0.96	55.5
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
900	50.8	48.2	0	0.9	0.1	0	1.05	55.0
1800, 1900, 2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2450	68.6	0	0	0	0	31.4	1.95	52.7
2600	68.1	0	0	0.1	0	31.8	2.16	52.5

Simulating Liquid for 5GHz, Manufactured by SPEAG

Ingredients	(% by weight)
Water	64~78%
Mineral oil	11~18%
Emulsifiers	9~15%
Additives and Salt	2~3%

<Tissue Dielectric Parameter Check Results>

Frequency (MHz)	Tissue Type	Liquid Temp. (℃)	Conductivity (σ)	Permittivity (ε_r)	Conductivity Target (σ)	Permittivity Target (ε_r)	Delta (σ) (%)	Delta (ε_r) (%)	Limit (%)	Date
835	Body	22.4	0.997	55.120	0.97	55.20	2.78	-0.14	±5	2014/4/10
1900	Body	22.5	1.516	53.631	1.52	53.30	-0.26	0.62	±5	2014/4/10
2600	Body	22.3	2.165	53.823	2.16	52.50	0.23	2.52	±5	2014/4/11

Table 8.2.1 Measuring Results for Simulating Liquid

10.2 System Performance Check Results

Comparing to the original SAR value provided by SPEAG, the verification data should be within its specification of 10 %. Below tablet shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance check can meet the variation criterion and the plots can be referred to Appendix A of this report.

Date	Frequency (MHz)	Tissue Type	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured SAR (W/kg)	Targeted SAR (W/kg)	Normalized SAR (W/kg)	Deviation (%)
2014/4/10	835	Body	250	D835V2-4d162	3955	1399	2.42	9.28	9.68	4.31
2014/4/10	1900	Body	250	D1900V2-5d142	3955	1399	9.78	40.80	39.12	-4.12
2014/4/11	2600	Body	250	D2600V2-1070	3955	1399	13.00	55.70	52	-6.64

Table 8.3.1 Target and Measurement SAR after Normalized

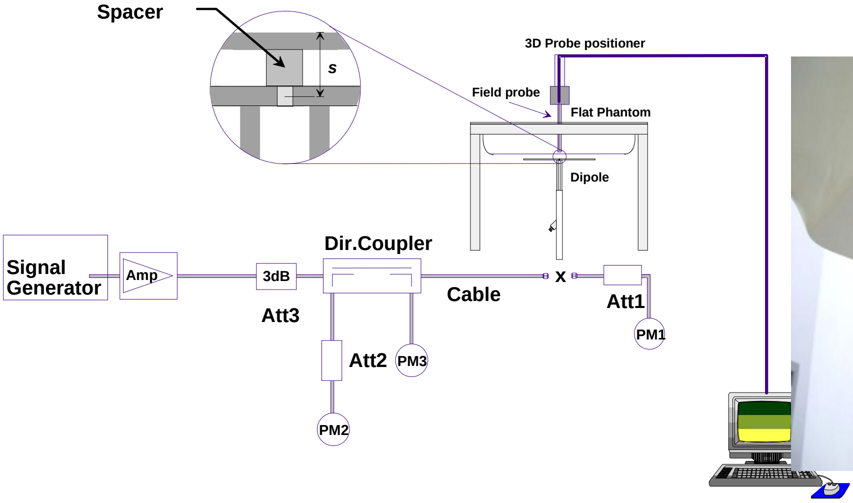
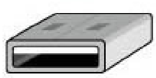
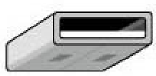
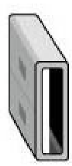
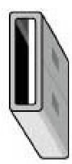


Fig 8.3.1 System Performance Check Setup **Fig 8.3.2 Setup Photo**

11. RF Exposure Positions

This EUT was tested in four different USB configurations. They are “direct laptop plug-in for configuration 1 and 3”, “USB cable plug-in for configuration 2 and 4”, and “USB cable plug-in for Tip Mode (the tip of the EUT)” shown as below. Both direct laptop plug-in and USB cable plug-in test configurations are tested with 5 cm separation between the particular dongle orientation and the flat phantom. Please refer to Appendix D for the test setup photos.

			
Configuration 1 (Horizontal Up)	Configuration 2 (Horizontal Down)	Configuration 3 (Vertical Front)	Configuration 4 (Vertical Back)

12. Conducted RF Output Power (Unit: dBm)

<GSM Conducted Power>

General Note:

1. Per KDB 447498 D01v05r02, the maximum output power channel is used for SAR testing and for further SAR test reduction.
2. For Body SAR testing was following KDB 941225 D03v01, the GPRS 4Tx slots modes was selected to be tested, according to the highest source-based time-averaged output power.

Band GSM850	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
TX Channel	128	189	251		128	189	251	
Frequency (MHz)	824.2	836.4	848.8		824.2	836.4	848.8	
GPRS (GMSK, 1 Tx slot)	32.00	31.96	31.84	33.00	23.00	22.96	22.84	24.00
GPRS (GMSK, 2 Tx slots)	28.53	28.51	28.38	30.00	22.53	22.51	22.38	24.00
GPRS (GMSK, 3 Tx slots)	27.26	27.16	27.04	28.50	23.00	22.90	22.78	24.24
GPRS (GMSK, 4 Tx slots)	26.02	25.93	25.81	27.50	23.02	22.93	22.81	24.50
EDGE (8PSK, 1 Tx slot)	26.06	25.99	25.95	26.50	17.06	16.99	16.95	17.50
EDGE (8PSK, 2 Tx slots)	26.04	25.90	25.82	26.50	20.04	19.90	19.82	20.50
EDGE (8PSK, 3 Tx slots)	25.90	25.86	25.78	26.50	21.64	21.60	21.52	22.24
EDGE (8PSK, 4 Tx slots)	25.81	25.68	25.67	26.50	22.81	22.68	22.67	23.50

Band GSM1900	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
TX Channel	512	661	810		512	661	810	
Frequency (MHz)	1850.2	1880	1909.8		1850.2	1880	1909.8	
GPRS (GMSK, 1 Tx slot)	28.84	28.76	28.74	30.00	19.84	19.76	19.74	21.00
GPRS (GMSK, 2 Tx slots)	26.29	26.20	26.13	27.00	20.29	20.20	20.13	21.00
GPRS (GMSK, 3 Tx slots)	24.80	24.68	24.63	25.50	20.54	20.42	20.37	21.24
GPRS (GMSK, 4 Tx slots)	23.97	23.81	23.81	24.50	20.97	20.81	20.81	21.50
EDGE (8PSK, 1 Tx slot)	24.55	24.41	24.38	25.00	15.55	15.41	15.38	16.00
EDGE (8PSK, 2 Tx slots)	24.50	24.34	24.31	25.00	18.50	18.34	18.31	19.00
EDGE (8PSK, 3 Tx slots)	24.46	24.33	24.30	25.00	20.20	20.07	20.04	20.74
EDGE (8PSK, 4 Tx slots)	23.96	23.80	23.75	24.00	20.96	20.80	20.75	21.00

<WCDMA Conducted Power>

The following tests were conducted according to the test requirements outlines in 3GPP TS 34.121 specification.

A summary of these settings are illustrated below:

HSDPA Setup Configuration:

a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting:
   i. Set Gain Factors (β_c and β_d) and parameters were set according to each
   ii. Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
   iii. Set RMC 12.2Kbps + HSDPA mode.
   iv. Set Cell Power = -86 dBm
   v. Set HS-DSCH Configuration Type to FRC (H-set 1, QPSK)
   vi. Select HSDPA Uplink Parameters
   vii. Set Delta ACK, Delta NACK and Delta CQI = 8
   viii. Set Ack-Nack Repetition Factor to 3
   ix. Set CQI Feedback Cycle (k) to 4 ms
   x. Set CQI Repetition Factor to 2
   xi. Power Ctrl Mode = All Up bits
d. The transmitted maximum output power was recorded.

Table C.10.1.4: β values for transmitter characteristics tests with HS-DPCCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1, Note 2)	CM (dB) (Note 3)	MPR (dB) (Note 3)
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 (Note 4)	15/15 (Note 4)	64	12/15 (Note 4)	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c.

Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, Δ_{ACK} and Δ_{NACK} = 30/15 with β_{hs} = 30/15 * β_c, and Δ_{CQI} = 24/15 with β_{hs} = 24/15 * β_c.

Note 3: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Note 4: 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 β_c = 11/15 and β_d = 15/15.

Setup Configuration

HSUPA Setup Configuration:

a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting * :
   i. Call Configs = 5.2B, 5.9B, 5.10B, and 5.13.2B with QPSK
   ii. Set the Gain Factors (β_c and β_d) and parameters (AG Index) were set according to each specific sub-test in the following table, C11.1.3, quoted from the TS 34.121
   iii. Set Cell Power = -86 dBm
   iv. Set Channel Type = 12.2k + HSPA
   v. Set UE Target Power
   vi. Power Ctrl Mode= Alternating bits
   vii. Set and observe the E-TFCI
   viii. Confirm that E-TFCI is equal to the target E-TFCI of 75 for sub-test 1, and other subtest's E-TFCI
d. The transmitted maximum output power was recorded.

Table C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1)	β_{ec}	β_{ed} (Note 5) (Note 6)	β_{ed} (SF)	β_{ed} (Codes)	CM (dB) (Note 2)	MPR (dB) (Note 2)	AG Index (Note 6)	E-TFCI
1	11/15 (Note 3)	15/15 (Note 3)	64	11/15 (Note 3)	22/15	209/225	1309/225	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	30/15	β_{ed}1: 47/15 β_{ed}2: 47/15	4 4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 (Note 4)	15/15 (Note 4)	64	15/15 (Note 4)	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c .
Note 2: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH 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 β_c = 10/15 and β_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 β_c = 14/15 and β_d = 15/15.
Note 5: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.
Note 6: β_{ed} can not be set directly, it is set by Absolute Grant Value.

Setup Configuration

DC-HSDPA 3GPP release 8 Setup Configuration:

a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration below
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting:
   i. Set RMC 12.2Kbps + HSDPA mode.
   ii. Set Cell Power = -25 dBm
   iii. Set HS-DSCH Configuration Type to FRC (H-set 12, QPSK)
   iv. Select HSDPA Uplink Parameters
   v. Set Gain Factors (β_c and β_d) and parameters were set according to each Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
      a). Subtest 1: β_c/β_d=2/15
      b). Subtest 2: β_c/β_d=12/15
      c). Subtest 3: β_c/β_d=15/8
      d). Subtest 4: β_c/β_d=15/4
   vi. Set Delta ACK, Delta NACK and Delta CQI = 8
   vii. Set Ack-Nack Repetition Factor to 3
   viii. Set CQI Feedback Cycle (k) to 4 ms
   ix. Set CQI Repetition Factor to 2
   x. Power Ctrl Mode = All Up bits
d. The transmitted maximum output power was recorded.

The following tests were conducted according to the test requirements outlines in 3GPP TS 34.121 specification.
A summary of these settings are illustrated below:

C.8.1.12 Fixed Reference Channel Definition H-Set 12

Table C.8.1.12: Fixed Reference Channel H-Set 12

Parameter	Unit	Value
Nominal Avg. Inf. Bit Rate	kbps	60
Inter-TTI Distance	TTI's	1
Number of HARQ Processes	Processes	6
Information Bit Payload (N_{INF})	Bits	120
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	960
Total Available SML's in UE	SML's	19200
Number of SML's per HARQ Proc.	SML's	3200
Coding Rate		0.15
Number of Physical Channel Codes	Codes	1
Modulation		QPSK
Note 1: The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table. Note 2: Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used.		

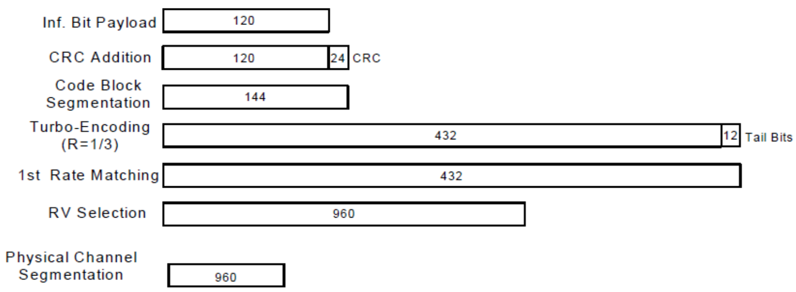


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

Setup Configuration

<WCDMA Conducted Power>

General Note:

1. Per KDB 941225 D02v02r02, RMC 12.2kbps setting is used to evaluate SAR. If HSDPA/HSUPA/DC-HSDPA output power is < 0.25dB higher than RMC, or reported SAR with RMC 12.2kbps setting is ≤ 1.2W/kg, HSDPA/HSUPA/DC-HSDPA SAR evaluation can be excluded..

Band			WCDMA V		
TX Channel			4132	4182	4233
Frequency (MHz)			826.4	836.4	846.6
MPR(dB)	3GPP Rel 99	RMC 12.2Kbps	21.56	21.61	21.82
0	3GPP Rel 6	HSDPA Subtest-1	20.71	20.84	20.93
0	3GPP Rel 6	HSDPA Subtest-2	20.56	20.65	20.72
0.5	3GPP Rel 6	HSDPA Subtest-3	20.32	20.34	20.39
0.5	3GPP Rel 6	HSDPA Subtest-4	20.12	20.16	20.27
0	3GPP Rel 8	DC-HSDPA Subtest-1	20.73	20.81	20.84
0	3GPP Rel 8	DC-HSDPA Subtest-2	20.56	20.73	20.79
0.5	3GPP Rel 8	DC-HSDPA Subtest-3	20.22	20.25	20.29
0.5	3GPP Rel 8	DC-HSDPA Subtest-4	20.05	20.09	20.28
0	3GPP Rel 6	HSUPA Subtest-1	20.51	20.60	20.72
2	3GPP Rel 6	HSUPA Subtest-2	19.68	19.86	19.92
1	3GPP Rel 6	HSUPA Subtest-3	19.52	19.68	19.95
2	3GPP Rel 6	HSUPA Subtest-4	20.13	20.29	20.50
0	3GPP Rel 6	HSUPA Subtest-5	20.55	20.78	21.10

<LTE Conducted Power>

General Note:

1. Anritsu MT8820C base station simulator was used to setup the connection with EUT; the frequency band, channel bandwidth, RB allocation configuration, modulation type are set in the base station simulator to configure EUT transmitting at maximum power and at different configurations which are requested to be reported to FCC, for conducted power measurement and SAR testing.
2. Per KDB 941225 D05v02r03, when a properly configured base station simulator is used for the SAR and power measurements, spectrum plots for each RB allocation and offset configuration is not required.
3. Per KDB 941225 D05v02r03, start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel.
4. Per KDB 941225 D05v02r03, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
5. Per KDB 941225 D05v02r03, For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.
6. Per KDB 941225 D05v02r03, 16QAM output power for each RB allocation configuration is > not ½ dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is ≤ 1.45 W/kg; Per KDB 941225 D05v02r03, 16QAM SAR testing is not required.
7. Per KDB 941225 D05v02r03, Smaller bandwidth output power for each RB allocation configuration is > not ½ dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is ≤ 1.45 W/kg; Per KDB 941225 D05v02r03, smaller bandwidth SAR testing is not required.

<LTE Band 5>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune up Limit (dBm)	MPR (dB)
Channel				20450	20525	20600		
Frequency (MHz)				829	836.5	844		
10	QPSK	1	0	22.41	22.35	22.56	23	0
10	QPSK	1	24	22.38	22.37	22.54		
10	QPSK	1	49	22.42	22.24	22.23		
10	QPSK	25	0	21.40	21.84	21.94	22	0-1
10	QPSK	25	12	21.39	21.77	21.88		
10	QPSK	25	24	21.30	21.70	21.95		
10	QPSK	50	0	21.13	21.25	21.24		
10	16QAM	1	0	21.39	21.31	21.49	22	0-1
10	16QAM	1	24	21.35	21.39	21.53		
10	16QAM	1	49	21.43	21.34	21.46		
10	16QAM	25	0	20.34	20.70	20.91	21	0-2
10	16QAM	25	12	20.31	20.69	20.89		
10	16QAM	25	24	20.30	20.72	20.88		
10	16QAM	50	0	20.16	20.17	20.15		
Channel				20425	20525	20625	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				826.5	836.5	846.5		
5	QPSK	1	0	21.77	21.76	21.77	23	0
5	QPSK	1	12	21.74	21.72	21.89		
5	QPSK	1	24	21.73	21.85	21.50		
5	QPSK	12	0	20.90	21.36	21.20	22	1
5	QPSK	12	6	20.74	21.18	21.20		
5	QPSK	12	11	20.77	21.18	21.19		
5	QPSK	25	0	20.66	20.81	20.94		
5	16QAM	1	0	20.80	20.73	20.81	22	1
5	16QAM	1	12	20.88	20.83	20.86		
5	16QAM	1	24	20.81	20.89	20.85		
5	16QAM	12	0	19.81	20.22	20.20	21	2
5	16QAM	12	6	19.78	20.15	20.23		
5	16QAM	12	11	19.85	20.18	20.24		
5	16QAM	25	0	19.65	19.72	19.90		

<table>
<tr><td colspan="4">Channel</td><td>20415</td><td>20525</td><td>20635</td><td rowspan="2">Tune up Limit (dBm)</td><td rowspan="2">MPR (dB)</td></tr>
<tr><td colspan="4">Frequency (MHz)</td><td>825.5</td><td>836.5</td><td>847.5</td></tr>
<tr><td>3</td><td>QPSK</td><td>1</td><td>0</td><td>21.76</td><td>21.80</td><td>21.80</td><td rowspan="3">23</td><td rowspan="3">0</td></tr>
<tr><td>3</td><td>QPSK</td><td>1</td><td>7</td><td>21.69</td><td>21.59</td><td>21.99</td></tr>
<tr><td>3</td><td>QPSK</td><td>1</td><td>14</td><td>21.71</td><td>21.71</td><td>21.85</td></tr>
<tr><td>3</td><td>QPSK</td><td>8</td><td>0</td><td>20.88</td><td>21.12</td><td>21.36</td><td rowspan="4">22</td><td rowspan="4">0-1</td></tr>
<tr><td>3</td><td>QPSK</td><td>8</td><td>4</td><td>20.91</td><td>21.11</td><td>21.30</td></tr>
<tr><td>3</td><td>QPSK</td><td>8</td><td>7</td><td>20.88</td><td>21.10</td><td>21.30</td></tr>
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<tr><td>3</td><td>16QAM</td><td>1</td><td>0</td><td>20.69</td><td>20.87</td><td>20.86</td><td rowspan="3">22</td><td rowspan="3">0-1</td></tr>
<tr><td>3</td><td>16QAM</td><td>1</td><td>7</td><td>20.69</td><td>20.70</td><td>21.00</td></tr>
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<tr><td>3</td><td>16QAM</td><td>8</td><td>4</td><td>19.88</td><td>20.10</td><td>20.29</td></tr>
<tr><td>3</td><td>16QAM</td><td>8</td><td>7</td><td>19.81</td><td>20.10</td><td>20.30</td></tr>
<tr><td>3</td><td>16QAM</td><td>15</td><td>0</td><td>19.67</td><td>19.85</td><td>19.94</td></tr>
<tr><td colspan="4">Channel</td><td>20407</td><td>20525</td><td>20643</td><td rowspan="2">Tune up Limit (dBm)</td><td rowspan="2">Target MPR (dB)</td></tr>
<tr><td colspan="4">Frequency (MHz)</td><td>824.7</td><td>836.5</td><td>848.3</td></tr>
<tr><td>1.4</td><td>QPSK</td><td>1</td><td>0</td><td>22.50</td><td>22.50</td><td>22.43</td><td rowspan="6">23</td><td rowspan="6">0</td></tr>
<tr><td>1.4</td><td>QPSK</td><td>1</td><td>2</td><td>22.46</td><td>22.45</td><td>22.46</td></tr>
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<tr><td>1.4</td><td>16QAM</td><td>1</td><td>2</td><td>21.50</td><td>21.42</td><td>21.46</td></tr>
<tr><td>1.4</td><td>16QAM</td><td>1</td><td>5</td><td>21.50</td><td>21.53</td><td>21.41</td></tr>
<tr><td>1.4</td><td>16QAM</td><td>3</td><td>0</td><td>21.48</td><td>21.50</td><td>21.58</td></tr>
<tr><td>1.4</td><td>16QAM</td><td>3</td><td>1</td><td>21.46</td><td>21.50</td><td>21.57</td></tr>
<tr><td>1.4</td><td>16QAM</td><td>3</td><td>2</td><td>21.57</td><td>21.47</td><td>21.54</td></tr>
<tr><td>1.4</td><td>16QAM</td><td>6</td><td>0</td><td>20.53</td><td>20.57</td><td>20.53</td><td>21</td><td>0-2</td></tr>
</table>

<LTE Band 7>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune up Limit (dBm)	MPR (dB)
Channel				20850	21100	21350		
Frequency (MHz)				2510	2535	2560		
20	QPSK	1	0	20.87	21.00	21.06	22.5	0
20	QPSK	1	49	20.68	20.90	20.58		
20	QPSK	1	99	20.63	20.71	20.79		
20	QPSK	50	0	19.69	20.03	19.93	21.5	0-1
20	QPSK	50	24	19.89	19.84	19.92		
20	QPSK	50	49	19.92	19.83	19.96		
20	QPSK	100	0	19.92	19.86	19.89		
20	16QAM	1	0	19.65	20.08	19.88	21.5	0-1
20	16QAM	1	49	19.98	20.01	19.99		
20	16QAM	1	99	20.04	20.03	20.36		
20	16QAM	50	0	18.62	18.97	18.94	20.5	0-2
20	16QAM	50	24	18.75	18.85	19.04		
20	16QAM	50	49	18.92	18.94	18.93		
20	16QAM	100	0	18.80	18.78	18.92		
Channel				20825	21100	21375	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				2507.5	2535	2562.5		
15	QPSK	1	0	20.62	20.81	20.74	22.5	0
15	QPSK	1	37	20.63	20.60	20.64		
15	QPSK	1	74	20.56	20.73	20.51		
15	QPSK	36	0	19.58	19.57	19.56	21.5	0-1
15	QPSK	36	18	19.74	19.66	19.63		
15	QPSK	36	37	19.82	19.56	19.63		
15	QPSK	75	0	19.68	19.57	19.62		
15	16QAM	1	0	19.53	19.73	19.58	21.5	0-1
15	16QAM	1	37	19.68	19.62	19.74		
15	16QAM	1	74	19.89	19.59	19.99		
15	16QAM	36	0	18.61	18.65	18.94	20.5	0-2
15	16QAM	36	18	18.62	18.56	18.60		
15	16QAM	36	37	18.80	18.59	18.63		
15	16QAM	75	0	18.69	18.58	18.58		

Channel				20800	21100	21400	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				2505	2535	2565		
10	QPSK	1	0	20.60	20.82	20.83	22.5	0
10	QPSK	1	24	20.76	20.58	20.75		
10	QPSK	1	49	21.02	20.93	21.01		
10	QPSK	25	0	19.73	19.69	19.60	21.5	0-1
10	QPSK	25	12	19.86	19.64	19.67		
10	QPSK	25	24	19.82	19.64	19.81		
10	QPSK	50	0	19.62	19.74	19.58		
10	16QAM	1	0	19.59	19.83	19.78	21.5	0-1
10	16QAM	1	24	19.89	19.78	19.77		
10	16QAM	1	49	19.96	19.87	20.09		
10	16QAM	25	0	18.73	18.77	18.64	20.5	0-2
10	16QAM	25	12	18.81	18.67	18.60		
10	16QAM	25	24	18.73	18.67	18.76		
10	16QAM	50	0	18.67	18.62	18.56		
Channel				20775	21100	21425	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				2502.5	2535	2567.5		
5	QPSK	1	0	20.54	20.62	20.73	22.5	0
5	QPSK	1	12	20.67	20.71	20.90		
5	QPSK	1	24	20.76	20.85	21.02		
5	QPSK	12	0	19.67	19.59	19.79	21.5	0-1
5	QPSK	12	6	19.71	19.68	19.86		
5	QPSK	12	11	19.70	19.66	20.02		
5	QPSK	25	0	19.70	19.65	19.82		
5	16QAM	1	0	19.56	19.65	19.66	21.5	0-1
5	16QAM	1	12	19.75	19.61	19.88		
5	16QAM	1	24	19.77	19.71	20.05		
5	16QAM	12	0	18.61	18.65	18.69	20.5	0-2
5	16QAM	12	6	18.76	18.58	18.79		
5	16QAM	12	11	18.72	18.76	19.02		
5	16QAM	25	0	18.60	18.62	18.76		

13. Antenna Location

Front View

14. SAR Test Results

General Note:

1. Per KDB 447498 D01v05r02, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
   a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
   b. For WWAN: Reported SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor
2. Per KDB 447498 D01v05r02, for each exposure position, testing of other required channels within the operating mode of a frequency band is not required when the *reported* 1-g or 10-g SAR for the mid-band or highest output power channel is:
   - ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
   - ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
   - ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
3. Per KDB 941225 D02v02r02, RMC 12.2kbps setting is used to evaluate SAR. If HSDPA/HSUPA/DC-HSDPA output power is < 0.25dB higher than RMC, or reported SAR with RMC 12.2kbps setting is ≤ 1.2W/kg, HSDPA/HSUPA/DC-HSDPA SAR evaluation can be excluded..
4. Per KDB 941225 D05v02r03, start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel.
5. Per KDB 941225 D05v02r03, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
6. Per KDB 941225 D05v02r03, For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.
7. Per KDB 941225 D05v02r03, 16QAM output power for each RB allocation configuration is > not ½ dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is ≤ 1.45 W/kg; Per KDB 941225 D05v02r03, 16QAM SAR testing is not required.
8. Per KDB 941225 D05v02r03, Smaller bandwidth output power for each RB allocation configuration is > not ½ dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is ≤ 1.45 W/kg; Per KDB 941225 D05v02r03, smaller bandwidth SAR testing is not required.
9. Per KDB 865664 D01v01r03, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg.

14.1 Body SAR

<GSM SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
01	GSM850	GPRS (4 Tx slots)	Horizontal Up	0.5cm	128	824.2	26.02	27.5	1.406	-0.14	0.706	0.993
	GSM850	GPRS (4 Tx slots)	Horizontal Up	0.5cm	189	836.4	25.93	27.5	1.435	-0.11	0.512	0.735
	GSM850	GPRS (4 Tx slots)	Horizontal Up	0.5cm	251	848.8	25.81	27.5	1.476	-0.03	0.390	0.576
	GSM850	GPRS (4 Tx slots)	Horizontal Down	0.5cm	128	824.2	26.02	27.5	1.406	-0.03	0.556	0.782
	GSM850	GPRS (4 Tx slots)	Vertical Front	0.5cm	128	824.2	26.02	27.5	1.406	-0.03	0.267	0.375
	GSM850	GPRS (4 Tx slots)	Vertical Back	0.5cm	128	824.2	26.02	27.5	1.406	-0.08	0.424	0.596
	GSM850	GPRS (4 Tx slots)	Tip Mode	0.5cm	128	824.2	26.02	27.5	1.406	0.06	0.051	0.072
	GSM1900	GPRS (4 Tx slots)	Horizontal Up	0.5cm	512	1850.2	23.97	24.5	1.130	-0.01	0.273	0.308
02	GSM1900	GPRS (4 Tx slots)	Horizontal Down	0.5cm	512	1850.2	23.97	24.5	1.130	-0.06	0.314	0.355
	GSM1900	GPRS (4 Tx slots)	Vertical Front	0.5cm	512	1850.2	23.97	24.5	1.130	0.07	0.199	0.225
	GSM1900	GPRS (4 Tx slots)	Vertical Back	0.5cm	512	1850.2	23.97	24.5	1.130	0.14	0.112	0.127
	GSM1900	GPRS (4 Tx slots)	Tip Mode	0.5cm	512	1850.2	23.97	24.5	1.130	0.02	0.063	0.071

<u><WCDMA SAR></u>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
03	WCDMA V	RMC 12.2Kbps	Horizontal Up	0.5cm	4233	846.6	21.82	23	1.312	-0.05	0.471	**0.618**
	WCDMA V	RMC 12.2Kbps	Horizontal Down	0.5cm	4233	846.6	21.82	23	1.312	-0.07	0.397	0.521
	WCDMA V	RMC 12.2Kbps	Vertical Front	0.5cm	4233	846.6	21.82	23	1.312	-0.15	0.153	0.201
	WCDMA V	RMC 12.2Kbps	Vertical Back	0.5cm	4233	846.6	21.82	23	1.312	-0.05	0.295	0.387
	WCDMA V	RMC 12.2Kbps	Tip Mode	0.5cm	4233	846.6	21.82	23	1.312	0	0.032	0.042

<u><LTE SAR></u>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	LTE Band 5	10M	QPSK	1	0	Horizontal Up	0.5cm	20600	844	22.56	23	1.107	-0.19	0.242	0.268
04	LTE Band 5	10M	QPSK	25	24	Horizontal Up	0.5cm	20600	844	21.95	23	1.274	-0.08	0.369	**0.470**
	LTE Band 5	10M	QPSK	1	0	Horizontal Down	0.5cm	20600	844	22.56	23	1.107	-0.19	0.232	0.257
	LTE Band 5	10M	QPSK	25	24	Horizontal Down	0.5cm	20600	844	21.95	23	1.274	0.04	0.337	0.429
	LTE Band 5	10M	QPSK	1	0	Vertical Front	0.5cm	20600	844	22.56	23	1.107	-0.11	0.135	0.149
	LTE Band 5	10M	QPSK	25	24	Vertical Front	0.5cm	20600	844	21.95	23	1.274	0	0.130	0.166
	LTE Band 5	10M	QPSK	1	0	Vertical Back	0.5cm	20600	844	22.56	23	1.107	-0.13	0.160	0.177
	LTE Band 5	10M	QPSK	25	24	Vertical Back	0.5cm	20600	844	21.95	23	1.274	0.03	0.238	0.303
	LTE Band 5	10M	QPSK	1	0	Tip Mode	0.5cm	20600	844	22.56	23	1.107	0.13	0.017	0.019
	LTE Band 5	10M	QPSK	25	24	Tip Mode	0.5cm	20600	844	21.95	23	1.274	-0.13	0.024	0.031
	LTE Band 7	20M	QPSK	1	0	Horizontal Up	0.5cm	21350	2560	21.06	22.5	1.393	-0.13	0.024	0.033
	LTE Band 7	20M	QPSK	50	0	Horizontal Up	0.5cm	21100	2535	20.03	21.5	1.403	0.05	0.027	0.038
	LTE Band 7	20M	QPSK	1	0	Horizontal Down	0.5cm	21350	2560	21.06	22.5	1.393	-0.18	0.084	0.117
05	LTE Band 7	20M	QPSK	50	0	Horizontal Down	0.5cm	21100	2535	20.03	21.5	1.403	-0.14	0.087	**0.122**
	LTE Band 7	20M	QPSK	1	0	Vertical Front	0.5cm	21350	2560	21.06	22.5	1.393	0	0.001	0.001
	LTE Band 7	20M	QPSK	1	0	Vertical Front	0.5cm	21100	2535	20.03	21.5	1.403	0.12	0.004	0.005
	LTE Band 7	20M	QPSK	1	0	Vertical Back	0.5cm	21350	2560	21.06	22.5	1.393	-0.12	0.016	0.022
	LTE Band 7	20M	QPSK	50	0	Vertical Back	0.5cm	21100	2535	20.03	21.5	1.403	0.16	0.019	0.027
	LTE Band 7	20M	QPSK	1	0	Tip Mode	0.5cm	21350	2560	21.06	22.5	1.393	-0.05	0.022	0.031
	LTE Band 7	20M	QPSK	50	0	Tip Mode	0.5cm	21100	2535	20.03	21.5	1.403	-0.04	0.027	0.038

Test Engineer : Ken Lee and Vic Yang

15. Uncertainty Assessment

The component of uncertainly may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainly by the statistical analysis of a series of observations is termed a Type An evaluation of uncertainty. The evaluation of uncertainty by means other than the statistical analysis of a series of observation is termed a Type B evaluation of uncertainty. Each component of uncertainty, however evaluated, is represented by an estimated standard deviation, termed standard uncertainty, which is determined by the positive square root of the estimated variance.

A Type A evaluation of standard uncertainty may be based on any valid statistical method for treating data. This includes calculating the standard deviation of the mean of a series of independent observations; using the method of least squares to fit a curve to the data in order to estimate the parameter of the curve and their standard deviations; or carrying out an analysis of variance in order to identify and quantify random effects in certain kinds of measurement.

A type B evaluation of standard uncertainty is typically based on scientific judgment using all of the relevant information available. These may include previous measurement data, experience, and knowledge of the behavior and properties of relevant materials and instruments, manufacture's specification, data provided in calibration reports and uncertainties assigned to reference data taken from handbooks. Broadly speaking, the uncertainty is either obtained from an outdoor source or obtained from an assumed distribution, such as the normal distribution, rectangular or triangular distributions indicated in Table 15.1

Uncertainty Distributions	Normal	Rectangular	Triangular	U-Shape
Multi-plying Factor[(a)]	1/k[(b)]	$1/\sqrt{3}$	$1/\sqrt{6}$	$1/\sqrt{2}$

(a) standard uncertainty is determined as the product of the multiplying factor and the estimated range of variations in the measured quantity

(b) κ is the coverage factor

Table 15.1. Standard Uncertainty for Assumed Distribution

The combined standard uncertainty of the measurement result represents the estimated standard deviation of the result. It is obtained by combining the individual standard uncertainties of both Type A and Type B evaluation using the usual "root-sum-squares" (RSS) methods of combining standard deviations by taking the positive square root of the estimated variances.

Expanded uncertainty is a measure of uncertainty that defines an interval about the measurement result within which the measured value is confidently believed to lie. It is obtained by multiplying the combined standard uncertainty by a coverage factor. Typically, the coverage factor ranges from 2 to 3. Using a coverage factor allows the true value of a measured quantity to be specified with a defined probability within the specified uncertainty range. For purpose of this document, a coverage factor two is used, which corresponds to confidence interval of about 95 %. The DASY uncertainty Budget is shown in the following tables.

Error Description	Uncertainty Value (±%)	Probability Distribution	Divisor	Ci (1g)	Ci (10g)	Standard Uncertainty (1g)	Standard Uncertainty (10g)
Measurement System							
Probe Calibration	6.0	Normal	1	1	1	± 6.0 %	± 6.0 %
Axial Isotropy	4.7	Rectangular	√3	0.7	0.7	± 1.9 %	± 1.9 %
Hemispherical Isotropy	9.6	Rectangular	√3	0.7	0.7	± 3.9 %	± 3.9 %
Boundary Effects	1.0	Rectangular	√3	1	1	± 0.6 %	± 0.6 %
Linearity	4.7	Rectangular	√3	1	1	± 2.7 %	± 2.7 %
System Detection Limits	1.0	Rectangular	√3	1	1	± 0.6 %	± 0.6 %
Readout Electronics	0.3	Normal	1	1	1	± 0.3 %	± 0.3 %
Response Time	0.8	Rectangular	√3	1	1	± 0.5 %	± 0.5 %
Integration Time	2.6	Rectangular	√3	1	1	± 1.5 %	± 1.5 %
RF Ambient Noise	3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %
RF Ambient Reflections	3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %
Probe Positioner	0.4	Rectangular	√3	1	1	± 0.2 %	± 0.2 %
Probe Positioning	2.9	Rectangular	√3	1	1	± 1.7 %	± 1.7 %
Max. SAR Eval.	1.0	Rectangular	√3	1	1	± 0.6 %	± 0.6 %
Test Sample Related							
Device Positioning	2.9	Normal	1	1	1	± 2.9 %	± 2.9 %
Device Holder	3.6	Normal	1	1	1	± 3.6 %	± 3.6 %
Power Drift	5.0	Rectangular	√3	1	1	± 2.9 %	± 2.9 %
Phantom and Setup							
Phantom Uncertainty	4.0	Rectangular	√3	1	1	± 2.3 %	± 2.3 %
Liquid Conductivity (Target)	5.0	Rectangular	√3	0.64	0.43	± 1.8 %	± 1.2 %
Liquid Conductivity (Meas.)	2.5	Normal	1	0.64	0.43	± 1.6 %	± 1.1 %
Liquid Permittivity (Target)	5.0	Rectangular	√3	0.6	0.49	± 1.7 %	± 1.4 %
Liquid Permittivity (Meas.)	2.5	Normal	1	0.6	0.49	± 1.5 %	± 1.2 %
Combined Standard Uncertainty						± 11.0 %	± 10.8 %
Coverage Factor for 95 %						K=2	
Expanded Uncertainty						**± 22.0 %**	**± 21.5 %**

Table 15.2. Uncertainty Budget for frequency range 300 MHz to 3 GHz

16. References

[1] FCC 47 CFR Part 2 “Frequency Allocations and Radio Treaty Matters; General Rules and Regulations”

[2] ANSI/IEEE Std. C95.1-1992, “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”, September 1992

[3] IEEE Std. 1528-2003, “Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”, December 2003

[4] SPEAG DASY System Handbook

[5] FCC KDB 447498 D01 v05r02, “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”, Feb 2014.

[6] FCC KDB 447498 D02 v02, “SAR Measurement Procedures for USB Dongle Transmitters” Nov 2009.

[7] FCC KDB 941225 D01 v02, “SAR Measurement Procedures for 3G Devices – CDMA 2000 / Ev-Do / WCDMA / HSDPA / HSPA”, October 2007

[8] FCC KDB 941225 D02 v02r02, “SAR Guidance for HSPA, HSPA+, DC-HSDPA and 1x-Advanced”, May 2013.

[9] FCC KDB 941225 D03 v01, “Recommended SAR Test Reduction Procedures for GSM / GPRS / EDGE”, December 2008

[10] FCC KDB 941225 D05 v02r03, “SAR Evaluation Considerations for LTE Devices”, Dec 2013

[11] FCC KDB 865664 D01 v01r03, "SAR Measurement Requirements for 100 MHz to 6 GHz", Feb 2014.

[12] FCC KDB 865664 D02 v01r01, “RF Exposure Compliance Reporting and Documentation Considerations” May 2013.