SAR Test Report

Report No.: AGC10849211104FH01

FCC ID	:	VTJ-BRAMALV2
APPLICATION PURPOSE	:	Original Equipment
PRODUCT DESIGNATION	:	Brama L V2
BRAND NAME	:	SoloProtect
MODEL NAME	:	SoloProtect ID touch
APPLICANT	:	SoloProtect Limited
DATE OF ISSUE	:	Jan. 12, 2022
STANDARD(S)	:	IEEE Std. 1528:2013 FCC 47 CFR Part 2§2.1093 IEEE Std C95.1 ™-2005 IEC 62209-1: 2016
REPORT VERSION	:	V1.0

Attestation of Global Compliance(Shenzhen) Co., Ltd.

Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Jan. 12, 2022	Valid	Initial Release

Test Report

Applicant Name	SoloProtect Limited
Applicant Address	Suzy Lamplugh House, Vantage Drive, Sheffild, United Kingdom, S9 1RG
Manufacturer Name	Shenzhen Unicair Communication Technology Co.,Ltd.
Manufacturer Address	8-9/F, Block1, Wutong Island, Shunchang Rd., Xixiang, Bao'an District, Shenzhen China.
Factory Name	Dongguan Unicair Communication Technology Co.,Ltd.
Factory Address	49 Yinhu Road, Qiaotou Town, Dongguan City, Guangdong Province, China
Product Designation	Brama L V2
Brand Name	SoloProtect
Model Name	SoloProtect ID touch
EUT Voltage	DC3.7V by battery
Applicable Standard	IEEE Std. 1528:2013 FCC 47 CFR Part 2§2.1093 IEEE Std C95.1 ™-2005 IEC 62209-1: 2016
Test Date	Dec. 19, 2021 to Dec. 29, 2021
Report Template	AGCRT-US-4G/SAR (2021-04-20)

Note: The results of testing in this report apply to the product/system which was tested only.

Prepared By: Thea Huang

Thea Huang (Project Engineer) Dec. 29, 2021

Reviewed By: Calvin Liu

Calvin Liu (Reviewer) Jan. 12, 2022

Approved By: Max Zhang

Max Zhang (Authorized Officer) Jan. 12, 2022

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1. SUMMARY OF MAXIMUM SAR VALUE

The maximum results of Specific Absorption Rate (SAR) found during testing for EUT are as follows:

Frequency Band	Highest Reported 1g-SAR(W/kg)		SAR Test Limit (W/kg)
	Body-worn		
GSM 850	0.736		1.6
PCS 1900	0.830		
UMTS Band II	0.894		
UMTS Band IV	0.729		
UMTS Band V	1.184		
LTE Band 2	0.613		
LTE Band 4	1.144		
LTE Band 5	0.675		
LTE Band 7	1.052		
LTE Band 12	0.576		
LTE Band 17	0.712		
WIFI 2.4G	0.166		
5.2GHz (U-NII-1)	0.392		
5.8GHz U-NII-3	0.365		
Simultaneous Reported SAR	1.576		
SAR Test Result	PASS		

This device is compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6W/kg) specified in IEEE Std. 1528:2013; FCC 47CFR § 2.1093; IEEE/ANSI C95.1:2005 and the following specific FCC Test Procedures:

- KDB 447498 D01 General RF Exposure Guidance v06
- KDB 648474 D04 Handset SAR v01r03
- KDB 865664 D01 SAR Measurement 100MHz to 6GHz v01r04
- KDB 941225 D01 3G SAR Procedures v03r01
- KDB 941225 D06 Hotspot Mode v02r01
- KDB 248227 D01 802 11 Wi-Fi SAR v02r02
- KDB 941225 D05 SAR for LTE Devices v02r05

2. GENERAL INFORMATION

2.1. EUT Description

General Information	
Product Designation	Brama L V2
Test Model	SoloProtect ID touch
Hardware Version	Brama-L _main_RevA
Software Version	Brama_L.D01.20211104
Device Category	Portable
RF Exposure Environment	Uncontrolled
Antenna Type	Internal
GSM and GPRS& EGPRS	
Support Band	☒GSM 850 ☒PCS 1900 (U.S. Bands) ☒GSM 900 ☒DCS 1800(Non-U.S. Bands)
GPRS & EGPRS Type	Class B
GPRS & EGPRS Class	Class 12(1Tx+4Rx, 2Tx+3Rx, 3Tx+2Rx, 4Tx+1Rx)
TX Frequency Range	GSM 850 : 820-850MHz;; PCS 1900: 1850-1910MHz;
RX Frequency Range	GSM 850 : 869~894MHz; PCS 1900: 1930~1990MHz
Release Version	R99
Type of modulation	GMSK for GSM/GPRS; GMSK & 8-PSK for EGPRS
Antenna Gain	GSM850: -1.2dBi; PCS1900: -0.9dBi
Max. Average Power	GSM850: 31.26dBm ;PCS1900: 28.64dBm
WCDMA	
Support Band	☒UMTS FDD Band II ☒UMTS FDD Band V ☒UMTS FDD Band IV (U.S. Bands) ☒UMTS FDD Band I ☒UMTS FDD Band VIII (Non-U.S. Bands)
HS Type	HSPA(HSUPA/HSDPA)
TX Frequency Range	WCDMA FDD Band II: 1850-1910MHz; WCDMA FDD Band V: 824-849MHz FDD Band IV: 1710-1770MHz
RX Frequency Range	WCDMA FDD Band II: 1930-1990MHz; WCDMA FDD Band V: 869-894MHz FDD Band IV: 2110-2170MHz
Release Version	Rel-6
Type of modulation	HSDPA:QPSK/16QAM; HSUPA:BPSK; WCDMA:QPSK
Antenna Gain	Band II: -1.1dBi; Band IV: -1.2dBi; Band V: -0.9dBi
Max. Average Power	Band II: 22.09dBm; Band IV: 23.66dBm; Band V: 23.07dBm
Bluetooth	
Operation Frequency	2402~2480MHz
Antenna Gain	0.5dBi
Bluetooth Version	V4.2
Type of modulation	**BR/EDR**: GFSK, Π/4-DQPSK, 8-DPSK; **BLE:** GFSK
EIRP	**BR/EDR**: 4.954dBm; **BLE:** -0.396dBm

EUT Description (Continue)

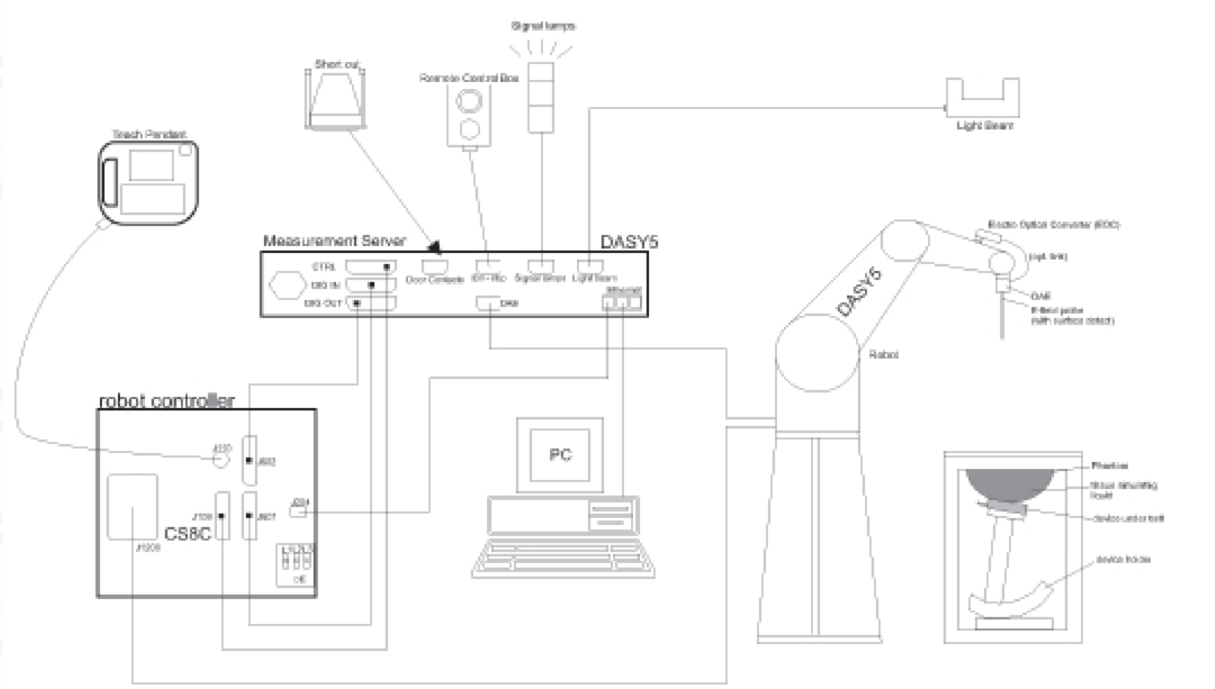
LTE	
Support Band	☒FDD Band 2 ☒FDD Band 4 ☒FDD Band 5 ☒FDD Band 7 ☒FDD Band 12 ☒FDD Band 17 (U.S. Bands) ☒FDD Band 1 ☒FDD Band 3 ☒FDD Band 7 ☒FDD Band 8 ☒FDD Band 20 (Non-U.S. Bands)
TX Frequency Range	Band 2:1850-1910MHz; Band 4:1710-1755MHz;Band 5:824-849MHz; Band 7:2500-2570MHz; Band 12:699-716MHz; Band 17: 704-716MHz;
RX Frequency Range	Band 2:1930-1990MHz; Band 4:2110-2155MHz; Band 5:869-894MHz; Band 7:2620-2690MHz; Band 12: 729-746 MHz; Band 17: 734-746 MHz;
Release Version	Rel-8
Type of modulation	QPSK, 16QAM
Antenna Gain	Band 2: -1.1dBi; Band 4: -1.2dBi; Band 5: -0.9dBi; Band 7: -1.5dBi; Band 12: -1.3dBi; Band 17: -1.32dBi;
Diversity Antenna gain	Band 2: -1.2dBi; Band 4: -1.3dBi; Band 5: -1.24dBi; Band 7: -1.52dBi; Band 12: -1.42dBi; Band 17: -1.45dBi;
Max. Average Power	Band 2: 23.10dBm; Band 4: 24.88dBm; Band 5: 23.66dBm; Band 7:23.76dBm; Band 12: 24.10dBm; Band 17: 23.41dBm;
2.4 GHz WIFI	
WIFI Specification	☐802.11a ☒802.11b ☒802.11g ☒802.11n(20) ☐802.11n(40)
Operation Frequency	2412~2462MHz
Antenna Gain	0.5dBi
Avg. Burst Power	11b:14.05dBm,11g:12.73dBm,11n(20):12.51dBm,
5 GHz WIFI	
WIFI Specification	☒802.11a ☒802.11n20 ☒802.11n40 ☒802.11ac20 ☒802.11ac40 ☐802.11ac80
Operation Frequency	U-NII-1: 5180MHz~5240MHz; U-NII-3: 5745MHz~5825MHz
Max. conducted Power	U-NII-1: 14.99dBm; U-NII-3: 15.70dBm
Antenna Gain	0.2dBi
Accessories	
Battery	Brand name: N/A Model No. : DC383072 Voltage and Capacitance: 3.85 V & 1150mAh
Earphone	Brand name: N/A Model No. : N/A

Note:1. CMU200 can measure the average power and Peak power at the same time
2. The sample used for testing is end product.
3. The test sample has no any deviation to the test method of standard mentioned in page 1.

Product	Type	
	☒ Production unit	☐ Identical Prototype

3. SAR MEASUREMENT SYSTEM

3.1. The DASY5 system used for performing compliance tests consists of following items



- A standard high precision 6-axis robot with controller, teach pendant and software.
- Data acquisition electronics (DAE) which attached to the robot arm extension. The DAE consist of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder with a control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information, as well as an optical uplink for commands and the clock
- A dosimetric probe equipped with an optical surface detector system.
- 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.
- A Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- Phantoms, device holders and other accessories according to the targeted measurement.

3.2. DASY5 E-Field Probe

The SAR measurement is conducted with the dosimetric probe manufactured by SPEAG. The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency. SPEAG conducts the probe calibration in compliance with international and national standards (e.g. IEEE-1528 etc.)Under ISO17025.The calibration data are in Appendix D.

Isotropic E-Field Probe Specification

Model	EX3DV4-SN:3953
Manufacture	SPEAG
frequency	0.7GHz-6GHz Linearity:±0.9%(k=2)
Dynamic Range	0.01W/kg-100W/kg Linearity: ±0.9%(k=2)
Dimensions	Overall length:337mm Tip diameter:2.5mm Typical distance from probe tip to dipole centers:1mm
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.

3.3. Data Acquisition Electronics description

The data acquisition electronics (DAE) consist if a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converte and a command decoder with a control logic unit. Transmission to the measurement sever is accomplished through an optical downlink fir data and status information, as well as an optical uplink for commands and the clock.

The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection.

DAE4

Input Impedance	200MOhm
The Inputs	Symmetrical and floating
Common mode rejection	above 80 dB

3.4. Robot

The DASY system uses the high precision robots (DASY5:TX60) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version from is used.
The XL robot series have many features that are important for our application:
□ High precision (repeatability 0.02 mm)
□ High reliability (industrial design)
□ Jerk-free straight movements
□ Low ELF interference (the closed metallic construction shields against motor control fields)
□ 6-axis controller

3.5. Light Beam Unit

The light beam switch allows automatic “tooling” of the probe. During the process, the actual position of the probe tip with respect to the robot arm is measured, as well as the probe length and the horizontal probe offset. The software then corrects all movements, such that the robot coordinates are valid for the probe tip.
The repeatability of this process is better than 0.1 mm. If a position has been taught with an aligned prob.1 mm, even if the other probe has different dimensions. During probe rotations, the probe tip will keep its actual position. e, the same position will be reached with another aligned probe within 0

3.6. Device Holder

The DASY device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation center for both scales is the ear reference point (EPR). Thus the device needs no repositioning when changing the angles. The DASY device holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity ε=3 and loss tangent δ = 0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.	

3.7. Measurement Server

The measurement server is based on a PC/104 CPU board with CPU (DASY5: 400 MHz, Intel Celeron), chip-disk (DASY5: 128MB), RAM (DASY5: 128MB). The necessary circuits for communication with the DAE electronic box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DAYS I/O board, which is directly connected to the PC/104 bus of the CPU board. The measurement server performs all the real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operations.	

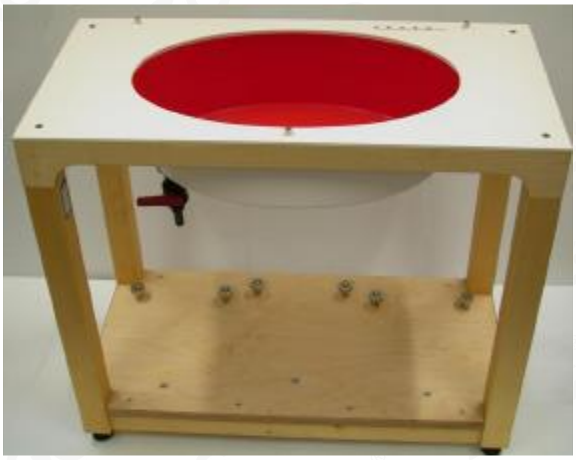
3.8. PHANTOM

SAM Twin Phantom

The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region where shell thickness increases to 6mm). It has three measurement areas: □ Left head □ Right head □ Flat phantom	

The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

ELI4 Phantom

□ Flat phantom a fiberglass shell flat phantom with 2mm+/- 0.2 mm shell thickness. It has only one measurement area for Flat phantom	

4. SAR MEASUREMENT PROCEDURE

4.1. Specific Absorption Rate (SAR)

SAR is related to the rate at which energy is absorbed per unit mass in 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 occupational/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.

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 given mass density (ρ). The equation description is as below:

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

SAR is expressed in units of Watts per kilogram (W/kg)
SAR can be obtained using either of the following equations:

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

$$SAR = c_h \left.\frac{dT}{dt}\right|_{t=0}$$

Where

SAR	is the specific absorption rate in watts per kilogram;
E	is the r.m.s. value of the electric field strength in the tissue in volts per meter;
σ	is the conductivity of the tissue in siemens per metre;
ρ	is the density of the tissue in kilograms per cubic metre;
c_h	is the heat capacity of the tissue in joules per kilogram and Kelvin;
$\frac{dT}{dt}\mid t=0$	is the initial time derivative of temperature in the tissue in kelvins per second

4.2. SAR Measurement Procedure

Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurement are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface is 2.7mm This distance cannot be smaller than the distance os sensor calibration points to probe tip as `defined in the probe properties,

Step 2: 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 locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in db) is specified in the standards for compliance testing. For example, a 2db range is required in IEEE Standard 1528, whereby 3db is a requirement when compliance is assessed in accordance with the ARIB standard (Japan) If one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximum are detected, the number of Zoom Scan has to be increased accordingly.

Area Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100MHz to 6GHz

	≤ 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.	

Step 3: Zoom Scan

Zoom Scan are used to assess the peak spatial SAR value within a cubic average volume containing 1g abd 10g of simulated tissue. The Zoom Scan measures points(refer to table below) within a cube whose 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 1g and 10g and displays these values next to the job's label.

Zoom Scan Parameters extracted from KDB865664 d01 SAR Measurement 100MHz to 6GHz

Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	≤ 1.5·$\Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm

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 *reported* 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.

Step 4: Power Drift Measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the same settings. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

4.3. RF Exposure Conditions

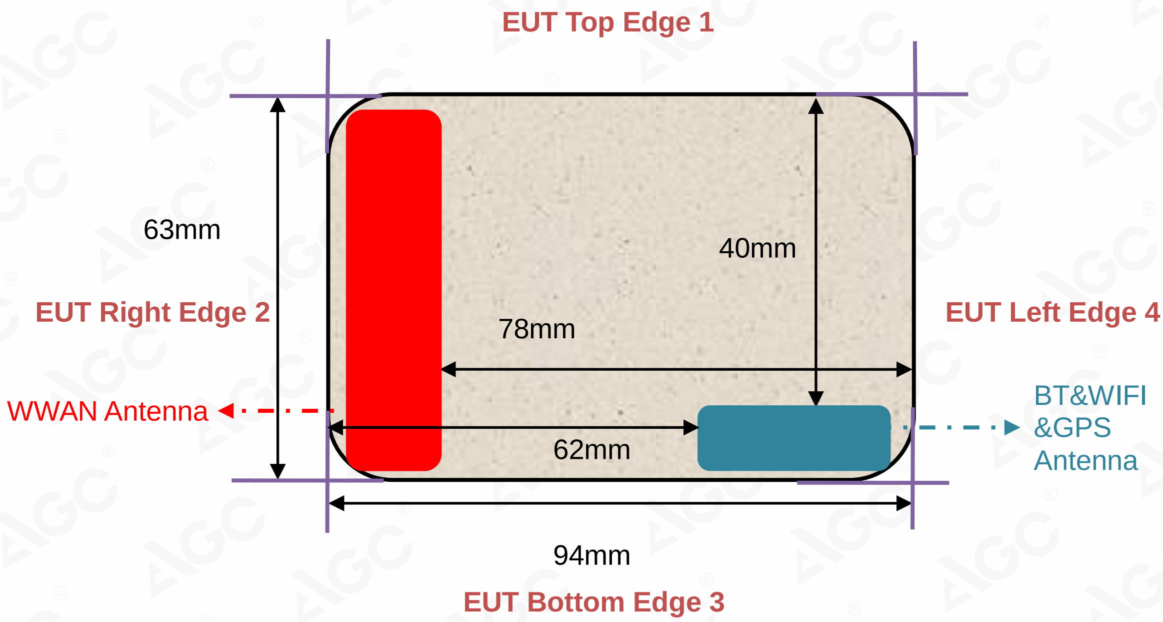
Test Configuration and setting:

The EUT is a model of GSM/WCDMA Portable Mobile Station (MS). It supports GSM/GPRS/EGPRS, WCDMA/HSPA, BT, WIFI, and support hot spot mode.

For WWAN SAR testing, the device was controlled by using a base station emulator. Communication between the device and the emulator were established by air link. The distance between the EUT and the antenna is larger than 50cm, and the output power radiated from the emulator antenna is at least 30db smaller than the output power of EUT.

For WLAN testing, the EUT is configured with the WLAN continuous TX tool through engineering command.

Antenna Location: (the back view)



For WWAN mode:

Test Configurations	Antenna to edges/surface	SAR required	Note
Body			
Back	<25mm	Yes	--
Front	<25mm	Yes	--
Hotspot			
Back	<25mm	Yes	--
Front	<25mm	Yes	--
Edge 1 (Top)	1mm	Yes	--
Edge 2 (Right)	1mm	Yes	--
Edge 3 (Bottom)	1mm	Yes	--
Edge 4 (Left)	78mm	No	SAR is not required for the distance between the antenna and the edge is >25mm as per KDB 941225 D06 Hotspot SAR

For WLAN mode:

Test Configurations	Antenna to edges/surface	SAR required	Note
Body			
Back	<25mm	Yes	--
Front	<25mm	Yes	--
Hotspot			
Back	<25mm	Yes	--
Front	<25mm	Yes	--
Edge 1 (Top)	40mm	No	SAR is not required for the distance between the antenna and the edge is >25mm as per KDB 941225 D06 Hotspot SAR
Edge 2 (Right)	62mm	No	SAR is not required for the distance between the antenna and the edge is >25mm as per KDB 941225 D06 Hotspot SAR
Edge 3 (Bottom)	1mm	Yes	--
Edge 4 (Left)	1mm	Yes	--

5. TISSUE SIMULATING LIQUID

For SAR measurement of the field distribution inside the phantom, the phantom must be filled with homogeneous tissue simulating liquid to a depth of at least 15cm. For head SAR testing the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15cm For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15cm.The nominal dielectric values of the tissue simulating liquids in the phantom and the tolerance of 10% are listed in 6.2

5.1. The composition of the tissue simulating liquid

Ingredient (% Weight) / Frequency (MHz)	Water	Nacl	Polysorbate 20	DGBE	1,2 Propanediol	Triton X-100
750 Head	35	2	0.0	0.0	63	0.0
835 Head	50.36	1.25	48.39	0.0	0.0	0.0
1750 Head	52.64	0.36	0.0	47	0.0	0.0
1900 Head	54.9	0.18	0.0	44.92	0.0	0.0
2450 Head	71.88	0.16	0.0	7.99	0.0	19.97
2600 Head	55.242	0.306	0	44.452	0	0

Ingredient (% Weight) / Frequency (MHz)	Water	Nacl	Polysorbate 20	DGBE	1,2-Propanediol	Triton X-100	Diethylen glycol monohexylether
5000 Head	65.52	0.0	0.0	0.0	0.0	17.24	17.24

Attestation of Global Compliance(Shenzhen)Co., Ltd
Attestation of Global Compliance(Shenzhen)Std & Tech Co., Ltd
Tel: +86-755 2523 4088 E-mail: agc@agc-cert.com Web: http://cn.agc-cert.com/

5.2. Tissue Dielectric Parameters for Head and Body Phantoms

The head tissue dielectric parameters recommended by the IEC 62209-1 have been incorporated in the following table. The body tissue dielectric parameters recommended by the IEC 62209-2 have been incorporated in the following table.

Target Frequency (MHz)	head		body	
	εr	σ (S/m)	εr	σ (S/m)
300	45.3	0.87	45.3	0.87
450	43.5	0.87	43.5	0.87
750	**41.9**	**0.89**	**41.9**	**0.89**
835	**41.5**	**0.90**	**41.5**	**0.90**
900	41.5	0.97	41.5	0.97
915	41.5	1.01	41.5	1.01
1450	40.5	1.20	40.5	1.20
1610	40.3	1.29	40.3	1.29
1750	**40.1**	**1.37**	**40.1**	**1.37**
1800 – 2000	**40.0**	**1.40**	**40.0**	**1.40**
2300	39.5	1.67	39.5	1.67
2450	**39.2**	**1.80**	**39.2**	**1.80**
2600	**39.0**	**1.96**	**39.0**	**1.96**
3000	38.5	2.40	38.5	2.40
5200	**36.0**	**4.66**	**36.0**	**4.66**
5300	35.9	4.76	35.9	4.76
5600	35.5	5.07	35.5	5.07
5800	**35.3**	**5.27**	**35.3**	**5.27**

(εr = relative permittivity, σ = conductivity and ρ = 1000 kg/m3)

5.3. Tissue Calibration Result

The dielectric parameters of the liquids were verified prior to the SAR evaluation using DASY 5 Dielectric Probe Kit and R&S Network Analyzer ZVL6.

Tissue Stimulant Measurement for 750MHz					
	Fr. (MHz)	Dielectric Parameters (±10%)		Tissue Temp [^{o}C]	Test time
		εr 41.9 (37.71-46.09)	δ[s/m] 0.89(0.801-0.979)		
Head	704	43.95	0.85	20.6	Dec. 25, 2021
	709	43.71	0.86		
	707.5	43.57	0.87		
	710	43.09	0.88		
	711	42.74	0.89		
	750	42.61	0.90		

Tissue Stimulant Measurement for 835MHz					
	Fr. (MHz)	Dielectric Parameters (±10%)		Tissue Temp [^{o}C]	Test time
		εr 41.5 (37.35-45.65)	δ[s/m] 0.90(0.81-0.99)		
Head	824.2	41.46	0.90	20.3	Dec. 27, 2021
	826.4	41.46	0.90		
	829	41.46	0.90		
	835	41.15	0.91		
	836.4	40.98	0.92		
	836.5	40.98	0.92		
	836.6	40.98	0.92		
	844	40.76	0.93		
	846.6	40.76	0.93		
	848.8	40.76	0.93		

Tissue Stimulant Measurement for 1750MHz					
	Fr. (MHz)	Dielectric Parameters (±10%)		Tissue Temp [^{o}C]	Test time
		εr 40.1 (36.09-44.11)	δ[s/m]1.37(1.233-1.507)		
Head	1712.4	40.84	1.36	20.5	Dec. 28, 2021
	1720	40.84	1.36		
	1732.4	40.46	1.37		
	1732.5	40.46	1.37		
	1745	40.17	1.38		
	1750	39.85	1.39		
	1752.6	39.61	1.40		

Tissue Stimulant Measurement for 1900MHz					
Head	Fr. (MHz)	Dielectric Parameters (±10%)		Tissue Temp [°C]	Test time
		εr40.00(36.00-44.00)	δ[s/m]1.40(1.26-1.54)		
	1850.2	40.82	1.37	20.3	Dec. 29, 2021
	1852.4	40.69	1.38		
	1860	40.35	1.39		
	1880	39.99	1.40		
	1900	39.72	1.41		
	1907.6	39.44	1.42		
	1909.8	39.25	1.43		

Tissue Stimulant Measurement for 2450MHz					
Head	Fr. (MHz)	Dielectric Parameters (±10%)		Tissue Temp [°C]	Test time
		εr39.2(35.28-43.12)	δ[s/m]1.80(1.62-1.98)		
	2412	40.16	1.74	21.2	Dec. 20, 2021
	2437	38.97	1.75		
	2450	38.61	1.76		
	2462	38.32	1.77		

Tissue Stimulant Measurement for 2600MHz					
Head	Fr. (MHz)	Dielectric Parameters (±10%)		Tissue Temp [°C]	Test time
		εr39(35.1-42.9)	δ[s/m]1.96(1.764-2.156)		
	2510	39.68	1.89	21.2	Dec. 19, 2021
	2535	39.42	1.90		
	2560	38.86	1.91		
	2600	38.67	1.92		

Tissue Stimulant Measurement for 5200MHz					
Head	Fr. (MHz)	Dielectric Parameters (±10%)		Tissue Temp [°C]	Test time
		εr 36.0(32.4-39.6)	δ[s/m] 4.66(4.194 -5.126)		
	5180	36.06	4.53	20.9	Dec. 21, 2021
	5200	35.81	4.54		
	5220	35.64	4.55		
	5240	35.41	4.56		

Tissue Stimulant Measurement for 5800MHz					
Head	Fr. (MHz)	Dielectric Parameters (±10%)		Tissue Temp [°C]	Test time
		εr 35.3 (31.77-38.83)	δ[s/m] 5.27 (4.743-5.797)		
	5745	36.08	5.30	20.6	Dec. 22, 2021
	5785	35.92	5.31		
	5800	35.71	5.32		
	5825	35.45	5.33		

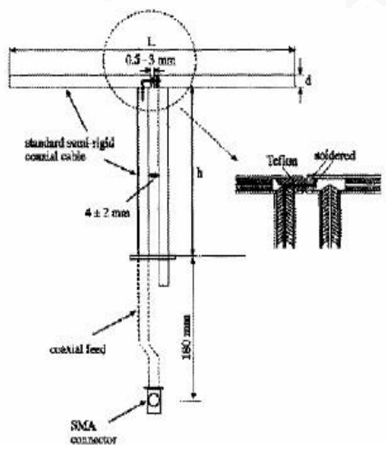
6. SAR SYSTEM CHECK PROCEDURE

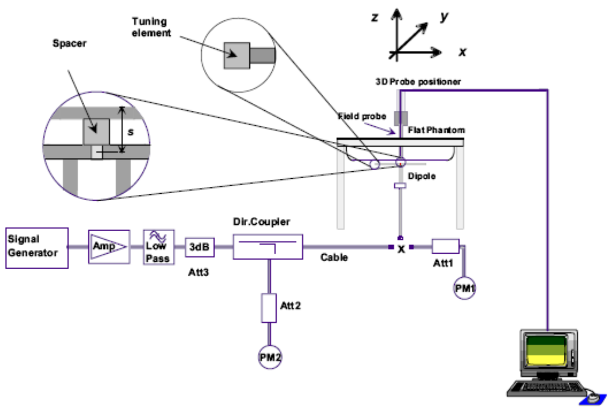
6.1. SAR System Check Procedures

SAR system check is required to confirm measurement accuracy, according to the tissue dielectric media, probe calibration points and other system operating parameters required for measuring the SAR of a test device. The system verification must be performed for each frequency band and within the valid range of each probe calibration point required for testing the device. The same SAR probe(s) and tissue-equivalent media combinations used with each specific SAR system for system verification must be used for device testing. When multiple probe calibration points are required to cover substantially large transmission bands, independent system verifications are required for each probe calibration point. A system verification must be performed before each series of SAR measurements using the same probe calibration point and tissue-equivalent medium. Additional system verification should be considered according to the conditions of the tissue-equivalent medium and measured tissue dielectric parameters, typically every three to four days when the liquid parameters are remeasured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

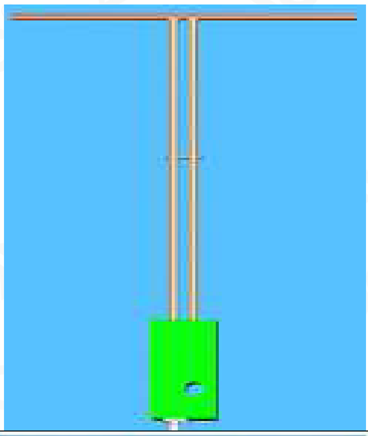
Each DASY system is equipped with one or more system check kits. These units, together with the predefined measurement procedures within the DASY software, enable the user to conduct the system check and system validation. System kit includes a dipole, and dipole device holder.

The system check verifies that the system operates within its specifications. It’s performed daily or before every SAR measurement. The system check uses normal SAR measurement in the flat section of the phantom with a matched dipole at a specified distance. The system check setup is shown as below.





6.2. SAR System Check
6.2.1. Dipoles

	The dipoles used are based on the IEEE-1528 standard, and is complied with mechanical and electrical specifications in line with the requirements of IEEE. the table below provides details for the mechanical and electrical specifications for the dipoles.
	The wave guide is based on the IEEE-1528 standard, and is complied with mechanical and electrical specifications in line with the requirements of IEEE. The table below provides details for the mechanical and electrical specifications for the wave guide.

Frequency	L (mm)	h (mm)	d (mm)
750MHz	176	100	6.35
835MHz	161.0	89.8	3.6
1800MHz	71.6	41.7	3.6
1900MHz	68	39.5	3.6
2450MHz	51.5	30.4	3.6
2600MHz	48.5	28.8	3.6

Frequency	L (mm)	W (mm)	L_f (mm)	W_f (mm)
5000MHz	40.39	20.19	81.03	61.98

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Attestation of Global Compliance(Shenzhen)Std & Tech Co., Ltd
Tel: +86-755 2523 4088 E-mail: agc@agc-cert.com Web: http://cn.agc-cert.com/

6.2.2. System Check Result

System Performance Check at 750MHz&835MHz &1800MHz &1900MHz&2450MHz&2600MHz &5000-6000MHz								
Validation Kit: SN47/14 DIP 0G750-340& SN29/15 DIP 0G835-383& SN46/11 DIP 1G800-186& SN 46/11 DIP 1G900-187& SN46/11 DIP 2G450-189&& SN 47/14 DIP 2G600-342& SN 15/15 WGA 36								
Frequency [MHz]	Target Value(W/kg)		Reference Result (± 10%)		Tested Value(W/kg)		Tissue Temp. [°C]	Test time
	1g	10g	1g	10g	1g	10g		
750	8.31	5.45	7.479-9.141	4.905-5.995	8.59	5.18	20.6	Dec. 25, 2021
835	9.85	6.27	8.865-10.835	5.643 -6.897	9.78	6.28	20.3	Dec. 27, 2021
1800	39.07	20.29	35.163-42.977	18.261-22.319	37.72	19.34	20.5	Dec. 28, 2021
1900	40.25	20.50	36.225-44.275	18.45-22.55	37.72	19.49	20.3	Dec. 29, 2021
2450	53.97	24.01	48.573-59.367	21.609-26.411	55.15	23.30	21.2	Dec. 20, 2021
2600	56.86	24.84	51.174-62.546	22.356-27.324	53.57	24.09	21.2	Dec. 19, 2021
5200	161.18	55.04	145.062-177.298	49.536-60.544	152.0	53.7	20.9	Dec. 21, 2021
5800	181.69	60.11	163.521-199.859	54.099-66.121	189.00	63.7	20.6	Dec. 22, 2021

Note:
(1) We use a CW signal of 18dBm&10dBm for system check, and then all SAR values are normalized to 1W forward power. The result must be within ±10% of target value.

7. EUT TEST POSITION

This EUT was tested in **Body back, Body front and 4 edges.**

7.1. Body Worn Position

(1) To position the EUT parallel to the phantom surface.

(2) To adjust the EUT parallel to the flat phantom.

(3) To adjust the distance between the EUT surface and the flat phantom to **5mm.**

8. SAR EXPOSURE LIMITS

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

Type Exposure	Uncontrolled Environment Limit (W/kg)
Spatial Peak SAR (1g cube tissue for brain or body)	1.60
Spatial Average SAR (Whole body)	0.08
Spatial Peak SAR (Limbs)	4.0

9. TEST FACILITY

Test Site	Attestation of Global Compliance (Shenzhen) Co., Ltd
Location	1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Designation Number	CN1259
FCC Test Firm Registration Number	975832
A2LA Cert. No.	5054.02
Description	Attestation of Global Compliance(Shenzhen) Co., Ltd is accredited by A2LA

10. TEST EQUIPMENT LIST

Equipment description	Manufacturer/ Model	Identification No.	Software version	Current calibration date	Next calibration date
Stäubli Robot	Stäubli-TX60	F13/5Q2UD1/A/01	N/A	N/A	N/A
Robot Controller	Stäubli-CS8	139522	N/A	N/A	N/A
E-Field Probe	Speag- EX3DV4	SN:3953	N/A	Aug. 27,2021	Aug. 26,2022
SAM Twin Phantom	Speag-SAM	1790	N/A	N/A	N/A
Device Holder	Speag-SD 000 H01 KA	SD 000 H01 KA	N/A	N/A	N/A
DAE4	Speag-SD 000 D04 BM	1398	N/A	May 17,2021	May 16,2022
SAR Software	Speag-DASY5	N/A	5.3da53	N/A	N/A
Liquid	SATIMO	N/A	N/A	N/A	N/A
Radio Communication Tester	R&S-CMU200	115532	V5.2.1	Apr. 14,2021	Apr. 13,2022
Dipole	SATIMO SID750	SN47/14 DIP 0G750-340	N/A	Apr. 26,2019	Apr. 25,2022
Dipole	SATIMO SID835	SN 29/15 DIP 0G850-383	N/A	Apr. 26,2019	Apr. 25,2022
Dipole	SATIMO SID1800	SN46/11 DIP 1G800-186	N/A	Apr. 26,2019	Apr. 25,2022
Dipole	SATIMO SID1900	SN 46/11 DIP 1G900-187	N/A	Apr. 26,2019	Apr. 25,2022
Dipole	SATIMO SID2450	SN 46/11 DIP 2G450-189	N/A	Apr. 26,2019	Apr. 25,2022
Dipole	SATIMO SID2600	SN 47/14 DIP 2G600-342	N/A	Apr. 26,2019	Apr. 25,2022
Wave guide	SWG5500	SN 15/15 WGA 36	N/A	Apr. 26,2019	Apr. 25,2022
Signal Generator	Agilent-E4438C	US41461365	V5.03	Aug. 18,2021	Aug. 17,2022
Vector Analyzer	Agilent / E4440A	MY44303916	N/A	Mar. 21,2021	Mar. 20,2022
Network Analyzer	Rhode & Schwarz ZVL6	SN101443	3.2	Oct. 28,2021	Oct. 27,2022
Attenuator	Warison /WATT-6SR1211	S/N:WRJ34AYM2F1	N/A	June 09,2021	June 08,2022
Attenuator	Mini-circuits / VAT-10+	31405	N/A	June 09,2021	June 08,2022
Amplifier	AS0104-55_55	1004793	N/A	June 10,2021	June 09,2022
Directional Couple	Werlatone/ C5571-10	SN99463	N/A	May 15,2020	May 14,2022
Directional Couple	Werlatone/ C6026-10	SN99482	N/A	May 15,2020	May 14,2022
Power Sensor	NRP-Z21	1137.6000.02	N/A	Sep. 07,2021	Sep. 06,2022
Power Sensor	NRP-Z23	100323	N/A	Feb. 17,2021	Feb. 16,2022
Power Viewer	R&S	V2.3.1.0	N/A	N/A	N/A
Calibration standard parts for network sub - port	R&S/ ZV-Z132	N/A	V2.3.1.0	Dec. 07, 2021	Dec. 06, 2022

Note: Per KDB 865664 Dipole SAR Validation, AGC Lab has adopted 3 years calibration intervals. On annual basis, every measurement dipole has been evaluated and is in compliance with the following criteria:
1. There is no physical damage on the dipole;
2. System validation with specific dipole is within 10% of calibrated value;
3. Return-loss is within 20% of calibrated measurement;
4. Impedance is within 5Ω of calibrated measurement.

11. MEASUREMENT UNCERTAINTY

DASY Uncertainty- EX3DV4 Measurement uncertainty for Dipole averaged over 1 gram / 10 gram.									
a	b	c	d	e f(d,k)	f	g	h c×f/e	i c×g/e	k
Uncertainty Component	Sec.	Tol (± %)	Prob. Dist.	Div.	Ci (1g)	Ci (10g)	1g Ui (±%)	10g Ui (±%)	vi
Measurement System									
Probe calibration	E.2.1	6.65	N	1	1	1	6.65	6.65	∞
Axial Isotropy	E.2.2	0.6	R	√3	√0.5	√0.5	0.24	0.24	∞
Hemispherical Isotropy	E.2.2	1.6	R	√3	√0.5	√0.5	0.65	0.65	∞
Boundary effect	E.2.3	1	R	√3	1	1	0.58	0.58	∞
Linearity	E.2.4	0.45	R	√3	1	1	0.26	0.26	∞
System detection limits	E.2.4	1	R	√3	1	1	0.58	0.58	∞
Modulation response	E2.5	3.3	R	√3	1	1	1.91	1.91	∞
Readout Electronics	E.2.6	0.15	N	1	1	1	0.15	0.15	∞
Response Time	E.2.7	0	R	√3	1	1	0.00	0.00	∞
Integration Time	E.2.8	1.7	R	√3	1	1	0.98	0.98	∞
RF ambient conditions-Noise	E.6.1	3	R	√3	1	1	1.73	1.73	∞
RF ambient conditions-reflections	E.6.1	3	R	√3	1	1	1.73	1.73	∞
Probe positioner mechanical tolerance	E.6.2	0.4	R	√3	1	1	0.23	0.23	∞
Probe positioning with respect to phantom shell	E.6.3	6.7	R	√3	1	1	3.87	3.87	∞
Extrapolation, interpolation, and integrations algorithms for max. SAR evaluation	E.5	4	R	√3	1	1	2.31	2.31	∞
Test sample Related									
Test sample positioning	E.4.2	2.9	N	1	1	1	2.90	2.90	∞
Device holder uncertainty	E.4.1	3.6	N	1	1	1	3.60	3.60	∞
Output power variation—SAR drift measurement	E.2.9	5	R	√3	1	1	2.89	2.89	∞
SAR scaling	E.6.5	5	R	√3	1	1	2.89	2.89	∞
Phantom and tissue parameters									
Phantom shell uncertainty—shape, thickness, and permittivity	E.3.1	6.6	R	√3	1	1	3.81	3.81	∞
Uncertainty in SAR correction for deviations in permittivity and conductivity	E.3.2	1.9	N	1	1	0.84	1.90	1.60	∞
Liquid conductivity measurement	E.3.3	4	N	1	0.78	0.71	3.12	2.84	M
Liquid permittivity measurement	E.3.3	5	N	1	0.23	0.26	1.15	1.30	M
Liquid conductivity—temperature uncertainty	E.3.4	2.5	R	√3	0.78	0.71	1.13	1.02	∞
Liquid permittivity—temperature uncertainty	E.3.4	2.5	R	√3	0.23	0.26	0.33	0.38	∞
Combined Standard Uncertainty			RSS				11.79	11.63	
Expanded Uncertainty (95% Confidence interval)			K=2				23.59	23.26	

DASY Uncertainty- EX3DV4 System Check uncertainty for Dipole averaged over 1 gram / 10 gram.									
a	b	c	d	e f(d,k)	f	g	h c×f/e	i c×g/e	k
Uncertainty Component	Sec.	Tol (± %)	Prob. Dist.	Div.	Ci (1g)	Ci (10g)	1g Ui (±%)	10g Ui (±%)	vi
Measurement System									
Probe calibration drift	E.2.1	0.5	N	1	1	1	0.5	0.5	∞
Axial Isotropy	E.2.2	0.6	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Hemispherical Isotropy	E.2.2	1.6	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Boundary effect	E.2.3	1	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Linearity	E.2.4	0.45	R	$\sqrt{3}$	0	0	0.00	0.00	∞
System detection limits	E.2.4	1	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Modulation response	E2.5	3.3	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Readout Electronics	E.2.6	0.15	N	1	0	0	0.00	0.00	∞
Response Time	E.2.7	0	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Integration Time	E.2.8	1.7	R	$\sqrt{3}$	0	0	0.00	0.00	∞
RF ambient conditions-Noise	E.6.1	3	R	$\sqrt{3}$	0	0	0.00	0.00	∞
RF ambient conditions-reflections	E.6.1	3	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Probe positioner mechanical tolerance	E.6.2	0.4	R	$\sqrt{3}$	1	1	0.37	0.37	∞
Probe positioning with respect to phantom shell	E.6.3	6.7	R	$\sqrt{3}$	1	1	3.87	3.87	∞
Extrapolation, interpolation, and integrations algorithms for max. SAR evaluation	E.5	4	R	$\sqrt{3}$	0	0	0.00	0.00	∞
System check source (dipole)									
Deviation of experimental dipoles	E.6.4	2.0	N	1	1	1	2.00	2.00	∞
Input power and SAR drift measurement	8,6.6.4	5.0	R	$\sqrt{3}$	1	1	2.89	2.89	∞
Dipole axis to liquid distance	8,E.6.6	2.0	R	$\sqrt{3}$	1	1	1.15	1.15	∞
Phantom and tissue parameters									
Phantom shell uncertainty—shape, thickness, and permittivity	E.3.1	6.6	R	$\sqrt{3}$	1	1	3.81	3.81	∞
Uncertainty in SAR correction for deviations in permittivity and conductivity	E.3.2	1.9	N	1	1	0.84	1.90	1.60	∞
Liquid conductivity measurement	E.3.3	4	N	1	0.78	0.71	3.12	2.84	M
Liquid permittivity measurement	E.3.3	5	N	1	0.23	0.26	1.15	1.30	M
Liquid conductivity—temperature uncertainty	E.3.4	2.5	R	$\sqrt{3}$	0.78	0.71	1.13	1.02	∞
Liquid permittivity—temperature uncertainty	E.3.4	2.5	R	$\sqrt{3}$	0.23	0.26	0.33	0.38	∞
Combined Standard Uncertainty			RSS				7.34	7.07	
Expanded Uncertainty (95% Confidence interval)			K=2				14.67	14.14	

DASY Uncertainty- EX3DV4 System Validation uncertainty for Dipole averaged over 1 gram / 10 gram.									
a	b	c	d	e f(d,k)	f	g	h c×f/e	i c×g/e	k
Uncertainty Component	Sec.	Tol (±%)	Prob. Dist.	Div.	Ci (1g)	Ci (10g)	1g Ui (±%)	10g Ui (±%)	vi
Measurement System									
Probe calibration	E.2.1	6.65	N	1	1	1	6.65	6.65	∞
Axial Isotropy	E.2.2	0.6	R	√3	1	1	0.35	0.35	∞
Hemispherical Isotropy	E.2.2	1.6	R	√3	0	0	0.00	0.00	∞
Boundary effect	E.2.3	1	R	√3	1	1	0.58	0.58	∞
Linearity	E.2.4	0.45	R	√3	1	1	0.26	0.26	∞
System detection limits	E.2.4	1	R	√3	1	1	0.58	0.58	∞
Modulation response	E2.5	3.3	R	√3	0	0	0.00	0.00	∞
Readout Electronics	E.2.6	0.15	N	1	1	1	0.15	0.15	∞
Response Time	E.2.7	0	R	√3	0	0	0.00	0.00	∞
Integration Time	E.2.8	1.7	R	√3	0	0	0.00	0.00	∞
RF ambient conditions-Noise	E.6.1	3	R	√3	1	1	1.73	1.73	∞
RF ambient conditions-reflections	E.6.1	3	R	√3	1	1	1.73	1.73	∞
Probe positioner mechanical tolerance	E.6.2	0.4	R	√3	1	1	0.23	0.23	∞
Probe positioning with respect to phantom shell	E.6.3	6.7	R	√3	1	1	3.87	3.87	∞
Extrapolation, interpolation, and integrations algorithms for max. SAR evaluation	E.5	4	R	√3	1	1	2.31	2.31	∞
System check source (dipole)									
Deviation of experimental dipole from numerical dipole	E.6.4	5.0	N	1	1	1	5.00	5.00	∞
Input power and SAR drift measurement	8,6.6.4	5.0	R	√3	1	1	2.89	2.89	∞
Dipole axis to liquid distance	8,E.6.6	2.0	R	√3	1	1	1.15	1.15	∞
Phantom and tissue parameters									
Phantom shell uncertainty—shape, thickness, and permittivity	E.3.1	6.6	R	√3	1	1	3.81	3.81	∞
Uncertainty in SAR correction for deviations in permittivity and conductivity	E.3.2	1.9	N	1	1	0.84	1.90	1.60	∞
Liquid conductivity measurement	E.3.3	4	N	1	0.78	0.71	3.12	2.84	M
Liquid permittivity measurement	E.3.3	5	N	1	0.23	0.26	1.15	1.30	M
Liquid conductivity—temperature uncertainty	E.3.4	2.5	R	√3	0.78	0.71	1.13	1.02	∞
Liquid permittivity—temperature uncertainty	E.3.4	2.5	R	√3	0.23	0.26	0.33	0.38	∞
Combined Standard Uncertainty			RSS				11.45	11.28	
Expanded Uncertainty (95% Confidence interval)			K=2				22.89	22.55	

12. CONDUCTED POWER MEASUREMENT

GSM BAND

Mode	Frequency(MHz)	Avg. Burst Power(dBm)	Duty cycle Factor(dBm)	Frame Power(dBm)
Maximum Power <1>				
GSM 850	824.2	31.05	-9	22.05
	836.6	31.23	-9	22.23
	848.8	**31.26**	-9	22.26
GPRS 850 （1 Slot）	824.2	31.09	-9	22.09
	836.6	31.23	-9	22.23
	848.8	30.98	-9	21.98
GPRS 850 （2 Slot）	824.2	30.46	-6	24.46
	836.6	30.22	-6	24.22
	848.8	31.18	-6	**25.18**
GPRS 850 （3 Slot）	824.2	28.23	-4.26	23.97
	836.6	28.30	-4.26	24.04
	848.8	28.25	-4.26	23.99
GPRS 850 （4 Slot）	824.2	26.12	-3	23.12
	836.6	26.09	-3	23.09
	848.8	26.14	-3	23.14
EGPRS 850 （1 Slot）	824.2	23.61	-9	14.61
	836.6	23.53	-9	14.53
	848.8	23.77	-9	14.77
EGPRS 850 （2 Slot）	824.2	21.48	-6	15.48
	836.6	21.59	-6	15.59
	848.8	21.67	-6	15.67
EGPRS 850 （3 Slot）	824.2	19.53	-4.26	15.27
	836.6	19.61	-4.26	15.35
	848.8	19.28	-4.26	15.02
EGPRS 850 （4 Slot）	824.2	17.48	-3	14.48
	836.6	17.35	-3	14.35
	848.8	17.27	-3	14.27

GSM BAND CONTINUE

Mode	Frequency(MHz)	Avg. Burst Power(dBm)	Duty cycle Factor(dBm)	Frame Power(dBm)
Maximum Power <1>				
PCS1900	1850.2	28.63	-9	19.63
	1880	28.60	-9	19.60
	1909.8	28.29	-9	19.29
GPRS1900 （1 Slot）	1850.2	**28.64**	-9	19.64
	1880	28.57	-9	19.57
	1909.8	28.25	-9	19.25
GPRS1900 （2 Slot）	1850.2	26.19	-6	20.19
	1880	26.42	-6	20.42
	1909.8	26.08	-6	20.08
GPRS1900 （3 Slot）	1850.2	24.58	-4.26	20.32
	1880	24.78	-4.26	**20.52**
	1909.8	24.55	-4.26	20.29
GPRS1900 （4 Slot）	1850.2	22.94	-3	19.94
	1880	22.54	-3	19.54
	1909.8	22.63	-3	19.63
EGPRS1900 （1 Slot）	1850.2	23.35	-9	14.35
	1880	23.78	-9	14.78
	1909.8	24.08	-9	15.08
EGPRS1900 （2 Slot）	1850.2	22.21	-6	16.21
	1880	21.89	-6	15.89
	1909.8	21.92	-6	15.92
EGPRS1900 （3 Slot）	1850.2	19.49	-4.26	15.23
	1880	19.57	-4.26	15.31
	1909.8	19.38	-4.26	15.12
EGPRS1900 （4 Slot）	1850.2	17.86	-3	14.86
	1880	17.64	-3	14.64
	1909.8	17.72	-3	14.72

Note 1:
The Frame Power (Source-based time-averaged Power) is scaled the maximum burst average power based on time slots. The calculated methods are show as following:
Frame Power = Max burst power (1 Up Slot) – 9 dB
Frame Power = Max burst power (2 Up Slot) – 6 dB
Frame Power = Max burst power (3 Up Slot) – 4.26 dB
Frame Power = Max burst power (4 Up Slot) – 3 dB

UMTS BAND
HSDPA Setup Configuration:

·The EUT was connected to Base Station CMU200 referred to the Setup Configuration.

·The RF path losses were compensated into the measurements.

·A call was established between EUT and Based Station with following setting:

(1) Set Gain Factors(βc and βd) parameters set according to each

(2) Set RMC 12.2Kbps+HSDPA mode.

(3) Set Cell Power=-86dBm

(4) Set HS-DSCH Configuration Type to FRC (H-set 1, QPSK)

(5) Select HSDPA Uplink Parameters

(6) Set Delta ACK, Delta NACK and Delta CQI=8

(7) Set Ack - Nack Repetition Factor to 3

(8) Set CQI Feedback Cycle (k) to 4ms

(9) Set CQI Repetition Factor to 2

(10) Power Ctrl Mode=All Up bits

·The transmitted maximum output power was recorded.

Table C.10.2.4: β values for transmitter characteristics tests with HS-DPCCH

Sub-test	βc (Note5)	βd	βd (SF)	βc/βd	βHS (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: ΔACK, ΔNACK and ΔCQI = 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, ΔACK and ΔNACK = 30/15 with β_{hs} = 30/15 * β_c , and ΔCQI = 24/15 with β_{hs} = 24/15 * β_c .
Note 3: CM = 1 for βc/βd =12/15, hs/ 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 c/ 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 c = 11/15 and d = 15/15.

HSUPA Setup Configuration:

· The EUT was connected to Base Station CMU200 referred to the Setup Configuration.

· The RF path losses were compensated into the measurements.

· A call was established between EUT and Base Station with following setting * :

(1) Call Configs = 5.2B, 5.9B, 5.10B, and 5.13.2B with QPSK

(2) Set the Gain Factors (βc and βd) 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

(3) Set Cell Power = -86 dBm

(4) Set Channel Type = 12.2k + HSPA

(5) Set UE Target Power

(6) Power Ctrl Mode= Alternating bits

(7) Set and observe the E-TFCI

(8) Confirm that E-TFCI is equal to the target E-TFCI of 75 for sub-test 1, and other subtest's E-TFCI

· 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	βc	βd	βd (SF)	βc/βd	βHS (Note 1)	βec	βed (Note 4) (Note 5)	βed (SF)	βed (Codes)	CM (dB) (Note 2)	MPR (dB) (Note 2) (Note 6)	AG Index (Note 5)	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	βed1: 47/15 βed2: 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	0	-	-	5/15	5/15	47/15	4	1	1.0	0.0	12	67

Note 1: For sub-test 1 to 4, ΔACK, ΔNACK and ΔCQI = 30/15 with $\beta_{hs} = 30/15 * \beta_c$. For sub-test 5, ΔACK, ΔNACK and ΔCQI = 5/15 with $\beta_{hs} = 5/15 * \beta_c$.
Note 2: CM = 1 for βc/βd =12/15, hs/ 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 c/ 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 c = 10/15 and d = 15/15.
Note 4: 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 5: βed cannot be set directly; it is set by Absolute Grant Value.
Note 6: For subtests 2, 3 and 4, UE may perform E-DPDCH power scaling at max power which could results in slightly smaller MPR values.

UMTS BAND II

Mode	Frequency (MHz)	Avg. Burst Power (dBm)
WCDMA 1900 RMC	1852.4	21.98
	1880	**22.09**
	1907.6	21.96
HSDPA Subtest 1	1852.4	21.00
	1880	21.09
	1907.6	21.00
HSDPA Subtest 2	1852.4	20.20
	1880	20.31
	1907.6	20.52
HSDPA Subtest 3	1852.4	20.18
	1880	20.27
	1907.6	20.07
HSDPA Subtest 4	1852.4	20.22
	1880	20.30
	1907.6	20.06
HSUPA Subtest 1	1852.4	18.44
	1880	18.54
	1907.6	18.41
HSUPA Subtest 2	1852.4	18.47
	1880	18.60
	1907.6	18.48
HSUPA Subtest 3	1852.4	19.48
	1880	19.55
	1907.6	19.46
HSUPA Subtest 4	1852.4	17.98
	1880	18.11
	1907.6	18.00
HSUPA Subtest 5	1852.4	19.58
	1880	17.58
	1907.6	17.53

UMTS BAND IV

Mode	Frequency (MHz)	Avg. Burst Power (dBm)
WCDMA 1700 RMC	1712.4	**23.66**
	1732.4	23.03
	1752.6	22.88
HSDPA Subtest 1	1712.4	22.70
	1732.4	22.07
	1752.6	21.89
HSDPA Subtest 2	1712.4	21.92
	1732.4	21.35
	1752.6	21.10
HSDPA Subtest 3	1712.4	21.92
	1732.4	21.27
	1752.6	21.03
HSDPA Subtest 4	1712.4	21.81
	1732.4	21.29
	1752.6	21.00
HSUPA Subtest 1	1712.4	20.42
	1732.4	19.79
	1752.6	19.59
HSUPA Subtest 2	1712.4	20.58
	1732.4	19.89
	1752.6	19.67
HSUPA Subtest 3	1712.4	21.49
	1732.4	20.82
	1752.6	20.56
HSUPA Subtest 4	1712.4	20.10
	1732.4	19.42
	1752.6	19.15
HSUPA Subtest 5	1712.4	19.71
	1732.4	19.05
	1752.6	18.78

UMTS BAND V

Mode	Frequency (MHz)	Avg. Burst Power (dBm)
WCDMA 850 RMC	826.4	22.91
	836.6	**23.07**
	846.6	23.06
HSDPA Subtest 1	826.4	21.91
	836.6	22.13
	846.6	22.10
HSDPA Subtest 2	826.4	21.06
	836.6	21.26
	846.6	21.21
HSDPA Subtest 3	826.4	20.91
	836.6	21.09
	846.6	21.10
HSDPA Subtest 4	826.4	20.90
	836.6	21.06
	846.6	21.08
HSUPA Subtest 1	826.4	19.73
	836.6	19.91
	846.6	19.92
HSUPA Subtest 2	826.4	19.64
	836.6	19.85
	846.6	19.90
HSUPA Subtest 3	826.4	20.72
	836.6	20.92
	846.6	20.91
HSUPA Subtest 4	826.4	19.14
	836.6	19.41
	846.6	19.43
HSUPA Subtest 5	826.4	18.79
	836.6	19.02
	846.6	19.04

According to 3GPP 25.101 sub-clause 6.2.2 , the maximum output power is allowed to be reduced by following the table.

Table 6.1aA: UE maximum output power with HS-DPCCH and E-DCH

UE Transmit Channel Configuration	CM(db)	MPR(db)
For all combinations of ,DPDCH,DPCCH HS-DPDCH,E-DPDCH and E-DPCCH	0≤ CM≤3.5	MAX(CM-1,0)
Note: 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.		

The device supports MPR to solve linearity issues (ACLR or SEM) due to the higher peak-to average ratios (PAR) of the HSUPA signal. This prevents saturating the full range of the TX DAC inside of device and provides a reduced power output to the RF transceiver chip according to the Cubic Metric (a function of the combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH).

When E-DPDCH channels are present the beta gains on those channels are reduced firsts to try to get the power under the allowed limit. If the beta gains are lowered as far as possible, then a hard limiting is applied at the maximum allowed level.

The SW currently recalculates the cubic metric every time the beta gains on the E-DPDCH are reduced. The cubic metric will likely get lower each time this is done .However, there is no reported reduction of maximum output power in the HSUPA mode since the device also provides a compensation for the power back-off by increasing the gain of TX_AGC in the transceiver (PA) device.

The end effect is that the DUT output power is identical to the case where there is no MPR in the device.

LTE Band

Conducted Power of LTE Band 2(dBm)							
Bandwidth	Modulation	RB size	RB offset	Target MPR	Channel 18607	Channel 18900	Channel 19193
1.4MHz	QPSK	1	0	0	22.32	22.39	22.12
			2	0	22.42	22.39	22.21
			5	0	22.27	22.37	22.18
		3	0	0	22.25	22.29	21.98
			1	0	22.15	22.29	21.96
			2	0	22.36	22.27	21.95
		6	0	1	21.37	21.34	20.92
	16QAM	1	0	1	21.25	21.23	21.01
			2	1	21.37	21.26	20.90
			5	1	21.27	21.26	20.77
		3	0	1	21.23	21.17	20.74
			1	1	21.20	21.13	20.87
			2	1	21.18	21.10	20.77
		6	0	2	20.35	20.35	19.95
Bandwidth	Modulation	RB size	RB offset	Target MPR	Channel 18615	Channel 18900	Channel 19185
3MHz	QPSK	1	0	0	22.60	**23.10**	22.70
			8	0	22.57	22.78	22.62
			14	0	22.43	22.76	22.62
		8	0	1	21.69	22.07	21.78
			4	1	21.61	22.04	21.79
			8	1	21.62	21.98	21.64
		15	0	1	21.69	22.04	21.63
	16QAM	1	0	1	21.67	22.02	21.74
			8	1	21.56	21.68	21.62
			14	1	21.68	21.64	21.54
		8	0	2	20.68	21.19	20.91
			4	2	20.69	21.12	20.89
			8	2	20.60	20.83	20.84
		15	0	2	20.69	21.01	20.59

Conducted Power of LTE Band 2(dBm)							
Bandwidth	Modulation	RB size	RB offset	Target MPR	Channel 18625	Channel 18900	Channel 19175
5MHz	QPSK	1	0	0	22.60	23.09	22.78
			12	0	22.53	22.87	22.64
			24	0	22.53	22.78	22.52
		12	0	1	21.52	22.06	21.70
			6	1	21.52	21.96	21.64
			13	1	21.57	21.88	21.68
		25	0	1	21.55	21.98	21.58
	16QAM	1	0	1	21.48	22.13	21.68
			12	1	21.51	21.90	21.57
			24	1	21.40	21.61	21.56
		12	0	2	20.45	20.89	20.66
			6	2	20.66	21.00	20.67
			13	2	20.51	21.01	20.63
		25	0	2	20.62	20.92	20.72
Bandwidth	Modulation	RB size	RB offset	Target MPR	Channel 18650	Channel 18900	Channel 19150
10MHz	QPSK	1	0	0	22.88	22.99	22.60
			24	0	22.52	22.84	23.04
			49	0	22.53	22.61	22.48
		25	0	1	21.70	22.02	21.81
			12	1	21.58	21.93	21.73
			25	1	21.49	21.76	21.63
		50	0	1	21.54	21.85	21.79
	16QAM	1	0	1	21.73	21.74	21.70
			24	1	21.83	21.77	21.93
			49	1	21.60	21.60	21.49
		25	0	2	20.62	21.07	20.73
			12	2	20.61	21.10	20.92
			25	2	20.52	20.85	20.85
		50	0	2	20.60	20.93	20.81

Conducted Power of LTE Band 2(dBm)							
Bandwidth	Modulation	RB size	RB offset	Target MPR	Channel 18675	Channel 18900	Channel 19125
15MHz	QPSK	1	0	0	22.41	22.79	22.54
			38	0	22.55	22.66	22.79
			74	0	22.51	22.32	22.31
		38	0	1	21.56	21.91	22.26
			18	1	21.43	21.80	22.35
			37	1	21.32	20.98	21.38
		75	0	1	21.46	21.80	21.53
	16QAM	1	0	1	21.57	21.93	21.54
			38	1	21.72	21.89	21.66
			74	1	21.51	20.97	21.38
		38	0	2	21.56	21.92	22.25
			18	2	21.43	21.78	22.27
			37	2	21.41	20.79	21.37
		75	0	2	20.39	20.88	20.54
Bandwidth	Modulation	RB size	RB offset	Target MPR	Channel 18700	Channel 18900	Channel 19100
20MHz	QPSK	1	0	0	22.63	22.86	22.31
			49	0	22.74	22.92	22.43
			99	0	22.64	22.15	22.30
		50	0	1	21.41	21.86	21.31
			25	1	21.40	21.82	21.36
			49	1	21.39	21.38	21.60
		100	0	1	21.30	21.77	21.39
	16QAM	1	0	1	21.51	22.31	21.14
			49	1	21.69	22.43	21.36
			99	1	21.60	21.73	21.27
		50	0	2	20.45	20.91	20.59
			25	2	20.44	20.91	20.59
			49	2	20.42	20.56	20.65
		100	0	2	20.35	20.74	20.50

Conducted Power of LTE Band 4(dBm)							
Bandwidth	Modulation	RB size	RB offset	Target MPR	Channel 19957	Channel 20175	Channel 20393
1.4MHz	QPSK	1	0	0	23.45	23.86	23.56
			2	0	22.74	23.46	23.58
			5	0	23.12	23.74	23.44
		3	0	0	23.78	23.91	23.33
			1	0	22.83	23.18	22.34
			2	0	22.39	23.25	23.74
		6	0	1	22.75	22.41	23.41
	16QAM	1	0	1	21.53	22.02	23.65
			2	1	21.78	23.85	23.54
			5	1	22.94	23.85	23.69
		3	0	1	21.34	24.82	22.63
			1	1	23.85	22.74	22.45
			2	1	22.18	21.69	22.28
		6	0	2	23.74	22.95	21.71
Bandwidth	Modulation	RB size	RB offset	Target MPR	Channel 19965	Channel 20175	Channel 20385
3MHz	QPSK	1	0	0	23.14	22.25	21.87
			7	0	23.92	23.96	22.89
			14	0	22.97	23.00	23.88
		8	0	1	23.73	21.04	23.88
			4	1	21.75	22.58	**24.88**
			7	1	21.73	22.94	24.78
		15	0	1	22.69	23.89	23.82
	16QAM	1	0	1	24.82	23.74	22.92
			7	1	23.84	21.45	23.57
			14	1	23.81	22.54	21.83
		8	0	2	22.72	22.32	22.81
			4	2	21.72	23.14	23.85
			7	2	21.62	24.21	23.96
		15	0	2	22.54	22.51	24.13

Conducted Power of LTE Band 4(dBm)							
Bandwidth	Modulation	RB size	RB offset	Target MPR	Channel 19975	Channel 20175	Channel 20375
5MHz	QPSK	1	0	0	24.72	21.66	23.46
			12	0	23.82	22.59	24.83
			24	0	24.84	22.91	24.78
		12	0	1	23.84	23.89	23.99
			6	1	23.81	21.87	24.59
			11	1	22.70	22.89	23.72
		25	0	1	21.55	23.82	23.69
	16QAM	1	0	1	22.72	21.10	21.32
			12	1	22.43	21.13	21.53
			24	1	22.18	21.18	21.46
		12	0	2	21.37	20.15	20.40
			6	2	21.36	20.17	20.37
			11	2	21.34	20.22	20.45
		25	0	2	21.22	20.25	20.41
Bandwidth	Modulation	RB size	RB offset	Target MPR	Channel 20000	Channel 20175	Channel 20350
10MHz	QPSK	1	0	0	23.19	21.94	22.31
			24	0	23.12	22.14	22.38
			49	0	22.96	22.32	22.32
		25	0	1	22.31	21.07	21.49
			12	1	22.31	21.14	21.38
			25	1	22.21	21.41	21.42
		50	0	1	22.26	21.58	21.36
	16QAM	1	0	1	22.10	21.05	21.12
			24	1	22.15	21.32	21.52
			49	1	22.12	22.47	21.46
		25	0	2	21.35	20.07	20.44
			12	2	21.39	20.88	20.46
			25	2	21.24	20.36	20.89
		50	0	2	22.45	20.79	20.41

Conducted Power of LTE Band 4(dBm)							
Bandwidth	Modulation	RB size	RB offset	Target MPR	Channel 20025	Channel 20175	Channel 20325
15MHz	QPSK	1	0	0	23.06	21.83	22.87
			37	0	22.88	22.02	22.17
			74	0	22.93	22.21	22.14
		36	0	1	22.31	20.92	21.45
			16	1	22.46	21.28	21.38
			35	1	21.51	21.44	21.28
		75	0	1	22.14	21.05	21.29
	16QAM	1	0	1	22.26	21.06	21.39
			37	1	22.17	21.41	21.66
			74	1	21.72	21.38	21.36
		36	0	2	22.25	20.97	21.78
			16	2	22.03	21.34	21.28
			35	2	21.73	21.35	21.75
		75	0	2	21.85	20.54	20.31
Bandwidth	Modulation	RB size	RB offset	Target MPR	Channel 20050	Channel 20175	Channel 20300
20MHz	QPSK	1	0	0	23.08	22.01	22.26
			49	0	22.81	22.11	22.26
			99	0	22.14	22.40	22.28
		50	0	1	22.13	21.00	21.45
			25	1	22.78	21.01	21.36
			49	1	21.68	21.26	21.69
		100	0	1	21.87	21.14	21.14
	16QAM	1	0	1	22.87	21.04	21.64
			49	1	21.24	19.94	21.15
			99	1	21.78	21.29	21.85
		50	0	2	21.12	19.99	20.35
			25	2	21.11	19.97	20.36
			49	2	20.86	20.23	20.56
		100	0	2	20.95	20.11	20.31

Conducted Power of LTE Band 5(dBm)							
Bandwidth	Modulation	RB size	RB offset	Target MPR	Channel 20407	Channel 20525	Channel 20643
1.4MHz	QPSK	1	0	0	23.51	22.91	23.31
			2	0	23.52	23.02	23.29
			5	0	23.43	22.94	23.22
		3	0	0	23.55	22.99	23.25
			1	0	23.25	22.92	23.29
			2	0	23.38	22.84	23.12
		6	0	1	22.27	21.98	22.21
	16QAM	1	0	1	22.56	21.92	22.11
			2	1	22.54	21.95	22.04
			5	1	22.41	21.91	21.91
		3	0	1	22.32	21.73	22.07
			1	1	22.46	21.76	22.57
			2	1	22.35	21.78	22.01
		6	0	2	21.65	20.88	21.37
Bandwidth	Modulation	RB size	RB offset	Target MPR	Channel 20415	Channel 20525	Channel 20635
3MHz	QPSK	1	0	0	23.64	22.71	23.43
			7	0	23.62	22.91	23.40
			14	0	23.42	23.00	23.19
		8	0	1	22.52	21.78	22.32
			4	1	22.55	21.74	22.38
			7	1	22.47	21.93	22.29
		15	0	1	22.59	21.92	22.22
	16QAM	1	0	1	22.64	21.82	22.74
			7	1	22.85	21.45	22.21
			14	1	22.53	22.02	22.46
		8	0	2	21.58	20.74	21.69
			4	2	21.76	20.64	21.21
			7	2	21.94	20.57	21.27
		15	0	2	21.54	20.91	21.16