SAR TEST REPORT

Number 14-027074-01-03

Be based on

IEEE 1528-2003,
OET Bulletin 65 Supplement C(July 2001)

For

Applicant	**Suntech International Ltd.**
Manufacturer	**Suntech International Ltd.**
Model or Type	**ST940**
	GSM/GPRS Vehicle Tracker
Final HW Version	**ST940 Rev05**
Final SW Version	**ST940 Rev001**
Test result	**Pass**

Issue To: **Suntech International Ltd.** Room 605, IT mirea Tower, 9 Gil 33, Digital-Ro Geumcheon-gu, Seoul, Korea	**Date of Application**	**2014-06-12**
	Date of Report	**2014-10-28**
	Date of Issue	**2014-10-28**

This Test Report consists of 27 pages with Appendix A,B,C

The above test certificate is the accredited test results by Korea Laboratory Accreditation Scheme, which signed the ILAC-MRA.

Korea Testing Laboratory

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Test Report revision History

Revision	Date	Comments
00	2014-09-18	Initial Version
01	2014-09-25	12.1 section update and KDB document added

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1. Administrative Information

1.1. Applicant Data

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1.2. Manufacturer Data (only if different from Appicant)

Company Name	
Address	
Contact Person	
Name	
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Phone	

1.3. Testing Laboratory Data

The following list shows all places and laboratories involved for test result generation.

Company Name	Korea Testing Laboratory
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2. EUT Information

2.1. General Description of the EUT

The following section lists all specifications of EUT (Equipment Under Test) involved in test. Additionally, KTL has received sufficient documentation from the client and/or manufacturer to perform the tests

General Information	
FCC ID & Model Number	FCC ID: WA2**ST940**, Model Number: **ST940**
GSM Specification	GSM/GPRS/850/1900
Antenna Type	Internal Antenna
Battery options	Li-ion, 3.7 V (1500mAh)
Device Dimension	Overall : 50.5 (W) mm x 75.0(L) mm x 22.5(T) mm

2.2. SAR Results Summaries

Band & Mode	**Tx Frequency**	**SAR**
		1g Body (W/kg)
GSM/GPRS 850	824.2 ~ 848.8 MHz	1.027
GSM/GPRS 1900	1850.2 ~ 1909.8 MHz	1.274

3. SAR DEFINITION

Specific Absorption Rate (SAR) is defined as the time derivative (rate) of the incremental energy (dU) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density(p). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body. (see Figure.1)

$$SAR = \frac{d}{dt}\left(\frac{dU}{dm}\right) = \frac{d}{dt}\left(\frac{dU}{pdv}\right)$$

Figure 1 SAR Mathematical Equation

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

$$\text{SAR} = \sigma E^2 / p$$

Where :

σ = conductivity of the tissue-simulant material (S/m)

p = mass density of the tissue-simulant material (kg/m^3)

E = Total RMS electric field strength (V/m)

Note: The primary factors that control rate or energy absorption were found to be the wavelength of the incident field in relations to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane.[4]

4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with IEEE Standard 1528-2003 and the following published KDB procedures.

- FCC KDB Publication 941225 D03 SAR Test Reduction GSM GPRS EDGE v01
- FCC KDB Publication 941225 D07 UMPC Mini Tablet v01r01
- FCC KDB Publication 447498 D01v05r02 (General SAR Guidance)
- FCC KDB Publication 865664 D01 SAR measurement 100 MHz to 6 GHz v01r03
- FCC KDB Publication 865664 D02 SAR Reporting v01r01
- October 2013 TCB Workshop Notes (GPRS testing criteria)

5. DESCRIPTION OF SAR MEASUREMENT SYSTEM

The DASY5 system used for performing compliance tests consists of the following items:

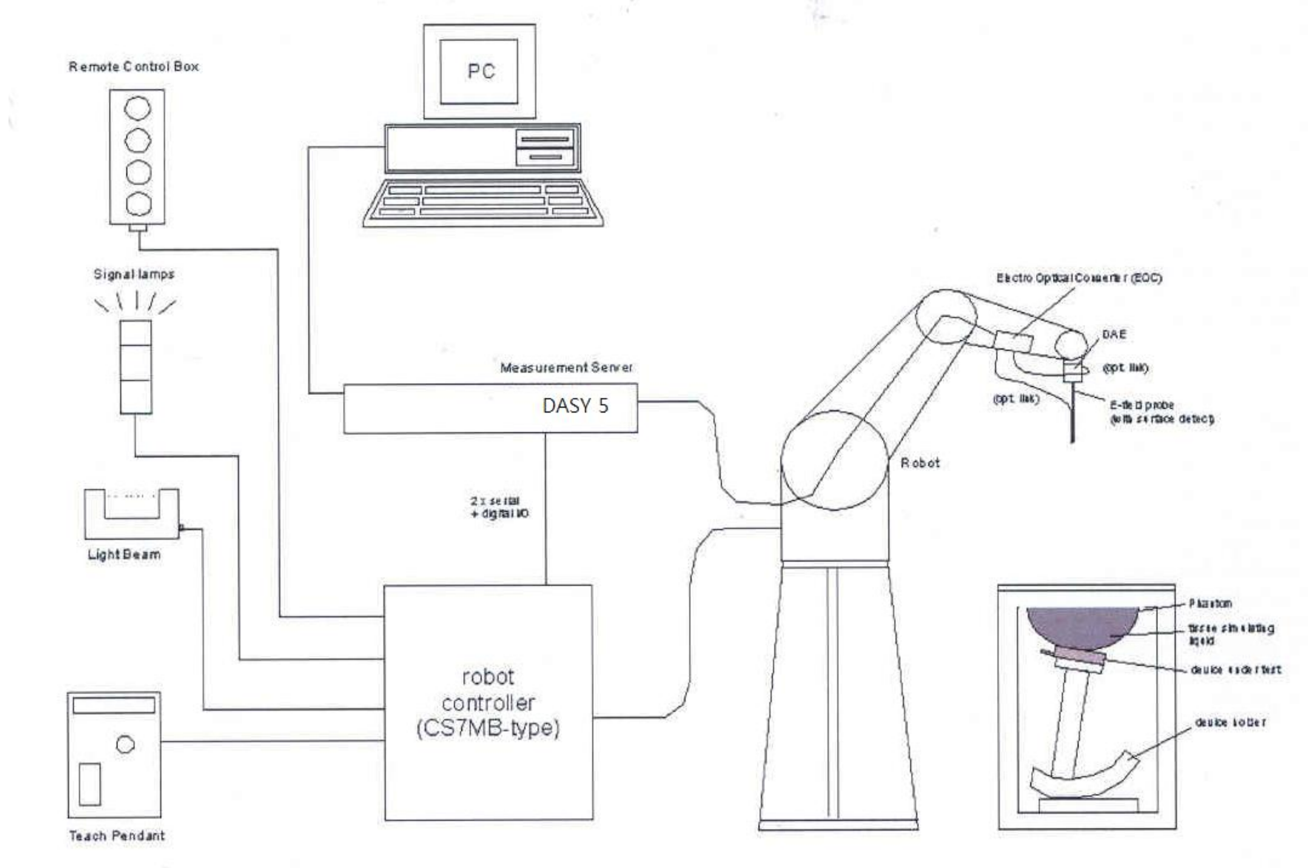


Figure 2 SAR Measurement System

- A standard high precision 6-axis robot with controller, teach pendant and software.
- Data acquisition electronics, DAE4 consists 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 and control logic unit.
- Transmission to the PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines.
- The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts.
- The robot uses its own controller with a built in VME-bus computer. 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.

6. SYSTEM VERIFICATION

6.1. Tissue Simulating Mixture Characterization

The mixture is characterized to obtain proper dielectric constant (permittivity) and conductivity of the tissue of interest. The tissue dielectric parameters recommended in IEEE 1528 have been used as targets for the compositions, and are to match within 5%, per the FC recommendations.

Ingredients (% by weight)	Frequency (MHz)							
	835		1900		2450		5200-5800	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body
Water	41.45	52.4	54.9	40.4	62.7	73.2	62.52	78.66
Salt (NaCl)	1.45	1.4	0.18	0.5	0.5	0.04	0.0	0.0
Sugar	56.0	45.0	0.0	58.0	0.0	0.0	0.0	0.0
HEC	1.0	1.0	0.0	1.0	0.0	0.0	0.0	0.0
Bactericide	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	36.8	0.0	17.24	10.67
DGBE	0.0	0.0	44.92	0.0	0.0	26.7	0.0	0.0
Diethylene glycol hexyl ether	-	-	-	-	-	-	17.24	10.67

Table 1 Composition of the Tissue Equivalent Materials

-Salt: 99+% Pure Sodium Chloride Sugar: 98+% Pure Sucrose
-Water: De-ionized, 16 MΩ+ resistivity HEC: Hydroxyethyl Cellulose
-DGBE: 99+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]
-Triton X-100 (ultra pure): Polyethylene glycol mono [4-(1,1, 3, 3-tetramethylbutyl)phenyl]ether

6.2. Tissue Verification

The dielectric parameters of the brain and muscle simulating liquid were measured prior to SAR assessment using the DAK-3.5 dielectric probe kit and Agilent 8753D Network Analyzer. The actual dielectric parameters are shown in the following table. The below measured tissue parameters were used in DASY software.

Freq. [MHz]	Liquid	Date	Liquid Temp [℃]	Parameters	Target Value	Measured Value	Dev. (%)	Limit (%)
835	Body	09/04/2014	22.7	ε_r	55.2	55.8	+1.0	± 5
				σ	0.97	0.96	-1.0	± 5
1900	Body	09/05/2014	22.2	ε_r	53.3	51.0	-4.3	± 5
				σ	1.52	1.57	+3.2	± 5

Table 2 Measured Simulating Liquid Dielectric Values

The humidity and dielectric/ambient temperatures are recorded during the assessment of the tissue material dielectric parameters. The difference between the ambient temperature of the liquid during the dielectric measurement and the temperature during tests was less than |2|°C.

6.3. System Validation

Prior to the SAR assessment, the system validation kit was used to verify that the DASY5 was operating within its specifications. The validation dipoles are highly symmetric and matched at the centre frequency for the specified liquid and distance to the phantom. The accurate distance between the liquid surface and the dipole centre is achieved with a distance holder that snaps onto the dipole. System validation is performed by feeding a known power level into a reference dipole, set at a known distance from the phantom. The measured SAR is compared to the theoretically derived level.

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 re-measured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

The measured 1g(10g) SAR should be within 10 % of the expected target reference values at the time of calibration by the calibration facility.

Tissue Frequency (MHz)	Tissue Type	Date	Probe SN	Dipole SN	Measured SAR 1g (W/kg)	Target SAR 1g (W/kg)	Deviation (%)	Limit (%)
835	Body	09/04/2014	3020	481	10.4	10.0	+4.0	±10
1900	Body	09/05/2014	3020	5d038	42.4	40.8	+3.9	±10

Table 3 Deviation from Reference Validation Values

6.4. Justification for Extended SAR Dipole Calibrations

According to maintaining return loss and impedance requirements per extended calibrations in KDB 865664, usage of SAR dipole calibrated less than 2 years ago but more than 1 year ago was confirmed.

KDB 865664 D01 requirements

a) return loss : < -20 dB, within 20% of prior calibration
b) impedance : within 5Ω from prior calibration.

D835V2 S/N:481					
Head/Body	Date of Measurement	Return Loss (dB)	Δ%	Impedance (Ω)	ΔΩ
Body	04/25/2013	-22.4	-	46.5	-
	04/03/2014	-19.5	-12.9	43.4	-3.1

D1900V2 S/N:5d038					
Head/Body	Date of Measurement	Return Loss (dB)	Δ%	Impedance (Ω)	ΔΩ
Body	05/29/2013	-22.5	-	47.5	-
	05/12/2014	-20.1	-10.6	45.7	-1.8

7. SAR MEASUREMENT PROCEDURE USING DASY5

The SAR evaluation is performed with the SPEAG DASY5 system as following;

Step 1: Power Reference Measurement

A measurement of the SAR value at a fixed location is used as a reference value for assessing the power drop of the EUT. The SAR at this point is measured at the start of the test and then again at the end of the test.

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 scanning 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 Standards 1528 and IEC 62209 standards. 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 are as below table from KDB 865664 D01 SAR Measurement 100MHz to 6GHz v01r03.

	≤ 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 Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1g and 10g 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 1g and 10g and displays these values next to the job's label.

Zoom Scan Parameters are as below table from KDB 865664 D01 SAR Measurement 100MHz to 6GHz v01r01.

<table>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>$\leq$ 2 GHz: $\leq$ 8 mm
2 – 3 GHz: $\leq$ 5 mm*</td><td>3 – 4 GHz: $\leq$ 5 mm*
4 – 6 GHz: $\leq$ 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>$\leq$ 5 mm</td><td>3 – 4 GHz: $\leq$ 4 mm
4 – 5 GHz: $\leq$ 3 mm
5 – 6 GHz: $\leq$ 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>$\leq$ 4 mm</td><td>3 – 4 GHz: $\leq$ 3 mm
4 – 5 GHz: $\leq$ 2.5 mm
5 – 6 GHz: $\leq$ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>$\geq$ 30 mm</td><td>3 – 4 GHz: $\geq$ 28 mm
4 – 5 GHz: $\geq$ 25 mm
5 – 6 GHz: $\geq$ 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 $\leq$ 1.4 W/kg, $\leq$ 8 mm, $\leq$ 7 mm and $\leq$ 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>

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.

Step 5: Z-Scan (FCC only)

The Z Scan measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. In order to get a reasonable extrapolation the extrapolated distance should not lager than the step size in Z-direction.

8. DESCRIPTION OF TEST POSITION

The EUT doesn't support head SAR configurations.

SAR measurements are performed in the "cheek" and "tilted" positions on left and right sides of the phantom according to IEEE 1528. Both were measured in the head section of the SAM Twin Phantom.

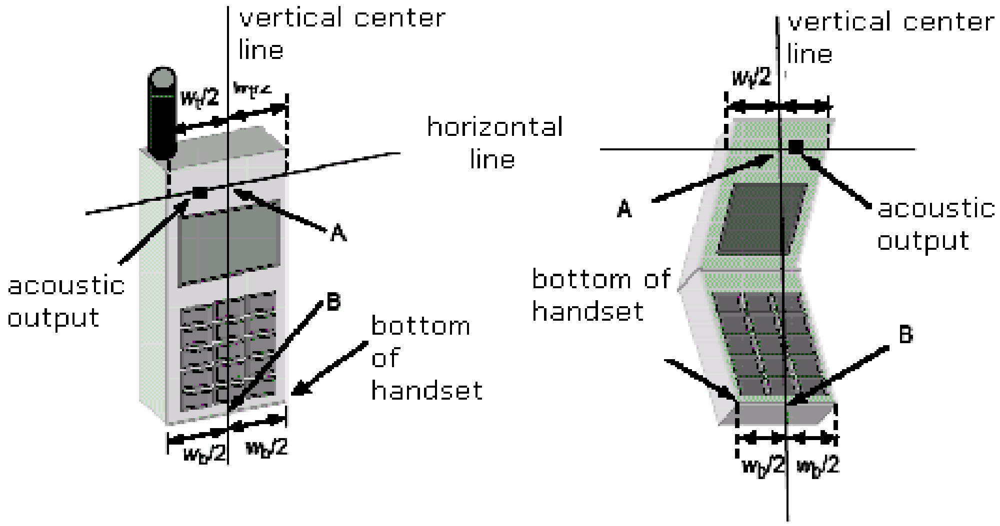


Figure 3 Handset vertical and horizontal reference line

8.1. Cheek Position

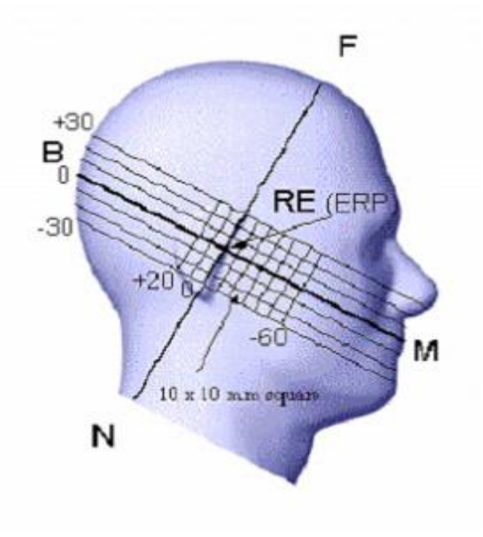


Figure 4 Side view of SAM phantom

The device was positioned with the vertical center line of the body of the device and the horizontal line crossing the center (see Figure 3) of the ear piece in a plane parallel to the sagittal plane of the phantom(see Figure 4). While maintaining the device in this plane, it was aligned the vertical center line with the reference plane containing the three ear and mouth reference points(M, RE and LE) and aligned the center of the ear piece with the line RE-LE. Then device was translated towards the phantom with the ear piece aligned with the line LE-RE until it touched the ear. While maintaining the device in the reference plane and maintaining the device contact with the ear, the bottom of the device was moved until any point on the front side is in contact with the cheek of the phantom.(see Figure 5)

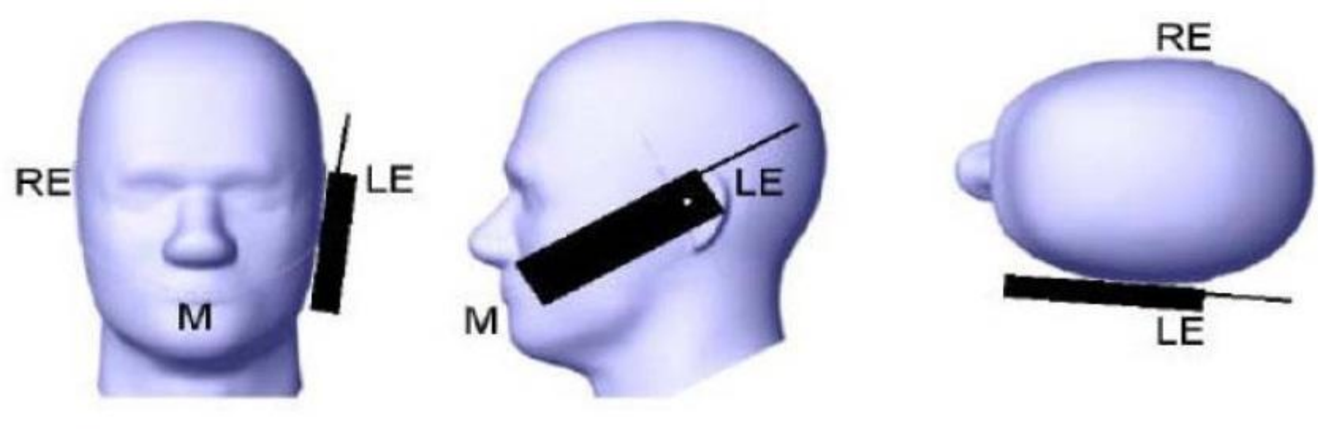


Figure 5 Cheek/Touch Position

8.2. Tilt Position

The device was positioned in the “Cheek” position. While maintaining the device in the reference plane described above cheek position and pivoting against the ear, device was moved outward away from the mouth by an angle of 15 degrees. (see Figure 6)

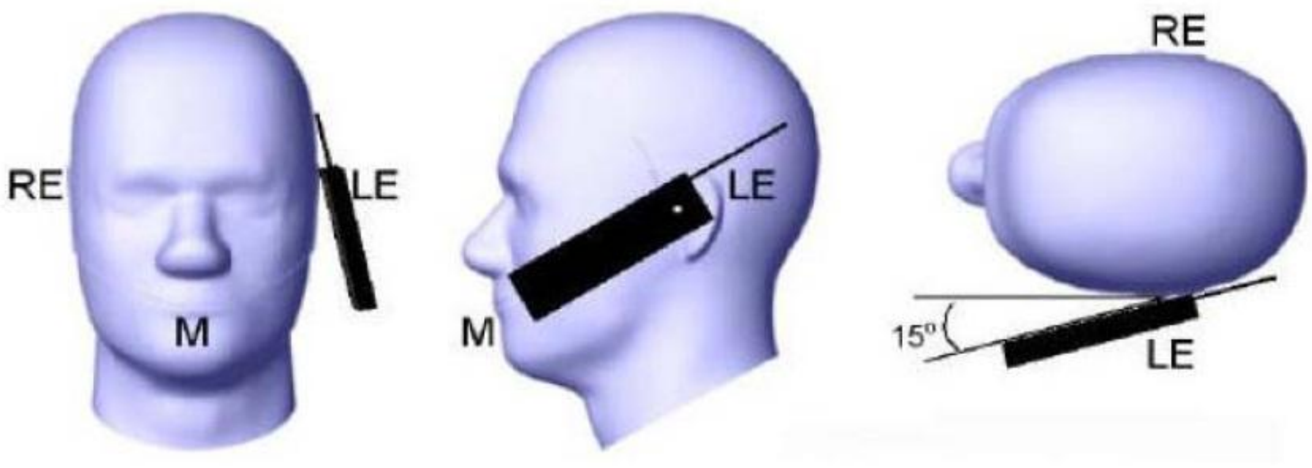


Figure 6 Ear/Tilt Position

8.3. Body Holster/ Belt Clip Configurations

Body-worn operating configurations are tested without the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration.

Accessories for Body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are tested with the device with each accessory. If multiple accessories share an identical metallic component(i.e. the same metallic belt-clip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

Body-worn accessories may not always be supplied or available as options for some devices intended to be authorized for body-worn use. In this case, a test configuration with a separation distance between the device and the flat phantom is used. Test position spacing was documented.

Transmitters that are designed to operate in front of a person's face, as the push-to-talk configurations, are test for SAR compliance with the front of the device positioned to face the flat phantom in brain fluid. For devices that are carried next to the body such as a shoulder, waist or chest-worn transmitters, SAR compliance is tested with the accessories, including headsets and microphones, attached to the device and positioned against a flat phantom in a normal use configuration.

In all cases SAR measurements are performed to investigate the worst-case positioning. Worst-case positioning is then documented and used to perform Body SAR testing.

9. MEASUREMENT UNCERTAINTY

Applicable for frequencies up to 6GHz

Uncertainty Component	Tol. (%)	Prob Dist	Div	c_i 1g	c_i 10g	u_i(%) 1g	u_i(%) 10g	v_i
Measurement System								
Probe Calibration	± 6.55	N	1	1	1	± 6.55	± 6.55	∞
Axial Isotropy	± 4.70	R	$\sqrt{3}$	0.7	0.7	± 1.90	± 1.90	∞
Hemispherical Isotropy	± 9.60	R	$\sqrt{3}$	0.7	0.7	± 3.38	± 3.38	∞
Linearity	± 4.70	R	$\sqrt{3}$	1	1	± 2.71	± 2.71	∞
System Detection Limits	± 1.00	R	$\sqrt{3}$	1	1	± 0.58	± 0.58	∞
Boundary Effect	± 1.00	R	$\sqrt{3}$	1	1	± 0.58	± 0.58	∞
Response Time	± 0.80	R	$\sqrt{3}$	1	1	± 0.46	± 0.46	∞
RF Ambient conditions	± 3.00	R	$\sqrt{3}$	1	1	± 1.73	± 1.73	∞
Readout Electronics	± 1.00	N	1	1	1	± 1.00	± 1.00	∞
Integration time	± 2.60	R	$\sqrt{3}$	1	1	± 1.50	± 1.50	∞
Probe Positioner	± 0.40	R	$\sqrt{3}$	1	1	± 0.23	± 0.23	∞
Probe Positioning	± 2.90	R	$\sqrt{3}$	1	1	± 1.67	± 1.67	∞
Max. SAR evaluation	± 1.00	R	$\sqrt{3}$	1	1	± 0.58	± 0.58	∞
Test Sample Related								
Device Positioning	± 2.90	N	1	1	1	± 2.90	± 2.90	145
Device Holder	± 3.60	N	1	1	1	± 3.60	± 3.60	5
Power Drift	± 5.00	R	$\sqrt{3}$	1	1	± 2.89	± 2.89	∞
Phantom and Setup								
Phantom Uncertainty	± 4.00	R	$\sqrt{3}$	1	1	± 2.31	± 2.31	∞
Liquid Conductivity (target)	± 5.00	R	$\sqrt{3}$	0.64	0.43	± 1.85	± 1.24	∞
Liquid Conductivity (meas.)	± 2.07	N	1	0.78	0.71	± 1.61	± 1.47	9
Liquid Permittivity (target)	± 5.00	R	$\sqrt{3}$	0.60	0.49	1.73	1.43	∞
Liquid Permittivity (meas.)	± 3.07	N	1	0.26	0.26	± 0.80	± 0.80	9
Combined Std. Uncertainty (k=1)		RSS				10.43	10.33	
Expanded STD Uncertainty (95% CONFIDENCE LEVEL)		**k=2**				20.87	20.66	

Table 4 Uncertainty Budget

10. FCC RF Exposure Limits

HUMAN EXPOSURE	UNCONTROLLED ENVIRONMENT General Population (W/Kg) or (mW/g)	CONTROLLED ENVIRONMENT Occupational (W/Kg) or (mW/g)
SPATIAL PEAK SAR (Brain)	1.60	8.00
SPATIAL AVERAGE SAR (Whole Body)	0.08	0.40
SPATIAL PEAK SAR (Hand / Feet / Ankle / Wrist)	4.00	20.00

Table 5 Safety Limits for Partial Body Exposure

NOTE :

* The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

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).

11. RF CONDUCTED POWERS

11.1.Nominal and Maximum Output Power Specifications

This device operates using the following maximum and nominal output power specifications. SAR values were scaled to the maximum allowed power to determine compliance per KDB Publication 447498 D01v05r02.

Band & Mode		Voice [dBm]	Burst Average GMSK [dBm]			
		1TX Slot	1TX Slot	2TX Slot	3TX Slot	4TX Slot
GSM/GPRS/ 850	Maximum	33.0	33.0	29.5	28.5	27.0
	Nominal	32.0	32.0	28.5	27.5	26.0
GSM/GPRS/ 1900	Maximum	30.0	31.0	28.5	26.7	25.5
	Nominal	29.0	30.0	27.0	25.2	24.0

11.2.SAR scaling factors sample calculation

Scaled SAR results are derived after scaling factors are applied to the measured values as below. Scaling for maximum tune-up tolerance must be considered separately.

SAR Section	Test Position	Mode	Dist. (mm)	Freq. (MHz)	CH #	Power (dBm)		SAR 1g (W/kg)	Scaling Factor	Scaled SAR 1g (W/kg)	Plot. No.
						Max. allowed	Mea-sured				
Body	Front	GPRS 4TX	5	1850.2	512	25.5	23.94	0.890	1.432	1.274	2

*Scaled SAR = Measured SAR x Scaling Factor

1.274 = 0.890 x 1.432

11.3.GSM/GPRS Conducted output Power Measurements

Conducted output power measurements were performed with a base station simulator under digital average power. SAR measurements for GSM/GPRS modes were performed with a base station simulator R&S CMU200. Communication between the device and the emulator was established by air link. Set base station emulator to allow DUT to radiate maximum output power during all tests. Followings are the worst configuration setup for SAR tests.

* GSM voice: Head SAR
* GPRS Multi-slots: Body SAR with GPRS Multi-slot Class12 with CS 1 (GMSK)

Note;

CS1 coding scheme was used in GPRS output power measurements and SAR Testing, as a condition where GMSK modulation was ensured. Investigation has shown that CS1 - CS4 settings do not have any impact on the output levels in the GPRS modes.

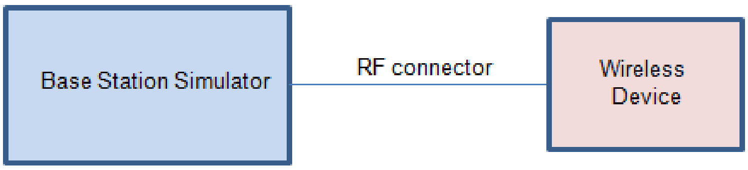


Figure 7 Power Measurement Setup

11.4. GSM/GPRS Conducted output Powers

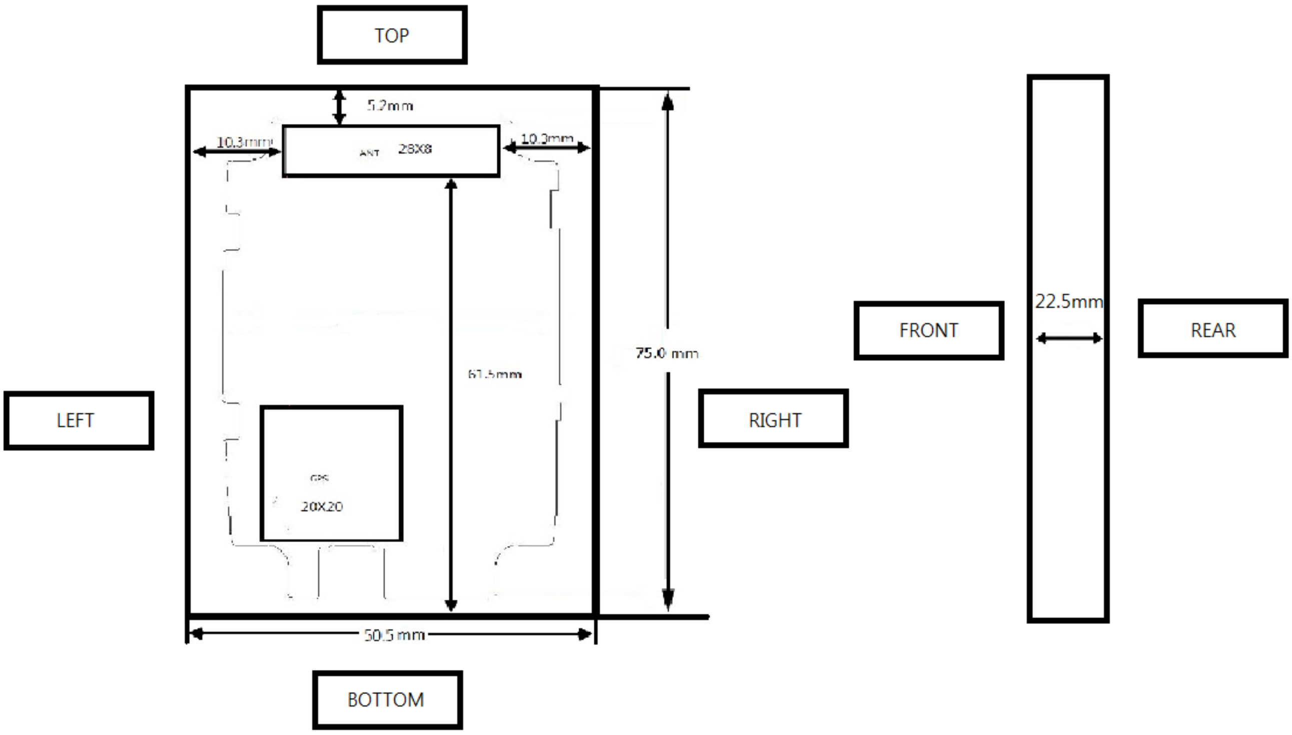
Band	Mode	Multi Slot	Maximum Burst-Averaged Output Power (dBm)			Calculated Maximum Frame-Averaged Output Power(dBm)		
			128CH	190CH	251CH	128CH	190CH	251CH
GSM850	GSM	1 Tx slot	31.10	31.13	31.11	22.07	22.10	22.08
	GPRS	1 Tx slot	31.07	31.09	31.07	22.04	22.06	22.04
		2 Tx slots	28.08	28.14	28.13	22.06	22.12	22.11
		3 Tx slots	27.08	27.10	27.12	22.81	22.83	22.85
		4 Tx slots	25.71	25.78	25.78	22.70	22.77	22.77
Band	Mode	Multi Slot	Maximum Burst-Averaged Output Power (dBm)			Calculated Maximum Frame-Averaged Output Power(dBm)		
			512CH	661CH	810CH	512CH	661CH	810CH
GSM1900	GSM	1 Tx slot	28.03	28.00	28.01	19.00	18.97	18.98
	GPRS	1 Tx slot	28.03	28.00	28.03	19.00	18.97	19.00
		2 Tx slots	27.07	27.05	27.08	21.05	21.03	21.06
		3 Tx slots	25.08	25.05	25.06	20.81	20.78	20.79
		4 Tx slots	23.94	23.91	23.94	20.93	20.90	20.93

Note:

1. Both burst-averaged and calculated frame-averaged powers are included. Frame-averaged power was calculated from the measured burst-averaged power by converting the slot powers into linear units and calculating the energy over 8 timeslots.
2. The 3 Tx slots/ 2 Tx slots GPRS modes were selected for GSM850/GSM1900 SAR testing according to the highest frame-averaged output power table according to KDB 941225 D03v01.

12. SAR TEST CONDITIONS & ANTENNA INFORMATION

12.1. Antenna Information



13. SAR MEASUREMENT RESULTS

13.1. GSM850 SAR Measurement Results

SAR Section	Test Position	Mode	Dist. (mm)	Freq. (MHz)	CH #	Power (dBm)		SAR 1g (W/kg)	Scaling Factor	Scaled SAR 1g (W/kg)	Plot. No.
						Max. allowed	Mea-sured				
Body	Front	GSM	5	836.6	190	33.0	31.13	0.498	1.538	0.765	-
	Rear	GPRS 3TX	5	836.6	190	28.5	27.10	0.573	1.380	0.790	-
	Top	GPRS 3TX	5	836.6	190	28.5	27.10	0.082	1.380	0.113	-
	Left	GPRS 3TX	5	836.6	190	28.5	27.10	0.230	1.380	0.317	-
	Right	GPRS 3TX	5	836.6	190	28.5	27.10	0.222	1.380	0.306	-
	Front	GPRS 3TX	5	824.2	128	28.5	27.08	0.479	1.386	0.663	-
	Front	GPRS 3TX	5	836.6	190	28.5	27.10	0.645	1.380	0.890	-
	Front	GPRS 3TX	5	848.8	251	28.5	27.12	0.748	1.374	**1.027**	**1**
	Front	GPRS 4TX	5	824.2	128	27.0	25.71	0.459	1.345	0.617	-
	Front	GPRS 4TX	5	836.6	190	27.0	25.78	0.574	1.324	0.759	-
	Front	GPRS 4TX	5	848.8	251	27.0	25.78	0.731	1.324	0.967	-
ANSI/IEEE C95.1 – 1992-Safety Limit Spatial Peak Uncontrolled Exposure/ General Population						**1.6 W/kg (mW/g)** Averaged over 1 gram					

13.2. GSM1900 SAR Measurement Results

SAR Section	Test Position	Mode	Dist. (mm)	Freq. (MHz)	CH #	Power (dBm)		SAR 1g (W/Kg)	Scaling Factor	Scaled SAR 1g (W/kg)	Plot. No.
						Max. allowed	Mea-sured				
Body	Front	GSM	5	1850.2	512	30.0	28.03	0.593	1.574	0.933	-
	Front	GSM	5	1880	661	30.0	28.0	0.569	1.584	0.901	-
	Front	GSM	5	1909.8	810	30.0	28.01	0.528	1.581	0.834	-
	Rear	GPRS 2TX	5	1850.2	512	28.5	27.07	0.886	1.389	1.230	-
	Rear	GPRS 2TX	5	1880	661	28.5	27.05	0.848	1.396	1.183	-
	Rear	GPRS 2TX	5	1909.8	810	28.5	27.08	0.764	1.386	1.058	
	Top	GPRS 2TX	5	1880	661	28.5	27.05	0.208	1.396	0.290	-
	Left	GPRS 2TX	5	1880	661	28.5	27.05	0.255	1.396	0.355	-
	Right	GPRS 2TX	5	1880	661	28.5	27.05	0.512	1.396	0.714	-
	Front	GPRS 2TX	5	1850.2	512	28.5	27.07	0.910	1.389	1.263	-
	Front Repeated SAR	GPRS 2TX	5	1850.2	512	28.5	27.07	0.894	1.389	1.241	-
	Front	GPRS 2TX	5	1880	661	28.5	27.05	0.853	1.396	1.190	-
	Front	GPRS 2TX	5	1909.8	810	28.5	27.08	0.781	1.386	1.082	-
	Front	GPRS 3TX	5	1850.2	512	26.7	25.08	0.863	1.452	1.253	-
	Front	GPRS 3TX	5	1880	661	26.7	25.05	0.833	1.462	1.217	-
	Front	GPRS 3TX	5	1909.8	810	26.7	25.06	0.774	1.458	1.128	-
	Front	GPRS 4TX	5	1850.2	512	25.5	23.94	0.890	1.432	**1.274**	**2**
	Front	GPRS 4TX	5	1880	661	25.5	23.91	0.860	1.442	1.240	-
	Front	GPRS 4TX	5	1909.8	810	25.5	23.94	0.791	1.432	1.132	-
ANSI/IEEE C95.1 – 1992-Safety Limit Spatial Peak Uncontrolled Exposure/ General Population						**1.6 W/Kg (mW/g)** Averaged over 1 gram					

13.3. SAR Test Notes

General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in IEEE 1528-2003, FCC KDB Procedure.
2. Batteries are fully charged at the beginning of the SAR measurements.
3. Liquid tissue depth was at least 15.0 cm for all frequencies.
4. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.
5. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB 447498 D01v05r02.
6. Per FCC KDB 941225 D07 Mini Tablet V01r01, Test separation distance of 5 mm is required.

GSM/GPRS Test Notes:

1. Justification for reduced test configurations per KDB 941225 D03v01: The source-based time-averaged output power was evaluated for all multi-slot operations. The multi-slot configuration with the highest frame averaged output power was evaluated for SAR.
2. Per FCC KDB 447498 D01v05r02, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the required test channels is ≤ 1/2 dB, instead of the middle channel, the highest output power channel must be used.
3. Per FCC KDB 941225 D07, UMPC mini-tablet devices must be tested for 1-g SAR on all surfaces and side edges with a transmitting antenna located at ≤ 25 mm from that surface or edge, at 5 mm separation from a flat phantom, for the data modes, wireless technologies and frequency bands supported by the device to determine SAR compliance. So bottom side configuration SAR was not performed.

14. SAR MEASUREMENT VARIABILITY

14.1. Measurement Variability

Per FCC KDB Publication 865664D01 V01R03, SAR measurement variability was assessed when measured 1g SAR is > 0.80 W/kg or when measured 10g SAR is >2.00 W/kg. Since all measured 1g SAR values were <0.8 W/kg SAR measurement variability was not assessed.

In accordance with published RF Exposure KDB procedure KDB865664 D01 SAR measurement 100 MHz to 6 GHz v01.

These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.

2) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.

3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).

4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

SAR Section	Test Position	Mode	Dist. (mm)	Freq. (MHz)	CH #	Original SAR 1g (W/kg)	Repeated SAR 1g (W/kg)	Largest to Smallest SAR Ratio
Body	Front	GPRS 2Tx	5	1850.2	512	0.910	0.894	1.017

Note(s)

1. Second Repeated Measurement is not required since the ratio of the largest to smallest SAR for the original and first repeated measurement is not > 1.20.
2. Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg.

14.2. Measurement Uncertainty

The measured SAR was <1.5 W/kg for all frequency bands. Therefore, per KDB Publication KDB865664 D01 v01r03, the extended measurement uncertainty analysis per IEEE 1528-2003 was not required.

15. CONCLUSION

The SAR evaluation indicates that ST940 complies with the RF radiation exposure limits of the FCC. These measurements were taken to simulate the RF effects of RF exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The results and statements relate only to the item(s) tested.

16. EQUIPMENT LIST AND CALIBRATION DETAILS

Equipment Type	Manufacturer	Model Number	Serial Number	Calibration Due	Used For this Test
Robot - Six Axes	Staubli	TX90XL	N/A	N/A	☒
Robot Remote Control	SPEAG	CS7MB	F13/55D0A1 /A/01	N/A	☒
SAM Twin Phantom V5.0	SPEAG	TP-1809	1809	N/A	☒
SAM Twin Phantom V5.0	SPEAG	TP-1810	1810	N/A	☒
ELI Phantom V5.0	SPEAG	TP-1228	1228	N/A	☐
Data Acquisition Electronics	SPEAG	DAE4	1422	2015.01.14	☒
Probe E-Field	SPEAG	ES3DV2	3020	2015.02.25	☒
Probe E-Field	SPEAG	EX3DV4	3905	2015.02.26	☐
Probe E-Field	SPEAG	EX3DV4	3972	2015.01.28	☐
Antenna Dipole 835 MHz	SPEAG	D835V2	481	2015.04.25	☒
Antenna Dipole 900 MHz	SPEAG	D900V2	194	2015.11.20	☐
Antenna Dipole 1800 MHz	SPEAG	D1800V2	2d066	2016.01.23	☐
Antenna Dipole 1900 MHz	SPEAG	D1900V2	5d038	2015.05.29	☒
Antenna Dipole 1950 MHz	SPEAG	D1950V2	1027	2016.01.22	☐
Antenna Dipole 2450 MHz	SPEAG	D2450V2	746	2016.01.21	☐
Antenna Dipole 5000 MHz	SPEAG	D5GHzV2	1147	2016.02.26	☐
High power RF Amplifier	EMPOWER	2057-BBS3Q5KCK	1002D/C0321	2015.03.06	☒
Digital Communication Tester	R&S	CMU200	111356	2015.01.15	☒
Digital Communication Tester	Agilent	E5515C	G44400380	2014.10.28	☐
Signal Generator	Hewlett Packard	8648C	3629U00868	2015.02.18	☒
Signal Generator	R&S	SMBV100A	1407.6004k02-259341-Ez	2014.10.10	☐
RF Power Meter Dual	Hewlett Packard	EPM-442A	GG37170495	2015.03.04	☒
RF Power Sensor 0.01 - 18 GHz	Hewlett Packard	8481A	US37299851	2015.03.14	☒
RF Power Sensor 0.01 - 18 GHz	Hewlett Packard	8481A	3318A92872	2015.03.14	☒
S-Parameter Network Analyzer	Agilent	8753D	3410A07251	2015.03.07	☒
Dual Directional Coupler	Hewlett Packard	778D	1144AO4576	2015.03.04	☒
Directional Coupler	Agilent	773D	MY28390213	2015.03.04	☒
Dielectric parameter probe	SPEAG	DAK-3.5	1147	2015.01.19	☒