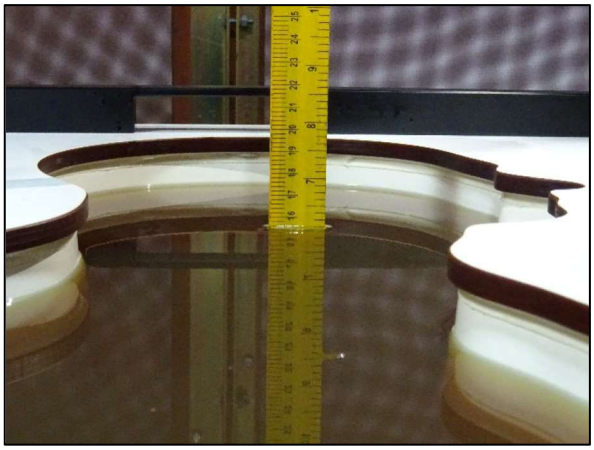
Tissue Simulating Liquids

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 15 cm. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm. The nominal dielectric values of the tissue simulating liquids in the phantom and the tolerance of 5% are listed.



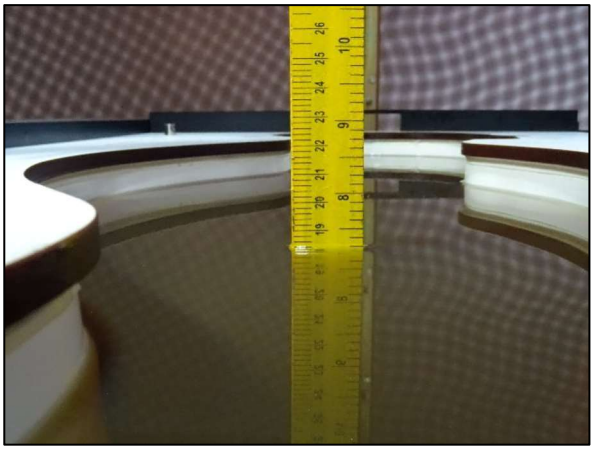


Figure 10: Photo of Liquid Height for Head Position & Photo of Liquid Height for Body Position

The dielectric properties of the head tissue simulating liquids are defined in IEEE 1528, and KDB 865664 D01 Appendix A. For the body tissue simulating liquids, the dielectric properties are defined in KDB 865664 D01 Appendix A. The dielectric properties of the tissue simulating liquids were verified prior to the SAR evaluation using a dielectric assessment kit(DAK) and a network analyzer.

Table 9: Targets of Tissue Simulating Liquid

Frequency (MHz)	Target Permittivity	Range of ±5%	Target Conductivity	Range of ±5%
For Head				
750	41.9	39.8 ~ 44.0	0.89	0.85 ~ 0.93
835	41.5	39.4 ~ 43.6	0.90	0.86 ~ 0.95
900	41.5	39.4 ~ 43.6	0.97	0.92 ~ 1.02
1450	40.5	38.5 ~ 42.5	1.20	1.14 ~ 1.26
1640	40.3	38.3 ~ 42.3	1.29	1.23 ~ 1.35
1750	40.1	38.1 ~ 42.1	1.37	1.30 ~ 1.44
1800	40.0	38.0 ~ 42.0	1.40	1.33 ~ 1.47
1900	40.0	38.0 ~ 42.0	1.40	1.33 ~ 1.47
2000	40.0	38.0 ~ 42.0	1.40	1.33 ~ 1.47
2300	39.5	37.5 ~ 41.5	1.67	1.59 ~ 1.75
2450	39.2	37.2 ~ 41.2	1.80	1.71 ~ 1.89
2600	39.0	37.1 ~ 41.0	1.96	1.86 ~ 2.06
3500	37.9	36.0 ~ 39.8	2.91	2.76 ~ 3.06
5200	36.0	34.2 ~ 37.8	4.66	4.43 ~ 4.89
5300	35.9	34.1 ~ 37.7	4.76	4.52 ~ 5.00
5500	35.6	33.8 ~ 37.4	4.96	4.71 ~ 5.21
5600	35.5	33.7 ~ 37.3	5.07	4.82 ~ 5.32
5800	35.3	33.5 ~ 37.1	5.27	5.01 ~ 5.53
For Body				
750	55.5	52.7 ~ 58.3	0.96	0.91 ~ 1.01
835	55.2	52.4 ~ 58.0	0.97	0.92 ~ 1.02
900	55.0	52.3 ~ 57.8	1.05	1.00 ~ 1.10
1450	54.0	51.3 ~ 56.7	1.30	1.24 ~ 1.37
1640	53.8	51.1 ~ 56.5	1.40	1.33 ~ 1.47
1750	53.4	50.7 ~ 56.1	1.49	1.42 ~ 1.56
1800	53.3	50.6 ~ 56.0	1.52	1.44 ~ 1.60
1900	53.3	50.6 ~ 56.0	1.52	1.44 ~ 1.60
2000	53.3	50.6 ~ 56.0	1.52	1.44 ~ 1.60
2300	52.9	50.3 ~ 55.5	1.81	1.72 ~ 1.90
2450	52.7	50.1 ~ 55.3	1.95	1.85 ~ 2.05
2600	52.5	49.9 ~ 55.1	2.16	2.05 ~ 2.27
3500	51.3	48.7 ~ 53.9	3.31	3.14 ~ 3.48
5200	49.0	46.6 ~ 51.5	5.30	5.04 ~ 5.57
5300	48.9	46.5 ~ 51.3	5.42	5.15 ~ 5.69
5500	48.6	46.2 ~ 51.0	5.65	5.37 ~ 5.93
5600	48.5	46.1 ~ 50.9	5.77	5.48 ~ 6.06
5800	48.2	45.8 ~ 50.6	6.00	5.70 ~ 6.30

The following table gives the recipes for tissue simulating liquids.

Table 10: Recipes of Tissue Simulating Liquid

Tissue Type	Bactericide	DGBE	HEC	NaCl	Sucrose	Triton X-100	Water	Diethylene Glycol Mono-hexylether
H750	0.2	-	0.2	1.5	56.0	-	42.1	-
H835	0.2	-	0.2	1.5	57.0	-	41.1	-
H900	0.2	-	0.2	1.4	58.0	-	40.2	-
H1450	-	43.3	-	0.6	-	-	56.1	-
H1640	-	45.8	-	0.5	-	-	53.7	-
H1750	-	47.0	-	0.4	-	-	52.6	-
H1800	-	44.5	-	0.3	-	-	55.2	-
H1900	-	44.5	-	0.2	-	-	55.3	-
H2000	-	44.5	-	0.1	-	-	55.4	-
H2300	-	44.9	-	0.1	-	-	55.0	-
H2450	-	45.0	-	0.1	-	-	54.9	-
H2600	-	45.1	-	0.1	-	-	54.8	-
H3500	-	8.0	-	0.2	-	20.0	71.8	-
H5G	-	-	-	-	-	17.2	65.5	17.3
B750	0.2	-	0.2	0.8	48.8	-	50.0	-
B835	0.2	-	0.2	0.9	48.5	-	50.2	-
B900	0.2	-	0.2	0.9	48.2	-	50.5	-
B1450	-	34.0	-	0.3	-	-	65.7	-
B1640	-	32.5	-	0.3	-	-	67.2	-
B1750	-	31.0	-	0.2	-	-	68.8	-
B1800	-	29.5	-	0.4	-	-	70.1	-
B1900	-	29.5	-	0.3	-	-	70.2	-
B2000	-	30.0	-	0.2	-	-	69.8	-
B2300	-	31.0	-	0.1	-	-	68.9	-
B2450	-	31.4	-	0.1	-	-	68.5	-
B2600	-	31.8	-	0.1	-	-	68.1	-
B3500	-	28.8	-	0.1	-	-	71.1	-
B5G	-	-	-	-	-	10.7	78.6	10.7

SAR System Verification

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

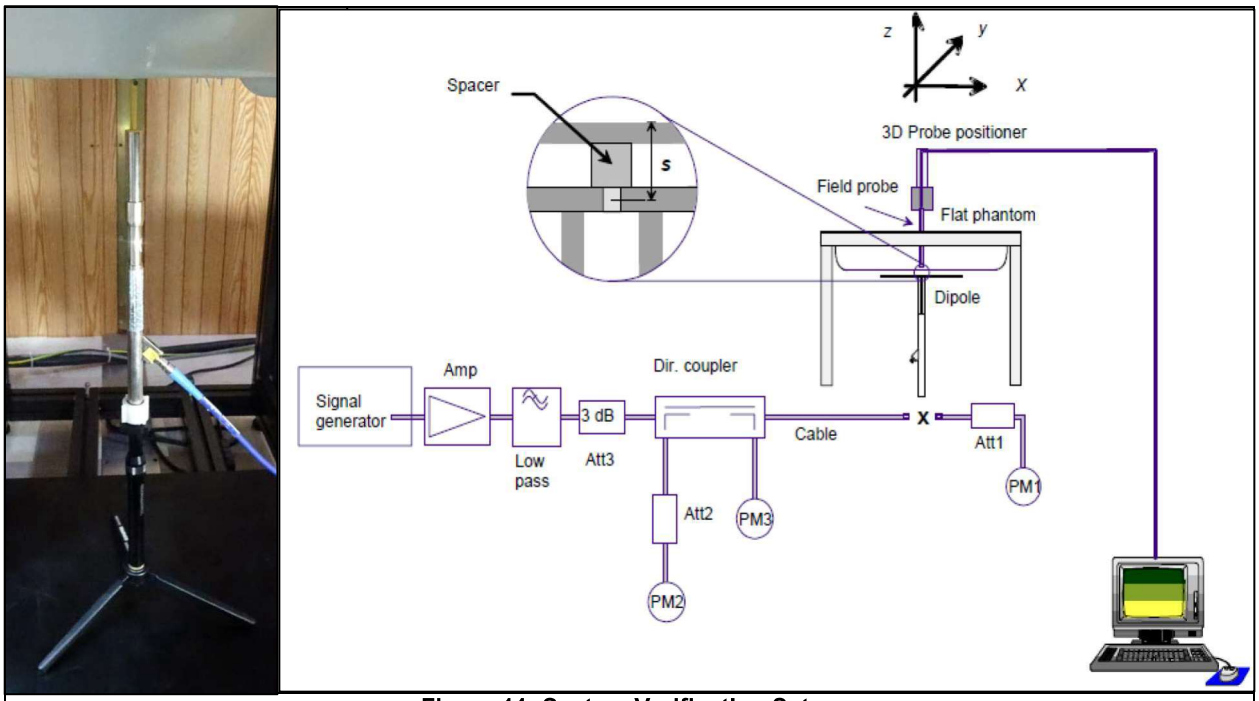


Figure 11: System Verification Setup

The validation dipole is placed beneath the flat phantom with the specific spacer in place. The distance spacer is touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The spectrum analyzer measures the forward power at the location of the system check dipole connector. The signal generator is adjusted for the desired forward power (250 mW is used for 700 MHz to 3 GHz, 100 mW is used for 3.5 GHz to 6 GHz) at the dipole connector and the power meter is read at that level. After connecting the cable to the dipole, the signal generator is readjusted for the same reading at power meter.

After system check testing, the SAR result will be normalized to 1W forward input power and compared with the reference SAR value derived from validation dipole certificate report. The deviation of system check should be within 10 %.

11 SAR Measurement Procedure

According to the SAR 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

The SAR measurement procedures for each of test conditions are as follows:

(a) Make EUT to transmit maximum output power

(b) Measure conducted output power through RF cable

(c) Place the EUT in the specific position of phantom

(d) Perform SAR testing steps on the DASY system

(e) Record the SAR value

11.1 Area & Zoom Scan Procedure

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10 g. According to KDB 865664 D01, the resolution for Area and Zoom scan is specified in the table below.

Items	<= 2 GHz	2-3 GHz	3-4 GHz	4-5 GHz	5-6 GHz
Area Scan (Δx, Δy)	<= 15 mm	<= 12 mm	<= 12 mm	<= 10 mm	<= 10 mm
Zoom Scan (Δx, Δy)	<= 8 mm	<= 5 mm	<= 5 mm	<= 4 mm	<= 4 mm
Zoom Scan (Δz)	<= 5 mm	<= 5 mm	<= 4 mm	<= 3 mm	<= 2 mm
Zoom Scan Volume	>= 30 mm	>= 30 mm	>= 28 mm	>= 25 mm	>= 22 mm

Note:
When zoom scan is required and report SAR is <= 1.4 W/kg, the zoom scan resolution of Δx / Δy (2-3GHz: <= 8 mm, 3-4GHz: <= 7 mm, 4-6GHz: <= 5 mm) may be applied.

11.2 Volume Scan Procedure

Volume Scans are 3D scans used to assess the peak spatial SAR values within an averaging volume containing 1g and 10g of simulated tissue. It is compatible with any phantom. For regular phantoms, the measurement grid is generated by projecting a plane onto the phantom surface as for Area and Zoom scans. For specific phantoms, the measurement grid is generated by a conformal offset to the phantom surface at the desired distances. The grid extents can be set by the end user to cover the DUT dimensions or the whole measurable area of the phantom.

11.3 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 drift more than 5%, the SAR will be retested.

11.4 Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the IEEE 1528 standard. It can be conducted for 1 g and 10 g, as well as for user-specific masses. 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 from 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

In DASY5 V5.2 SAR, the calculation is performed in the SEMCAD post processing engine. In cDASY6 Module SAR, the 1 g and 10 g cubes are calculated in the software itself.

11.5 SAR Averaged Methods

In DASY, the interpolation and extrapolation are both based on the modified Quadratic Shepard's method. The interpolation scheme combines a least-square fitted function method and a weighted average method which are the two basic types of computational interpolation and approximation.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5 mm.

11.6 Tissue Verification

Table 11: The measuring results for tissue simulating liquid

Tissue Type	Frequency (MHz)	Liquid Temp. (℃)	Measured Conductivity (σ)	Measured Permittivity (ε_r)	Target Conductivity (σ)	Target Permittivity (ε_r)	Conductivity Deviation (%)	Permittivity Deviation (%)	Test Date
H2450	2450	23.08	1.80	37.63	1.80	39.2	0.24	-4.00	Sep. 01, 2020
H5300	5300	22.40	4.79	35.50	4.75	35.87	0.68	-1.01	Sep. 02, 2020
H5600	5600	22.40	5.16	34.99	5.06	35.52	1.91	-1.49	Sep. 02, 2020

Note:

1. The dielectric properties of the tissue simulating liquid must be measured within 24 hours before the SAR testing and within ±5% of the target values. Liquid temperature during the SAR testing must be within ±2°C.
2. Since the maximum deviation of dielectric properties of the tissue simulating liquid is within 5%, SAR correction is evaluated in the measurement uncertainty shown on section 3.3 of this report.

11.7 System Verification

Table 12: The measuring results for system check

Frequency (MHz)	TSL	Power [dBm]	Deviation 1g [%]	Deviation 10g [%]	Deviation Peak [%]	Isotropic Error [%]	Test Date
2450	HSL	17	5.5	2.9	8.6	2.5	Sep. 01, 2020
5300	HSL	17	0.4	-2.0	8.9	-3.5	Sep. 02, 2020
5600	HSL	17	-8.1	-8.5	-6.5	2.7	Sep. 02, 2020

Note:

Comparing to the reference SAR value provided by SPEAG, the validation data should be within its specification of 10 %. The result indicates the system check can meet the variation criterion and the plots can be referred to APPENDIX B: PLOTS FOR SYSTEM VERIFICATION of this report.

11.8 RF Conducted Power

The measuring conducted power (Unit: dBm) are shown as below.

Table 13: The results of conducted power (Wi-Fi 2.4GHz)

Mode	Data rate (Mbps)	Frequency (MHz)	Measured Average Power (dBm)		Tune-up Tolerance (dB)	Duty cycle correction factor (dB)	Total Average Output Power (dBm)	Maximum Average e.i.r.p (dBm)	SAR Test applicability (Yes/No)**
			CHAIN 0	CHAIN 1					
b	1	2412	17.03	15.51	1	0.03	20.37	22.37	Yes
		2437	16.78	16.10	1	0.29	20.75	**22.75**	
		2462	16.39	15.82	1	0.31	20.44	22.44	
g	6	2412	16.15	15.12	1	0.19	19.86	21.86	Yes
		2437	16.32	15.19	1	0.27	20.07	**22.07**	
		2462	16.10	15.04	1	0.25	19.86	21.86	
VHT20	MCS0	2412	15.93	14.42	1	0.31	19.56	21.56	Yes
		2437	15.49	14.91	1	0.27	19.49	21.49	
		2462	15.64	14.86	1	0.35	19.63	**21.63**	
VHT40	MCS0	2422	14.62	13.72	1	0.68	18.88	**20.88**	Yes
		2437	14.29	13.89	1	0.33	18.44	20.44	
		2452	14.39	13.67	1	0.71	18.77	20.77	

Table 14: The results of conducted power (BLE)

Data rate (Mbps)	Frequency (MHz)	Measured Average Power (dBm)	Tune-up Tolerance (dB)	Duty Cycle Correction factor (dB)	Total Average Output Power (dBm)	Maximum e.i.r.p (dBm)	SAR Test applicability (Yes/No)**
1	2402	-0.18	1	2.04	2.86	4.86	No*
	2440	0.37	1	2.17	3.54	5.54	
	2480	0.47	1	2.08	3.55	**5.55**	

Table 15: The results of conducted power (BT-EDR)

Data rate (Mbps)	Frequency (MHz)	Measured Average Power (dBm)	Tune-up Tolerance (dB)	Duty Cycle Correction factor (dB)	Total Average Output Power (dBm)	Maximum e.i.r.p (dBm)	SAR Test applicability (Yes/No)**
1	2402	8.35	1	1.21	10.56	12.56	Yes
	2440	8.64	1	1.15	10.79	**12.79**	
	2480	8.45	1	1.20	10.65	12.65	

Notes : SAR test reduction was applied from KDB 248227

** YES : SAR testing is performed, Refer clause 11.10 Guidelines Applied of this report

NO :SAR testing is excluded, Refer clause 11.10 Guidelines Applied of this report

*Reffer clause 11.9 SAR Test Exclusion of this test report

Table 16: The results of conducted power (WiFi-5GHz)

Mode	Data rate (Mbps)	Frequency (MHz)	Measured Average Power (dBm)		Tune-up Tolerance (dB)	Duty cycle correction factor (dB)	Total Average Output Power (dBm)	Maximum Average e.i.r.p (dBm)	SAR Test applicability (Yes/No)**
			CHAIN 0	CHAIN 1					
a	6	5180	12.09	13.11	1	0.25	16.89	19.89	Yes
		5200	12.53	12.69	1	0.36	16.98	19.98	
		5240	12.88	12.43	1	0.31	16.98	19.98	
		5260	13.09	12.88	1	0.42	17.41	20.41	
		5300	13.66	13.12	1	0.32	17.72	20.72	
		5320	14.05	13.47	1	0.27	18.05	**21.05**	
		5500	12.74	12.52	1	0.29	16.93	19.93	
		5600	12.26	12.24	1	0.29	16.55	19.55	
		5700	12.02	11.85	1	0.23	16.18	19.18	
		5720	11.7	11.55	1	0.25	15.88	18.88	
		5745	11.72	12.07	1	0.30	16.20	19.20	
		5785	11.83	12.14	1	0.31	16.31	19.31	
		5825	10.3	11.21	1	0.29	15.08	18.08	
AC/ VHT20	MCS 0	5180	10.75	11.45	1	0.37	15.50	18.50	Yes
		5200	10.77	11.31	1	0.38	15.43	18.43	
		5240	11.44	11.15	1	0.67	15.98	18.98	
		5260	11.64	11.43	1	0.51	16.05	19.05	
		5300	12.16	11.74	1	0.33	16.30	19.30	
		5320	12.21	11.78	1	0.73	16.74	**19.74**	
		5500	11.07	11.26	1	0.67	15.85	18.85	
		5600	10.93	10.74	1	0.31	15.16	18.16	
		5700	10.89	10.51	1	0.55	15.27	18.27	
		5720	10.62	10.08	1	0.31	14.68	17.68	
		5745	11.00	10.45	1	0.55	15.30	18.30	
		5785	10.21	10.15	1	0.33	14.52	17.52	
		5825	10.27	9.89	1	0.55	14.65	17.65	
AC/ VHT40	MCS 0	5190	9.32	9.81	1	1.37	14.95	17.95	Yes
		5230	9.27	9.79	1	1.61	15.16	18.16	
		5270	10.26	9.96	1	0.97	15.09	18.09	
		5310	10.93	10.32	1	1.25	15.90	**18.90**	
		5510	9.19	10.32	1	1.13	14.93	17.93	
		5590	9.69	9.27	1	1.15	14.65	17.65	
		5670	9.36	8.85	1	1.35	14.47	17.47	
		5710	9.37	8.82	1	1.32	14.44	17.44	
		5755	9.54	8.97	1	1.37	14.64	17.64	
		5795	9.36	8.86	1	1.37	14.49	17.49	
AC/ VHT80	MCS 0	5210	7.82	8.1	1	2.64	14.61	17.61	Yes
		5290	9.27	8.57	1	1.89	14.84	**17.84**	
		5530	7.15	7.75	1	1.93	13.40	16.40	
		5610	7.83	7.51	1	2.43	14.11	17.11	
		5690	7.64	7.35	1	2.22	13.73	16.73	
		5775	8.09	7.22	1	2.65	14.34	17.34	

Notes : SAR test reduction was applied from KDB 248227

** YES : SAR testing is performed, Refer clause 11.10 Guidelines Applied of this report

NO :SAR testing is excluded, Refer clause 11.10 Guidelines Applied of this report

*Reffer clause 11.9 SAR Test Exclusion of this test report

11.9 SAR Test Exclusion

Based on the conducted power measurement, reported under section " RF Conducted Power " of this test report and derivation of Low-Power exclusion level defined in FCC KDBs 447498 D01 General RF Exposure Guidance v06 (See 4.3 a), SAR test exclusion was identified for the followong frequency band

RF protocol	Measured Frequency (MHz)	Maximum measured RF output power at antenna terminal (dBm)	Tune-up tolerance (dB)	Max power Including tune-up tolerance * (mW)	Exclusion threshold ** for separation distance of < 5 mm	SAR Test required (Yes/No)
BLE	2480	0.47 dBm	±1	1.40	0.44	No

*Max power is rounded to two decimal place for reporting
**separation distance of < 5 mm is used for the calculation

Hence RF exposure evaluation or SAR testig is required for Wi-Fi 2.4 GHz frequency range

- Per KDB 447498 D01v06, the 1-g and 10-g SAR Test Exclusion threshold for 100MHz to 6GHz at separation distance ≤5 mm are determined by
- The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm, and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 4.1 f) is applied to determine SAR test exclusion.

[(*max. power of channel, including tune-up tolerance, mW*) / (*min. test separation distance, mm*)] · [$\sqrt{f_{(GHz)}}$] ≤ 3.0 for 1-g SAR, and ≤ 7.5 for 10-g extremity SAR

Where

f (GHz) is the RF channel transmit frequency in GHz

11.10 Guidelines Applied

FCC KDB 248227 D01 802.11 Wi-Fi SAR v02r02

- The maximum output power specified for production units, including tune-up tolerance, are used to determine initial SAR test requirements for the 802.11 transmission modes in a frequency band.
- SAR test reduction is determined according to 802.11 transmission mode and configuration with multiple positons
- When the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel in the initial test configuration, for each frequency band
- The reported SAR must be scaled to the maximum transmission duty factor to determine compliance
- During SAR testing, RF transmission and EUT fuctionality is verified with spectrum analyzer

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04

- Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg
- When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once
- 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).
- 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.

447498 D01 General RF Exposure Guidance v06

- Measured SAR is adjusted for maximum tune-up tolerance
- The test separation distances required for a device to demonstrate SAR or MPE compliance must be sufficiently conservative to support the operational separation distances required by the device and its antennas and radiating structures
- For SAR testing of WLAN signal with duty cycle <100%, the measured SAR is scalled-up by the duty cycle scalling factor (i.e. 1/duty cycle)
- For all the applicable 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 of the mid-channel or highest output power channel is
  - ≤0.8 W/kg or ≤2 W/kg, for 1-g or 10-g respectively, when transmission band is ≤100MHz
  - ≤0.6 W/kg or ≤1.5 W/kg, for 1-g or 10-g respectively, when transmission band is between 100MHz and 200 MHz
  - ≤0.4 W/kg or ≤1 W/kg, for 1-g or 10-g respectively, when transmission band is ≥200MHz

11.11 SAR Testing Results

Table 17: SAR Testing Results(WiFi-2.4GHz)

CHAIN-0

Phantom	Position	Test Distance (mm)	Description	Channel	Frequency (MHz)	Measured SAR 1g [W/Kg]	Measured SAR 10g [W/Kg]	Tune-up tolerance (dB)	Adjusted SAR 1g [W/Kg]	Adjusted SAR 10g [W/Kg]
Flat HSL	FRONT	5	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	6	2437	0.557	0.275	±1	**0.701**	**0.346**
Flat HSL	BACK	5		6	2437	0.524	0.248	±1	0.660	0.312
Flat HSL	EDGE TOP	5		6	2437	0.086	0.033	±1	0.108	0.042
Flat HSL	EDGE BOTTOM	5		6	2437	0.03	0.017	±1	0.038	0.021
Flat HSL	EDGE LEFT	5		6	2437	0.309	0.154	±1	0.389	0.194
Flat HSL	EDGE RIGHT	5		6	2437	0.281	0.14	±1	0.354	0.176

CHAIN-1

Phantom	Position	Test Distance (mm)	Description	Channel	Frequency (MHz)	Measured SAR 1g [W/Kg]	Measured SAR 10g [W/Kg]	Tune-up tolerance (dB)	Adjusted SAR 1g [W/Kg]	Adjusted SAR 10g [W/Kg]
Flat HSL	FRONT	5	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	6	2437	0.095	0.036	±1	**0.120**	**0.045**
Flat HSL	BACK	5		6	2437	0.049	0.024	±1	0.062	0.030
Flat HSL	EDGE TOP	5		6	2437	0.002	0.000	±1	0.003	0.000
Flat HSL	EDGE BOTTOM	5		6	2437	0.014	0.007	±1	0.018	0.009
Flat HSL	EDGE LEFT	5		6	2437	0.033	0.014	±1	0.042	0.018
Flat HSL	EDGE RIGHT	5		6	2437	0.012	0.005	±1	0.015	0.006

Note:

a. No further SAR testing is required for 802.11b DSSS since the adjusted SAR is ≤ 0.8 W/kg & test exclusion is as per section 5.2.1 of KDB 248227 D01 802.11 Wi-Fi SAR v02r02.

b. SAR testing of 802.11g/n OFDM is not required since the adjusted SAR is ≤ 1.2 W/kg & test exclusion is as per section 5.2.2 of KDB 248227 D01 802.11 Wi-Fi SAR v02r02.

Table 18: SAR Testing Results(BT-EDR)

Phantom	Position	Test Distance (mm)	Description	Channel	Frequency (MHz)	Measured SAR 1g [W/Kg]	Measured SAR 10g [W/Kg]	Tune-up tolerance (dB)	Adjusted SAR 1g [W/Kg]	Adjusted SAR 10g [W/Kg]
Flat HSL	FRONT	5	IEEE 802.15.1 Bluetooth (GFSK, DH1)	0	2402	0.099	0.049	±1	**0.125**	**0.062**
Flat HSL	FRONT	5		38	2440	0.091	0.044	±1	0.115	0.055
Flat HSL	FRONT	5		78	2480	0.062	0.029	±1	0.078	0.037

Table 19: SAR Testing Results U-NII-1 & U-NII-2A (WiFi-5GHz)

CHAIN-0

Phantom	Position	Test Distance (mm)	Description	Channel	Frequency (MHz)	Measured SAR 1g [W/Kg]	Measured SAR 10g [W/Kg]	Tune-up tolerance (dB)	Adjusted SAR 1g [W/Kg]	Adjusted SAR 10g [W/Kg]
Flat HSL	FRONT	5	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	64	5320	0.689	0.194	±1	**0.867**	**0.244**
Flat HSL	BACK	5		64	5320	0.575	0.152	±1	0.724	0.191
Flat HSL	EDGE TOP	5		64	5320	0.218	0.114	±1	0.274	0.144
Flat HSL	EDGE BOTTOM	5		64	5320	0.181	0.073	±1	0.228	0.092
Flat HSL	EDGE LEFT	5		64	5320	0.441	0.235	±1	0.555	0.296
Flat HSL	EDGE RIGHT	5		64	5320	0.432	0.196	±1	0.544	0.247
Flat HSL	FRONT	5		60	5300	0.533	0.176	±1	0.671	0.222
Flat HSL	FRONT	5		52	5260	0.488	0.132	±1	0.614	0.166

CHAIN-1

Phantom	Position	Test Distance (mm)	Description	Channel	Frequency (MHz)	Measured SAR 1g [W/Kg]	Measured SAR 10g [W/Kg]	Tune-up tolerance (dB)	Adjusted SAR 1g [W/Kg]	Adjusted SAR 10g [W/Kg]
Flat HSL	FRONT	5	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	64	5320	0.458	0.129	±1	**0.577**	**0.162**
Flat HSL	BACK	5		64	5320	0.376	0.122	±1	0.473	0.154
Flat HSL	EDGE TOP	5		64	5320	0.161	0.083	±1	0.203	0.104
Flat HSL	EDGE BOTTOM	5		64	5320	0.113	0.061	±1	0.142	0.077
Flat HSL	EDGE LEFT	5		64	5320	0.133	0.069	±1	0.167	0.087
Flat HSL	EDGE RIGHT	5		64	5320	0.115	0.053	±1	0.407	0.131
Flat HSL	FRONT	5		60	5300	0.318	0.156	±1	0.400	0.196
Flat HSL	FRONT	5		52	5260	0.292	0.148	±1	0.368	0.186

1. The highest power mode tested as initial configuration, and other channels SAR is optional when SAR value in initial configuration less than 0.8W/kg.
2. The adjusted SAR is less than 1.2W/kg.

Table 20: SAR Testing Results U-NII-2C & U-NII-3 (WiFi-5GHz)

CHAIN-0

Phantom	Position	Test Distance (mm)	Description	Channel	Frequency (MHz)	Measured SAR 1g [W/Kg]	Measured SAR 10g [W/Kg]	Tune-up tolerance (dB)	Adjusted SAR 1g [W/Kg]	Adjusted SAR 10g [W/Kg]
Flat HSL	FRONT	5	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	100	5500	0.541	0.218	±1	**0.681**	**0.274**
Flat HSL	BACK	5		100	5500	0.427	0.192	±1	0.538	0.242
Flat HSL	EDGE TOP	5		100	5500	0.07	0.040	±1	0.088	0.050
Flat HSL	EDGE BOTTOM	5		100	5500	0.033	0.016	±1	0.042	0.020
Flat HSL	EDGE LEFT	5		100	5500	0.293	0.148	±1	0.369	0.186
Flat HSL	EDGE RIGHT	5		100	5500	0.284	0.136	±1	0.358	0.171
Flat HSL	FRONT	5	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	157	5785	0.481	0.182	±1	**0.606**	**0.229**
Flat HSL	BACK	5		157	5785	0.394	0.144	±1	0.496	0.181
Flat HSL	EDGE TOP	5		157	5785	0.052	0.022	±1	0.065	0.028
Flat HSL	EDGE BOTTOM	5		157	5785	0.026	0.009	±1	0.033	0.011
Flat HSL	EDGE LEFT	5		157	5785	0.182	0.091	±1	0.229	0.115
Flat HSL	EDGE RIGHT	5		157	5785	0.174	0.082	±1	0.219	0.103

CHAIN-1

Phantom	Position	Test Distance (mm)	Description	Channel	Frequency (MHz)	Measured SAR 1g [W/Kg]	Measured SAR 10g [W/Kg]	Tune-up tolerance (dB)	Adjusted SAR 1g [W/Kg]	Adjusted SAR 10g [W/Kg]
Flat HSL	FRONT	5	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	100	5500	0.389	0.169	±1	**0.490**	**0.213**
Flat HSL	BACK	5		100	5500	0.375	0.156	±1	0.472	0.196
Flat HSL	EDGE TOP	5		100	5500	0.118	0.058	±1	0.149	0.073
Flat HSL	EDGE BOTTOM	5		100	5500	0.081	0.037	±1	0.102	0.047
Flat HSL	EDGE LEFT	5		100	5500	0.248	0.118	±1	0.312	0.149
Flat HSL	EDGE RIGHT	5		100	5500	0.212	0.109	±1	0.267	0.137
Flat HSL	FRONT	5	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	157	5785	0.352	0.178	±1	**0.443**	**0.224**
Flat HSL	BACK	5		157	5785	0.329	0.144	±1	0.414	0.181
Flat HSL	EDGE TOP	5		157	5785	0.109	0.052	±1	0.137	0.065
Flat HSL	EDGE BOTTOM	5		157	5785	0.067	0.032	±1	0.084	0.040
Flat HSL	EDGE LEFT	5		157	5785	0.206	0.098	±1	0.259	0.123
Flat HSL	EDGE RIGHT	5		157	5785	0.198	0.086	±1	0.249	0.108

1. The highest power mode tested as initial configuration, and other channels SAR is optional when SAR value in initial configuration less than 0.8W/kg.
2. The adjusted SAR is less than 1.2W/kg.

11.12 Simultaneous Transmission

The following procedures adopted from FCC KDB Publication 447498 D01v06 are applicable to built-in unlicensed transmitters such as WLAN & Bluetooth devices which may simultaneously transmit with the licensed transmitter.

SL. No.	Simultaneous Transmission Configuration	Body
1.	WLAN 2.4GHz Chain-0 + WLAN 2.4GHz Chain-1	Yes
2.	WLAN 5GHz Chain-0 + WLAN 5GHz Chain-1	Yes
3.	WLAN 5GHz Chain-1 + BT Chain-0	Yes
4.	WLAN 2.4GHz Chain-1 + BT Chain-0	Yes

Note:

The simultaneous transmission possibilities are listed as below.

1. WLAN 2.4GHz Chain-0 Ant and Bluetooth Chain-0 Ant share the same antenna and cannot transmit simultaneously.
2. WLAN 5GHz Chain-0 Ant and Bluetooth Chain-0 Ant share the same antenna and cannot transmit simultaneously.
3. EUT will chose either WLAN 5GHz or WLAN 2.4GHz according to the network signal condition; therefore, WLAN 5GHz and WLAN 2.4GHz will not operate simultaneously share the same antenna and cannot transmit simultaneously.
4. We used the sum of 1-g SAR provision in KDB 447498 D01v06 to exclude the simultaneous transmission.

11.12.1 Body Exposure Conditions

Simultaneous Transmission	Chain-0 Antenna (W/kg)	Chain-1 Antenna (W/kg)	∑SAR (W/kg)	SPLSR Analysis
WLAN 2.4GHz	0.701	0.144	0.845	ΣSAR < 1.6,Not required
WLAN 5GHz	0.867	0.577	**1.444**	ΣSAR < 1.6,Not required
BT + WLAN 2.4GHz	0.125	0.144	0.269	ΣSAR < 1.6,Not required
BT + WLAN 5GHz	0.125	0.577	0.702	ΣSAR < 1.6,Not required

*SPLSR – SAR to peak location spacing ratio

12 TEST SETUP PHOTOS

Remarks: 5mm spacer

Photo 1 : EUT kept in Front position with the Flat phantom

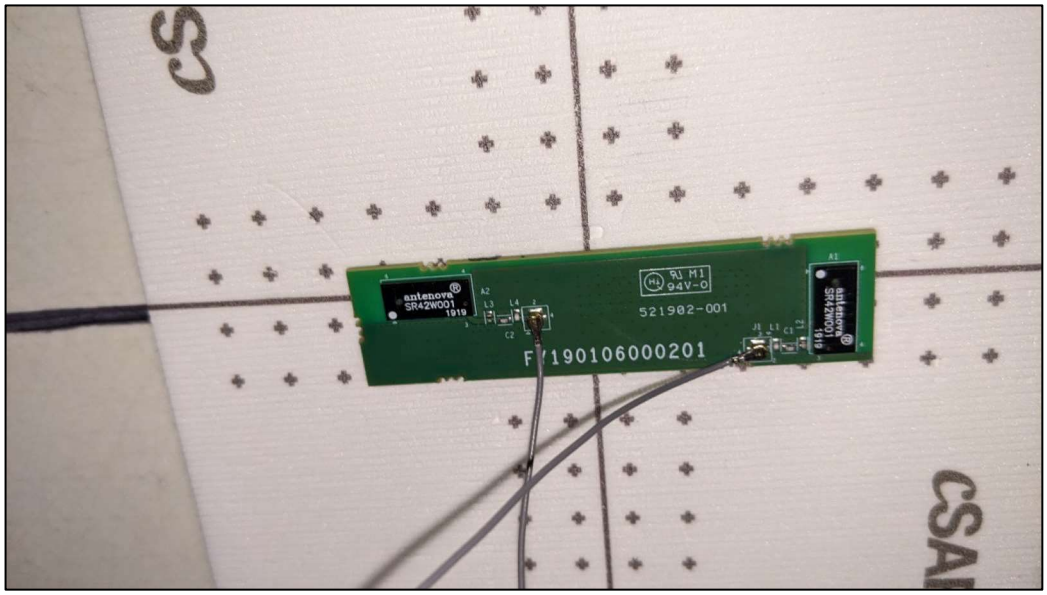


Photo 2 : EUT kept in Back position with the Flat phantom

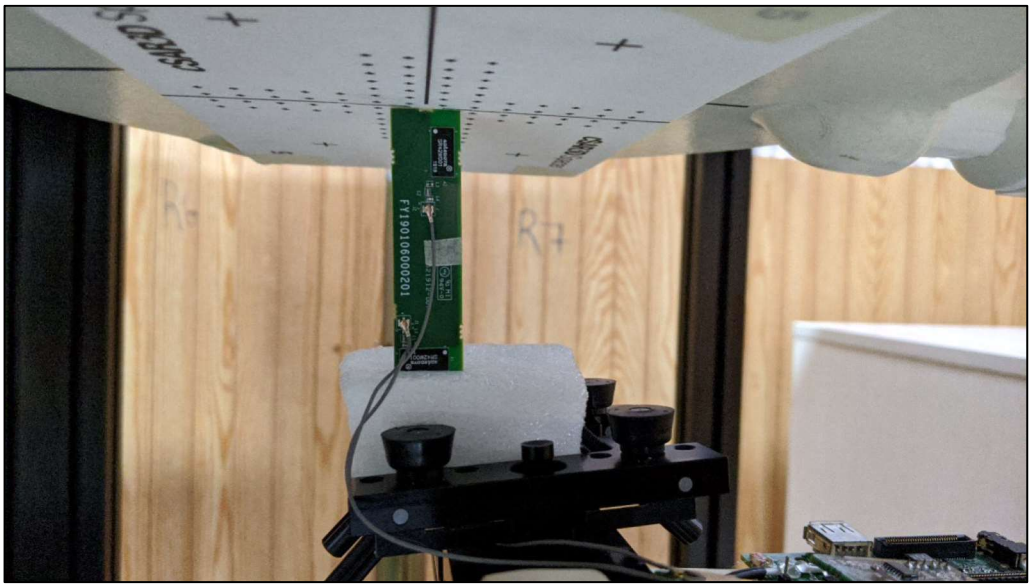


Photo 3 : EUT kept in Edge Right position with the Flat phantom

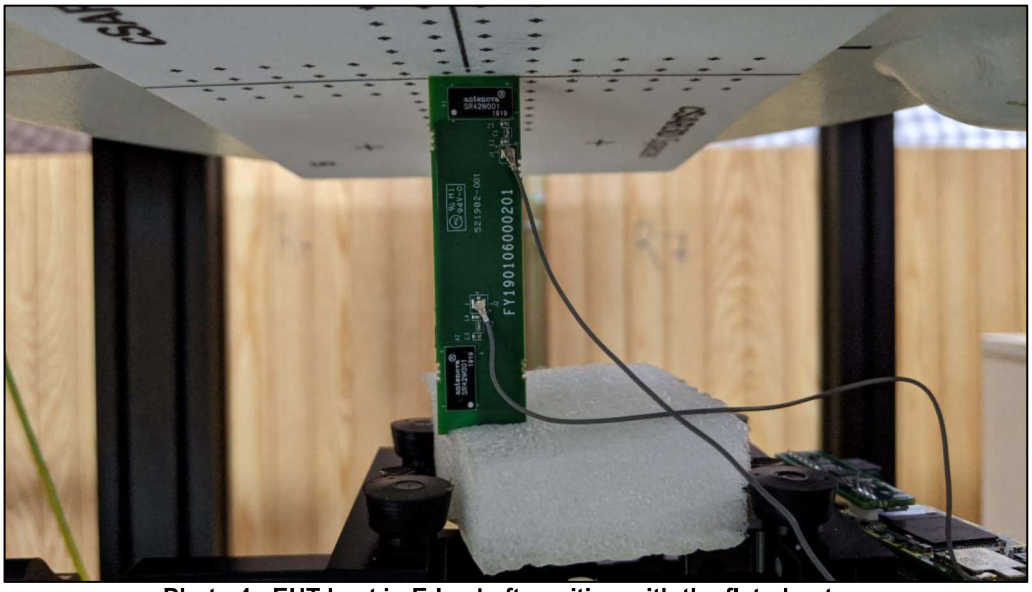


Photo 4 : EUT kept in Edge Left position with the flat phantom

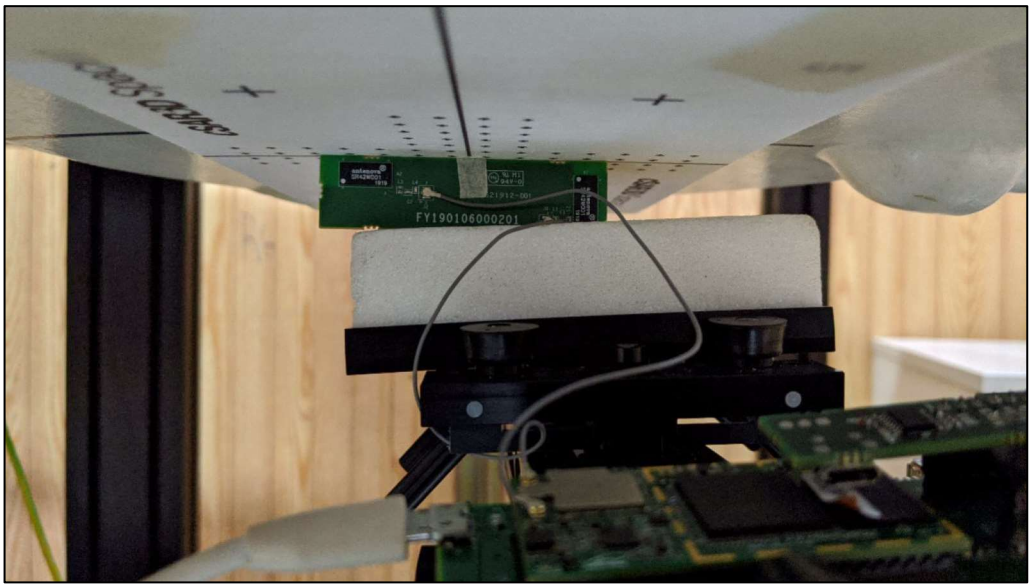


Photo 5 : EUT kept in Edge Top position with the flat phantom

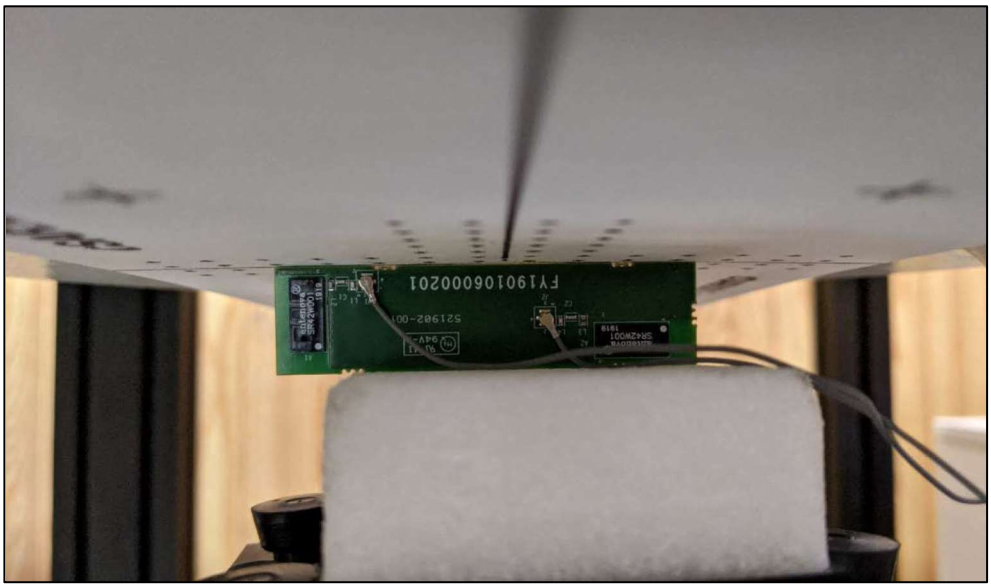


Photo 6 : EUT kept in Edge Bottom position with the flat phantom

13 LIST OF TABLES

14 LIST OF FIGURES

15 Photographs

*****END OF TEST REPORT*****