מכון טכנולוגי חולון
Holon Institute of Technology

HIT SAR Labs איכות ומצוינות

Comparative SAR Measurements Report

Report Number: 0104

Equipment under Test: 3Mobile Devices.

Model Name: See section 1.

Test Protocol: The impact of the radiation insulating material (Apron-c and Apron-d) on the SAR level and the far field.

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Content

1.General Information

Client information:

Doctor Finkel LTD.

www.doctorfinkel.co.uk

DOCTOR FINKEL

Devices to be tested:

Mobile phones:

1. iPhone 3
2. iPhone5
3. iPhone6

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2.SAR Comparative measurements

2.1 Goals

To check the performance of the proposed insulatingmaterial (Apron-c), in order to examine its SAR reduction capabilities and to make sure it does not effectthe cell phone's radiated far field.

All conditions in terms of frequency, power, position and orientation were kept unchanged in all tests.

2.2 Measurement conditions

Environmental Conditions:

Temperature: 68˚F to 77˚F (20˚C to 25˚C)
Relative Humidity: 32 to 47 %
Frequencies: 900 – 1,800 MHz
Phantom type: Twin SAM.
Section: Human Head Immitation.

3. Presentation of the materials

3.1 Apron-c

A thin material with flexible structure consisting of many ultrathin layers, made with the application of nano-technology. Its one resembles a grey metal foil, while another side appears to be covered with a thin plastic film. The roll`s width is 33.9inches (86 cm), its thickness is 0.1 mm. The material is intended for electromagnetic radiation reflection in the range of 20 GHz. Radiation factor of Apron-c claimed by manufacturer is 42 dB. It also withstands the following temperatures -76˚F to 752˚F .((-60˚C up to 400˚C

Apron-d 3.2

The described material is of fabric structure. There are three types of Apron-d, which mainly differ in thickness and metal content. The material is flexible and rumpled. It is thin and almost weightless. Its thickness varies from 0.1 mm to 0.15 mm. It is durable .(and dense by touch. It can be of light bronze or silver tinge color (non transparent

The thickest type of Apron-d (its thickness is 0.15mm) is of light bronze color, with one of its sides appearing lighter and glossier than the other side, which in turn is comparably dim and dark.

The second type of Apron-d has a bright silver tinge and is somewhat thinner (depending on the metal quantity content in its chemical structure) than a previously .described material, with the thickness of 0.13 mm

The third type of Apron-d is almost weightless, transparent and resembles a thin plastic net. Amidst the types that have been mentioned, this material can be

classified as the thinnest one, with the thickness of 0.1 mm. It is also flexible and is .almost not rumpled. It feels soft

4. Experimental Results

4.1 General material test results

This test is intended to measure the impact of the material on the signals which are received in the air.

Material type	Frequency [MHz]	Power without Apron-c	Power with Apron-c	Total reduction
Apron-c	995	10.06[mV]	386.5[µV]	96%

Material type	Frequency [MHz]	Power without Apron-d1	Power with Apron-d1	Total reduction
Apron-d1	995	10.06[mV]	47.05[µV]	94%

Material Type	Frequency [MHz]	Power without Apron-d2	Power with Apron-d2	Total reduction
Apron-d2	995	10.06[mV]	183.6[µV]	98%

Material type	Frequency [MHz]	Power without Apron-d3	Power with Apron-d3	Total reduction
Apron-d3	995	10.06[mV]	1.228[mV]	88%

Material type	Frequency [MHz]	Power without Apron-d4	Power with Apron-d4	Total reduction
Apron-d4	950	3.5[mV]	169[µV]	95%

4.2 SAR Experimental Results

Host Phone	Total SAR [mW/g] without Apron-c	Total SAR [mW/g] with Apron-c	Total SAR reduction
iPhone 4	1.84 (1gr) 0.888 (10gr)	0.0664 (1gr) 0.0053 (10gr)	96% - 99%
Host Phone	**Total SAR [mW/g] without Apron-c**	**Total SAR [mW/g] with Apron-c**	**Total SAR reduction**
iPhone 5	1.12 (1gr) 0.606 (10gr)	0.188 (1gr) 0.0836 (10gr)	83% - 86%

Host Phone	Total SAR [mW/g] without Apron-c	Total SAR [mW/g] with Apron-c	Total SAR reduction
iPhone 6	1.58 (1gr) 0.825 (10gr)	0.132 (1gr) 0.0685 (10gr)	91%

- The measurements were performed using Multi UE Tester in order to control the transmission power of the devices under test.

4.3 Far Field Experimental Results

Host Phone	Frequency [MHz]	Position	Intensity - Far field [3m]			
			Without material	With a human head	with Apron -c	With a human head + Apron-c
iPhone 4	889	Screen in front of the antenna	-23 dBm	-28 dBm	-29 dBm	-34 dBm **A decrease of 11 dBm**
		Screen at 45 degrees from the antenna	dBm 19-	dBm 27-	24- dBm	dBm 35- **A decrease of 16 dBm**
		Screen at 90 degrees from the antenna	dBm 19-	dBm 19-	22- dBm	dBm 26- **A decrease of 7 dBm**
		Screen at 135 degrees from the antenna	dBm 18-	dBm 18-	21- dBm	dBm 25- **A decrease of 7 dBm**
		Screen at 180 degrees from the antenna	dBm 20-	dBm 20-	25- dBm	dBm 27- **A decrease of 7 dBm**

4.4 Conclusions

1. Placing the material on the surface cell phone causes a significant decrease in the SAR levels.

2. The use of the marital interfere with the transmition of the cell phone's Far field. Depending on the different positions, a decrease in signal intensity ranging from 7-16 dBm.

3.The material serves a buffer between the wireless device and the human head and therefore should be placed between the head of the cell phone user and the wireless device.

4.5 SAR Measurement Equipment:

Equipment	Model	Manufacturer	Serial Number
Dasy3 Controller	RX60BL	Stäubli	5N22A1
E-Field Probe	ET3DV6	Speag	1662
Probe Alignment Light Beam	LB2	Speag	298
Data Acquisition Electronics	DAE3	Speag	488
Phantom	Twin Sam	Speag	1108
PC	HP Vectra	HP	NL14213453
Spectrum analyzer	E4402B	Agilent Technologies	E4402B
Multi UE Tester	N9360A	Agilent Technologies	

4.6Testing setup photographs:

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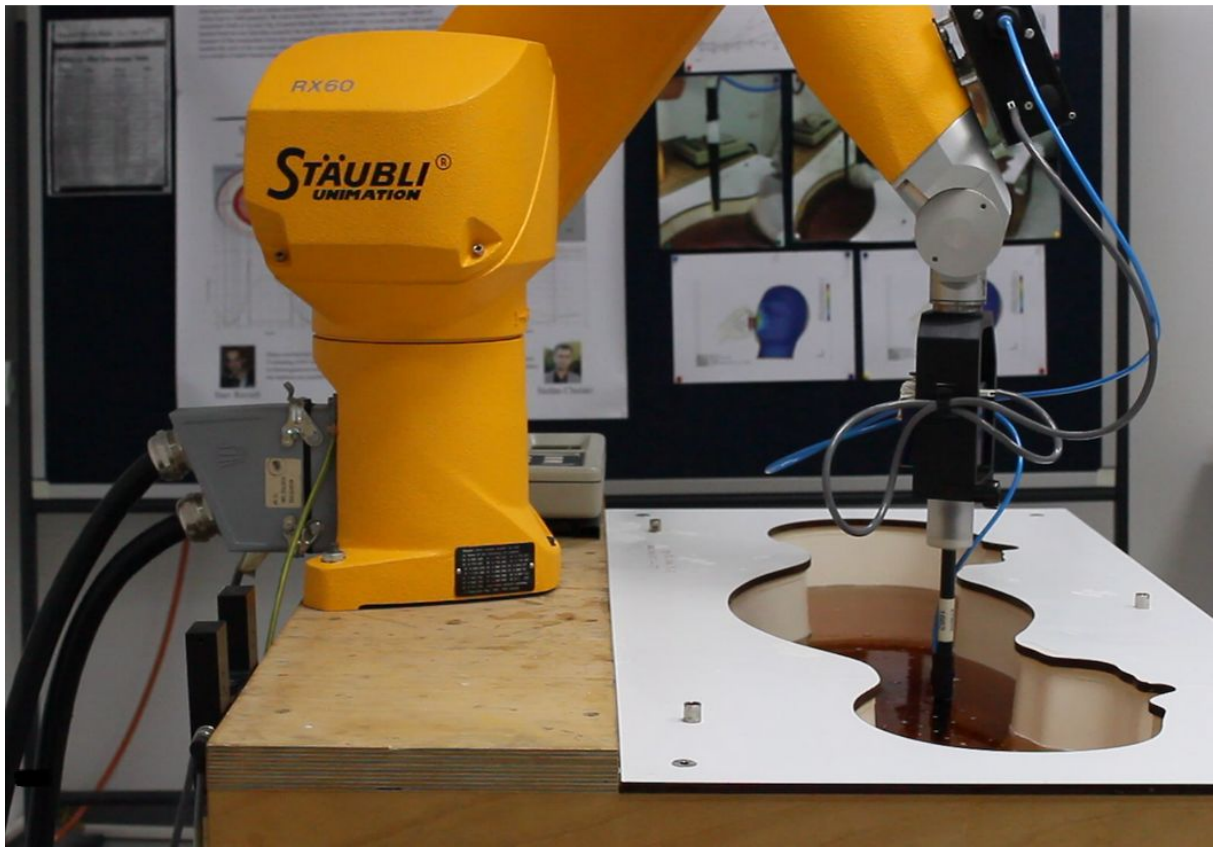

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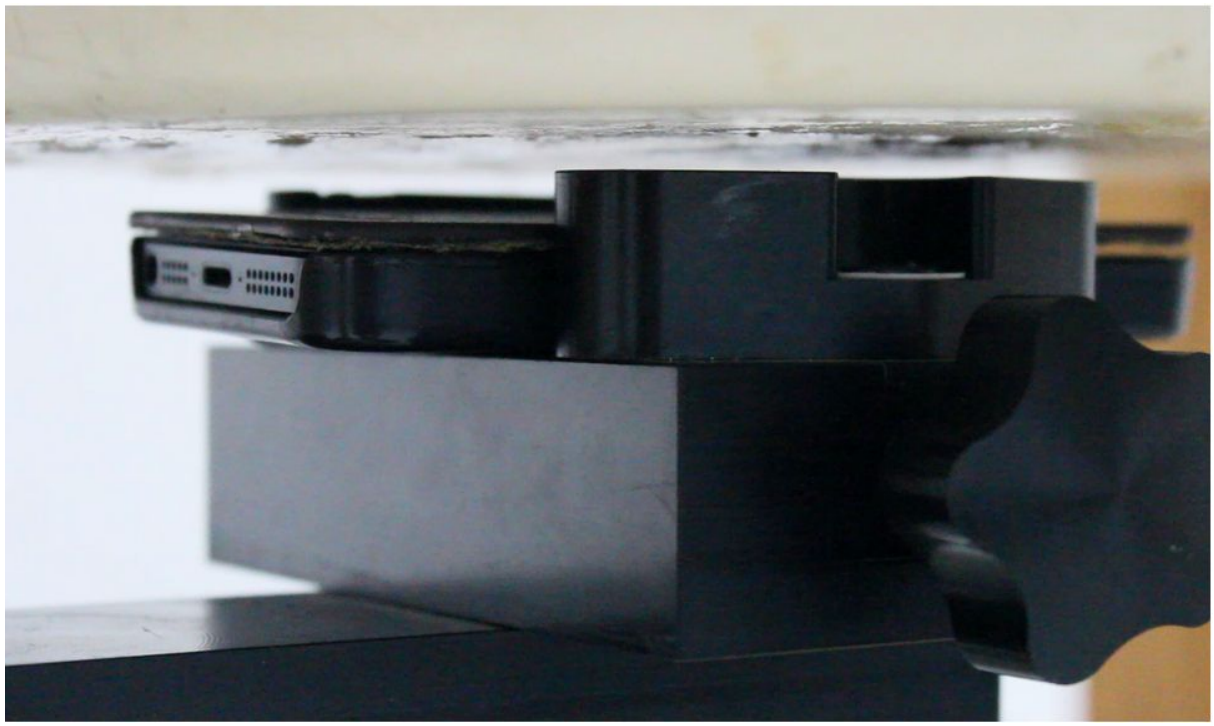

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