Antenna Type Approval Laboratory
University of Tehran
School of Electrical & Computer Eng., Kargar Ave. North, Tehran, Iran

Certificate of Measurement Conformance
LQS-F5100200
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The instrument identified below has been individually calibrated in compliance with the following standard(s):

- ANSI/IEEE Std 686 – 2008 Radar Definitions, (Revision of IEEE Std 686-1997)
- ANSI/IEEE Std 145 - 1993, Definitions of Terms for Antennas;
- ANSI/IEEE Std 149 - 1979, Antenna Measurement Standards;

Environment: Laboratory was maintained in a temperature-controlled environment with ambient conditions from 19 to 25 C, relative humidity less than 60%. The device under test has been measured and calibrated inside a shielded pyramidal anechoic chamber, which has no known influences on measurement quality.

Test Type: Response Measurement
Test Date: July 22, 2014

DUT Identification:
    Manufacturer: ZARSIM
    Model: ---
    Serial Number / ID: SA-93-04-105
    Device Type: Coaxial Cable

Comments: Impedance, Attenuation, Velocity Ratio

Main Equipment Used:

Make	Model	Name	Calibration Date
Agilent	E8361C	PNA Series Network Analyzer, 10MHz - 67GHz	Feb-2009

Technical Manager
Dr. Karim Mohammadpour-Aghdam

Director of the Lab.
Prof. Reza Faraji-Dana

Attested and Issued on July 22, 2014

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Test Date: July 22, 2014	**Antenna Type Approval Lab.** **University of Tehran** School of Electrical & Computer Eng., Kargar Ave. North, Tehran, Iran	Antenna Type-Approval Laboratory University of Tehran
	Test report for Response Measurement Manufactured: ZARSIM Model Number: --- Serial Number: SA-93-04-105	

Real and Imaginary Part of the Characteristic Impedance of the Coaxial Cable:

- **Real & Imaginary$\{Z_0\}$ [Ω]:**

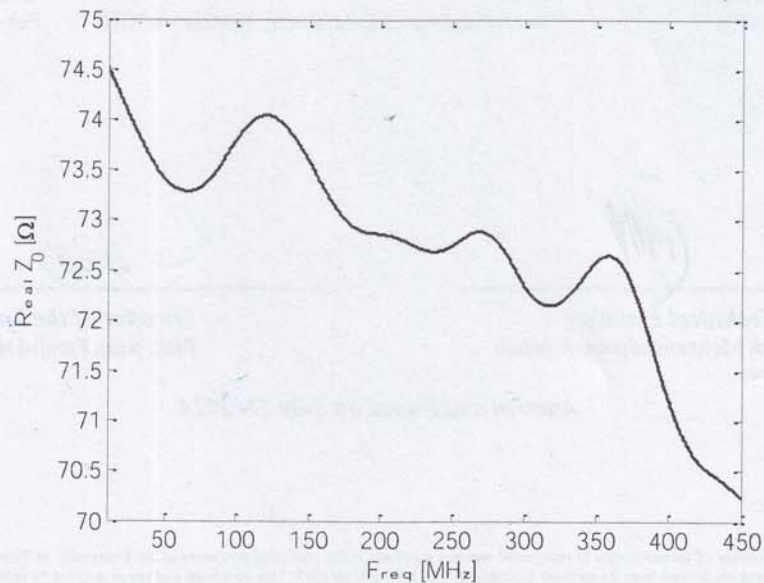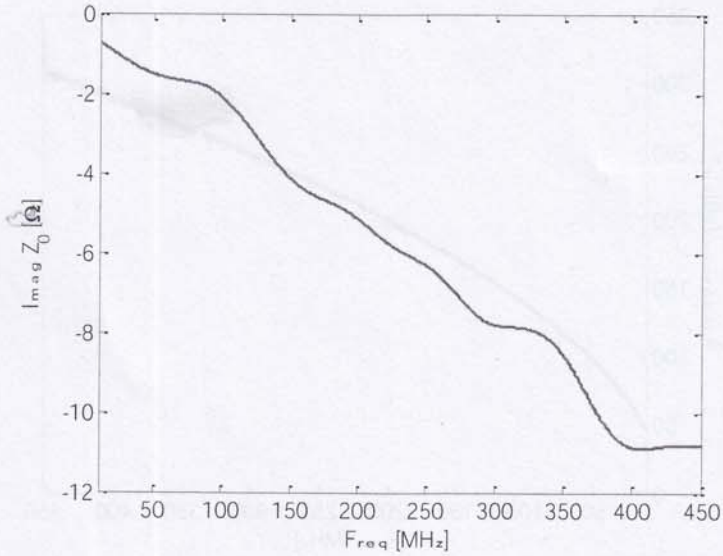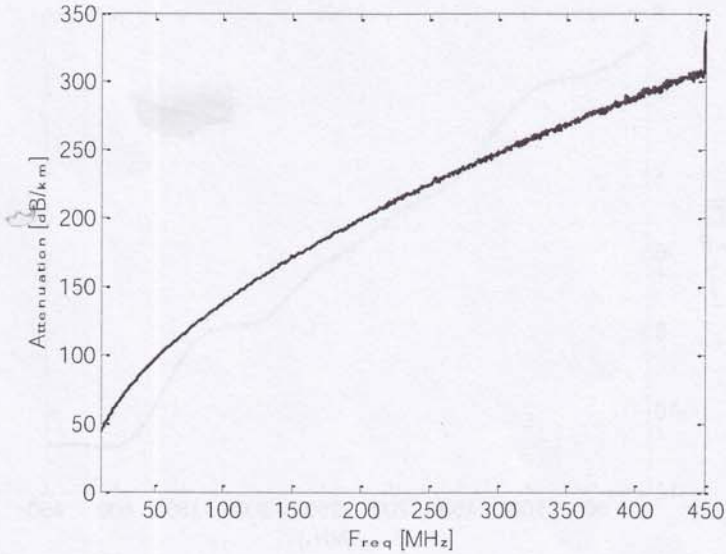- **Real$\{Z_0\}$ [Ω]:**

Test Date:
July 22, 2014

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Control
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Test report for Response Measurement
Manufactured: ZARSIM **Model Number:** --- **Serial Number:** SA-93-04-105
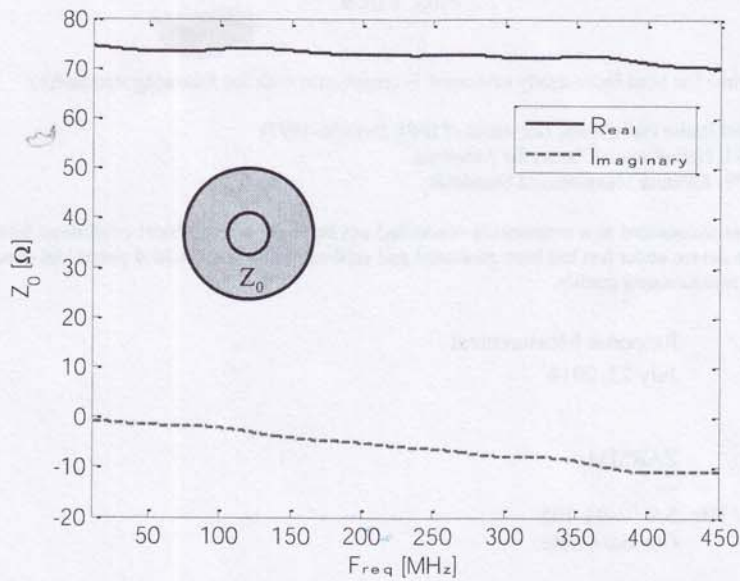
- **Imaginary{Z_0} [Ω]:**

Freq [MHz]	Impedance [Ω]
10	74.52-0.71i
100	73.81-2.08i
200	72.86-5.13i
300	72.35-7.80i
400	71.21-10.8i

			Control
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			Laboratory
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	Test report for Response Measurement		
	Manufactured: ZARSIM **Model Number:** --- **Serial Number:** SA-93-04-105		

Attenuation of the Coaxial Cable:

Freq [MHz]	Attenuation [dB/km]
10	43.14
100	137.8
200	199.7
300	246.9
400	286.4

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Group Delay of the Coaxial Cable with the Length of 200 Meters:

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Calculation of Velocity Ratio:

Freq [MHz]	Group Delay [µs]	Velocity Ratio [µs]
20	1.0245	65.07%
150	1.0208	65.31%
300	1.0174	65.53%
400	1.0179	65.49%

$$\tau_g = \frac{1.0245\ [\mu s]}{200\ [m]} = 5.1\ [ns] \implies n = \tau_g \times c = 1.53$$

$$\implies \text{Velocity Ratio} = \frac{1}{1.53} \times 100 = 65.3\ \%$$