Input Impedance Comparison of MR-Conditional Cardiac Implantable Pulse Generators at the 1.5T MR Frequency of 63.87 MHz

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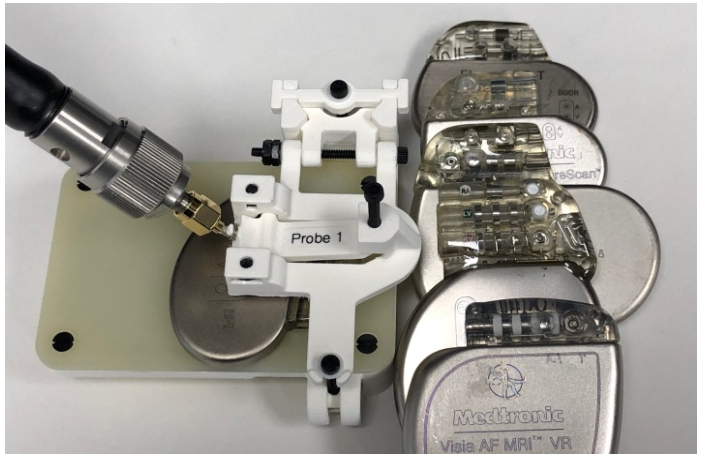
Introduction and Background: Tissue damage due to RF-induced heating is a primary hazard in the MR environment for patients with an implanted cardiac system composed of leads connected to an implantable pulse generator (IPG). In this study, we measured the impedance at 63.87MHz of several MR-conditional IPGs from different manufacturers to assess the role of the IPG in determining the RF-induced heating at the lead electrodes.



Impedance Measurement Test Fixture and measured IPGs

Methods: We measured the impedances of six IPGs with MR-Conditional labeling around 63.87MHz using a calibrated vector network analyzer and a custom test fixture designed to perform these measurements with minimal residual error.

Results: Measurements at 63.87MHz are presented in the following table:

Manufacturer And Model	Measurement	Complex Impedance	Mag Z [Ω]	Angle (deg)
Biotronik Eluna 8 HF-T QP	V Tip-Can	0.85 + j4.93	5.00	80.21
	V Ring-Can	0.89 + j5.80	5.87	81.24
Biotronik Iperia 7 DR-T	V Tip-Can	1.08 + j0.85	1.37	38.08
	V Ring1-Can	1.26 + j2.14	2.48	59.51
Boston Sci. Dynagen X4	RV Tip-Can	0.57 + j1.65	1.75	70.82
	RV Ring1-Can	0.61 + j0.80	1.00	52.75
Medtronic Advisa DR MRI	V Tip-Can	0.39 + j1.64	1.68	76.55
	V Ring-Can	1.68 + j1.51	2.26	41.98
Medtronic Visia AF	RV Tip-Can	0.99 + j1.06	1.45	46.87
	RV Ring1-Can	0.84 + j1.09	1.37	52.4
Abbott Assurity MRI	V Tip-Can	3.61 + j0.28	3.62	4.39
	V Ring-Can	1.10 + j5.28	5.39	78.21

Discussion and Conclusions: The measured IPGs exhibited inductive impedances with magnitudes averaging 2.77Ω with a standard deviation of 1.75Ω. This narrow impedance range suggests that the IPG component of an MR-Conditional system could be interchanged without compromising safety.

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