1. **Purpose of Experiments**
   Include immediate goal of the experiments, scientific importance and/or programatic relevance. Refer to any relevant program milestones or ITER R&D commitments.

   Characterize antenna loading of the monopole antenna, as functions of plasma density, minority concentration, antenna position relative to the plasma, and plasma shape. Initial data on RF effects at the 100 kW power level will also be obtained. This proposal does not cover toroidal field scan, current scan, or different minority heating scenarios.

2. **Background**
   Discuss Physics basis of the proposed research, Prior results at Alcator or elsewhere, and any related work being carried out separately.

   A preliminary low power antenna loading measurement was performed using a network analyzer during the last run period under one specific plasma condition and with the antenna positioned 5 cm behind the outboard limiter. This proposal is aimed at characterizing the antenna loading at a moderate power level under a variety of conditions forseen for higher power heating experiments.

3. **Approach**
   Describe the methodology to be employed; explain the rationale for the choice of parameters, etc. Describe the analysis techniques to be employed in interpreting the data, if applicable. If the approach is standard or otherwise self-evident, this section may be absorbed into the Experimental Plan.

   Checkout of RF diagnostics and antenna conditioning will be done piggybacking on other experiments. This is expected to take approximately 2 weeks. Tuning up of the plasma can be done in hydrogen, but parameter scans will be carried out in deuterium majority plasmas with varying amounts of hydrogen minority. He may be substituted for deuterium as the majority species if reliable plasma startup has already been achieved and if neutron production is a concern. It is very important to avoid runaways during this experiment.
4. Resources

4.1 Machine and Plasma Parameters

Give values or range for:

**Toroidal Field:** 5.3 T (5 T minimum).

**Plasma Current:** As high as possible but still reproducible (300 kA minimum).

**Working gas species:** Start with H, then switch to H minority in D or $^4$He majority.

**Density:** $10^{20}$ m$^{-3}$ and up.

**Equilibrium configuration** (if possible, refer to database equilibria): Lower single null, $z = -2$ cm, $\kappa$ up to 1.6 (match the antenna, but needs to be stable).

**Pulse length, typical current & density waveforms, etc.** Refer to database or sketch desired waveforms: Current flat-top of at least 150 msec, steady or rising density.

4.2 Auxiliary Systems

**RF Power, pulse length, phasing:** 100 kW (50–300 kW), 100 msec (50–200 msec).

**Pellet Injection (species):** none

**Impurity blow-off injection:** none

**Special gas puffing:** H minority, D majority.

**Other:**

4.3 Diagnostics

List required diagnostics, and any special setup or configuration, e.g. non-standard digitization rate.

All available diagnostics, especially RF diagnostics (including RF probes), optical view of antenna, impurity lines (need to decide on spectral coverage), edge diagnostics (probes, H$_\alpha$, etc.), temperature diagnostics (including neutrons).

4.4 Neutron Budget

Estimate the neutron dose rate at the site boundary. Give basis for estimate. (Once some experience has been gained a standard formula will be provided for estimating dose rates.)

Small but finite. This run will provide data on neutron dose rate.

5. Experimental Plan

5.1 Run sequence plan

Specify total number of runs required, and any special requirements, such as consecutive days, no Monday runs, extended run period (10 hours maximum), etc.

Three good runs minimum (preferably consecutive), after RF diagnostic checkout and conditioning are complete.
5.2 Shot sequence plan

For each run day, give detailed specification for proposed shot sequence: number of shots at
each condition, specific parameters and auxiliary systems requirements, etc. Include contin-
gency plans, if appropriate.

Day 1: Establish starting condition in H (5). Find optimum limiter position (5). Move
antenna in in steps, density ramping (5). Switch to D and scan H minority concentration
(10).

Day 2: Antenna position scan at low density (5). Scan density, steady density (5). An-
tenna position scan at high density (5). Vary elongation (5). Divertor/Limiter comparison
at same $\kappa$ (1). Shift R position (2). Shift z position (2).

Day 3: Complete scans from previous days. Use the remainder to establish the best
operating condition and increase RF power (optimize heating, minimize impurity produc-
tion).

6. Anticipated Results

Discuss possible experimental outcomes and implications. Indicate if the program may be expected
to lead to publications, milestone completions, improved operating techniques, etc. Indicate if
the experiments are intended to contribute to a joint research effort, or an external database.

Primary results will be antenna loading as functions of plasma density, minority con-
centration, antenna position relative to the plasma, and plasma shape. Initial heating data
and RF effects (such as impurity generation, edge plasma modification, etc.) at the 100
kW power level will also be obtained.

7. References

Include references both to external and internal literature or communications which bear on this
proposal. See Section 2.