

# The Green Bank Interference Protection Group: Policies for RFI Management

Updated: January 24, 2007<sup>1</sup>

*C. Beaudet, C. Clark, C. Niday, F. Ghigo,  
J. Ford, R. McCullough, W. Sizemore, P. Woody*

## Purpose and Scope

The fundamental goal of the Green Bank Interference Protection Group (IPG) is to provide the best possible access to the spectrum for Observers at Green Bank. Our general philosophy regarding this task has been set forth in a previous document, “The Green Bank Interference Protection Group: Charge, Practices, and Policies”. The tools we have at our disposal to accomplish this task are based on legal instruments as well as internal policies, which are variously applicable in different jurisdictions, or zones. In this document, we define five Zones of protection in which different policies for RFI mitigation apply. We also develop the internal policies applicable to Zones 1 and 2, which are on Observatory property. Defining and clarifying internal policies is important so that we can distinguish violations of policy from the variances due to the existence of two internal zones which are treated differently. The enforcement procedures for Zones 1 and 2 will be elaborated in a future document. The limits we voluntarily impose on Zones 1 and 2 are uniformly more strict than those applicable to Zones outside of Observatory property. Furthermore, we take a proactive approach to mitigation of all unintentional radiators in Zone 1 and for selective unintentional radiators in zone 2, whereas, outside of Observatory property, mitigation of unintentional radiators is interference driven. The policies applicable to Zones 3 and 4 have been defined by §37A-1 of the West Virginia code (the “Radio Astronomy Zoning Act”). In this paper, we define NRAO’s policy for exercising the provisions of this law. The policy applicable to Zone 5 was defined by the establishment of the National Radio Quiet Zone (NRQZ) in 1958 by the Federal Communications Commission (FCC) and the Interdepartmental Radio Advisory Committee (IRAC). The NRAO has followed consistent procedures for administering the NRQZ for many years; we will refer to this administrative process, but a detailed expansion is outside the scope of this document.

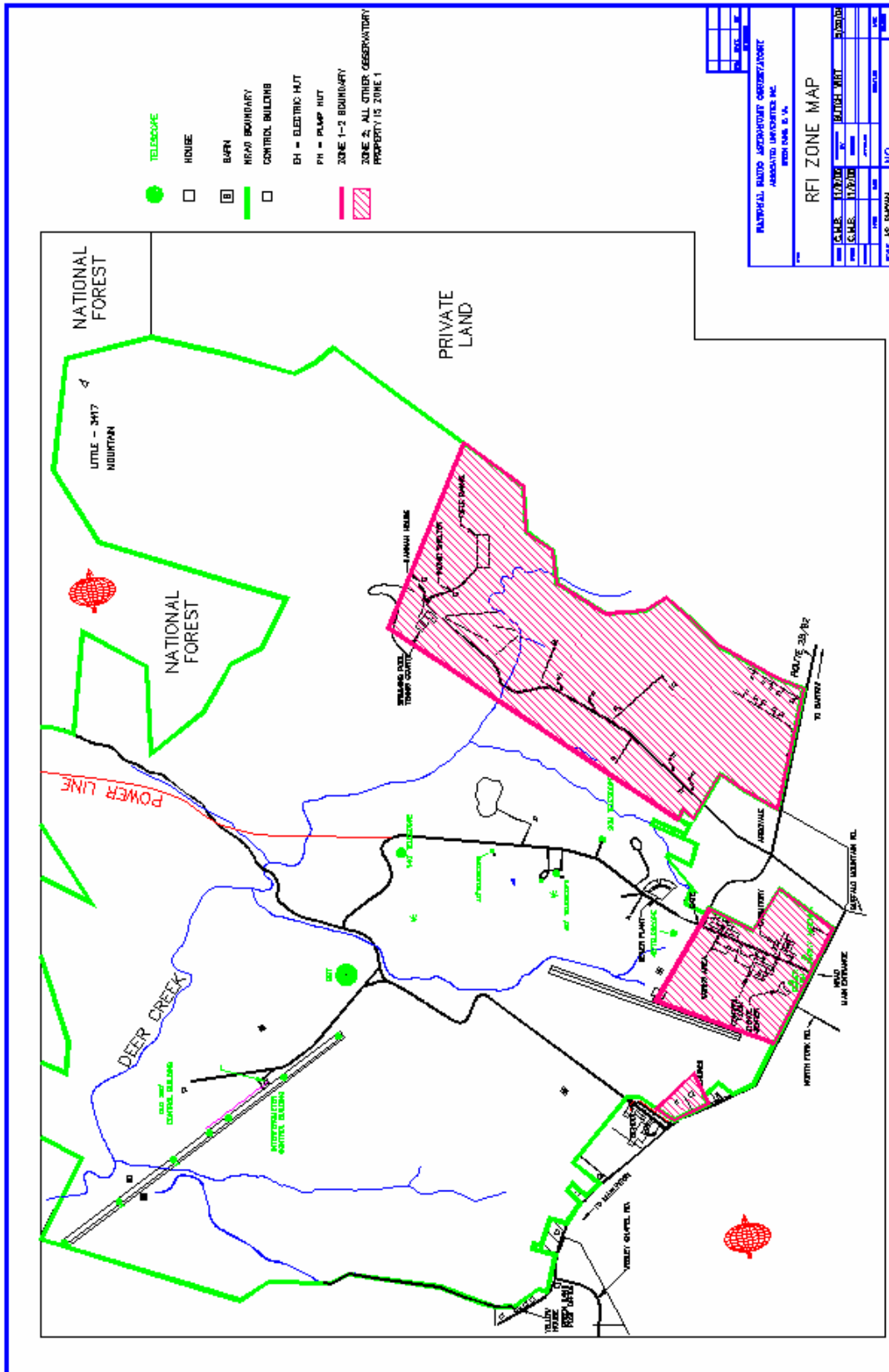
### Physical Descriptions of the Zones:

#### Zone 1: Radio Astronomical Instrument Zone

All National Radio Astronomy Observatory (Green Bank) property except that designated as Zone 2 on the map that follows.

#### Zone 2: On-Site, housing, visitor and laboratory areas

The housing, visitor and laboratory areas on the Green Bank Facility are defined as Zone 2, the red hatched areas designated by the map on the following page.



**Zone 3: 2-Mile Radius**

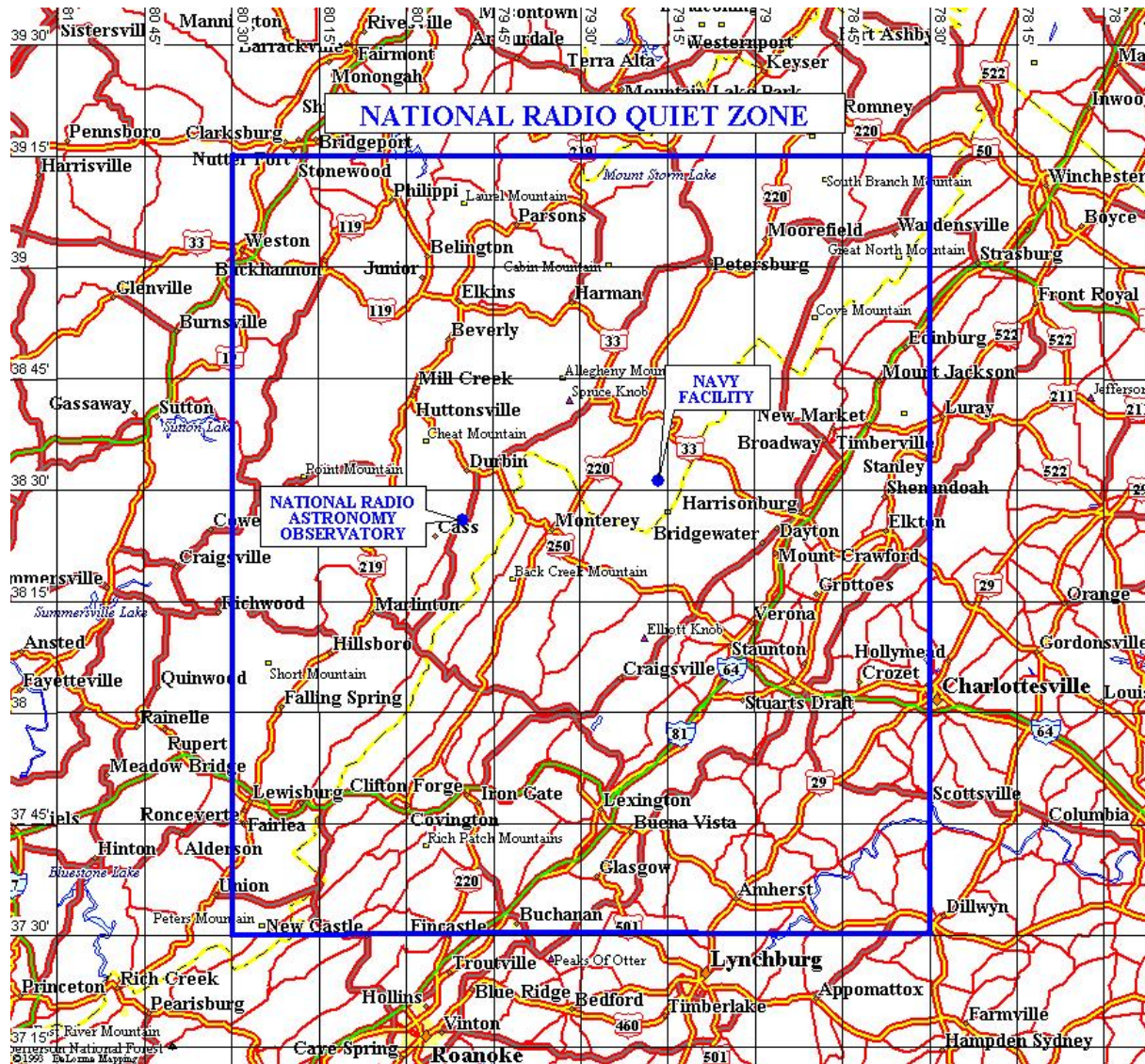
A circle of two miles radius drawn with the GBT pintle bearing as the center point.

**Zone 4: 10-Mile Radius**

A circle of ten miles radius drawn with the GBT pintle bearing as the center point.

**Zone 5: NRQZ**

The NRQZ, as defined by Section 1.924, Title 47 of the Code of Federal Regulations, is bounded by NAD-83 meridians of longitude at 78d 29m 59.0s W and 80d 29m 59.2s W and latitudes of 37d 30m 0.4s N and 39d 15m 0.4s N, and encloses a land area of approximately 13,000 square miles near the state border between Virginia and West Virginia, as illustrated on the following map:



## IPG Policy, Zone 1

### Applicable Rules/Enforcement Authority:

While the Site Director is the final authority in determining RFI suppression policy on site, the responsibility of developing and enforcing the policy has been delegated to members of the IPG. The general philosophy for interference mitigation in Zone 1 is a preventative, proactive approach; interference potential is assessed through testing, and equipment is shielded, filtered, etc. as necessary **before** installation. We do not install equipment first and then mitigate it if it happens to cause interference. At risk of stating the obvious, we note here that the equipment of visiting Scientists, Summer Students, and Educational groups is subject to the same restrictions as that of the permanent staff at the Green Bank site.

#### A) Intentional Radiators:

Intentional radiators are banned from this zone with the exception of those the IPG deems **essential** for the operation of the facility. A comprehensive list of those exceptions and their frequencies of operation is maintained by the IPG.

#### B) Unintentional Radiators:

1) **Installed Equipment:** Any and all electrical equipment installed in Zone 1 is subject to the limits set forth in J. R. Fisher's 1997 paper titled "RFI Radiation Limits in The Vicinity of GBT". These limits are consistent with the ITU-R RA.769 limits, which are used worldwide as a basis for protecting Radio Astronomy instruments from harmful RFI. The IPG will use the distance from the installed equipment to the focal point of the primary instrument on site (at this writing, that would be the GBT) in evaluating the allowable emissions. The limit is so strict that, in practice, other instruments on site are effectively protected as well. Procedural controls, that is, controls by which non-compliant equipment would be powered down during the operation of a RA instrument, are not to be used. This is because there are multiple RA instruments operating on site, and effectively, non-compliant equipment would not ever be able to be used.

#### 2) Non-installed equipment:

- a. **Automobiles:** Only diesel vehicles are permitted to drive on site due to the strong broadband emissions from spark plugs. It is acknowledged that modern diesel vehicles contain other non-compliant equipment, and as such they should not be used in zone 1 except for facility maintenance and educational purposes.
- b. **Test equipment:** Non-compliant, portable equipment used to evaluate RA instruments or RFI issues is permitted for the duration of the test. This equipment may not be left to operate unattended, however, and its use must be coordinated through Operations.

- c. Other portable equipment: All portable electronic equipment other than that used for testing and maintenance may not be operated in Zone 1.

## IPG Policy, Zone 2

### Applicable Rules/Enforcement Authority:

While the Site Director is the final authority in determining RFI suppression policy on site, the responsibility of developing and enforcing the policy has been delegated to members of the IPG. The general philosophy for interference mitigation in Zone 2 is a risk assessment approach, balanced by practical concerns, unlike the blanket compliance requirements for zone 1. While the same limit applies for interference assessment, the preventative, proactive mitigation approach is reserved for equipment that would be difficult to power off in the event that it is identified as an actual interference source, or equipment whose emissions are very strong and therefore likely to interfere.

#### A) Intentional Radiators:

Intentional radiators are banned from this zone with the exception of those the IPG deems **essential** for the operation of the facility, and those specifically coordinated with the NRQZ administrator. Included in the list of banned intentional radiators are wireless LAN devices and cordless telephones. A comprehensive list of the exceptions and their frequencies of operation is maintained by the IPG.

#### B) Unintentional Radiators:

##### 1) Installed Equipment: In Zone 2, installed equipment falls into three categories:

###### a. Equipment that runs continuously

Equipment that runs continuously includes equipment that is vital to the operation of the facility, for example, equipment responsible for the climate control of the buildings, security equipment, etc. This category also includes equipment used to operate and take data from the RA instruments, the LAN equipment, plus any other equipment that is intentionally, or in practice, left running continuously. Personal computers are not included in this category; see (c). This category of electrical equipment is subject to the same limits as equipment in Zone 1, and must be contained in a filtered, shielded enclosure which provides sufficient attenuation of its emissions to bring it into compliance with these limits.

###### b. High-Risk Equipment

Equipment that is not run continuously but has very strong emissions and/or a long duty cycle must be contained in a filtered, shielded enclosure which provides sufficient attenuation of its emissions to bring it into compliance with the Zone 1 limits. Microwave Ovens are one example in this category.

c. Equipment that is powered down when not in use

This category includes non-compliant equipment that is operated on a temporary basis and not left running while not in use. Since the emissions of a typical PC located in the Jansky Laboratory exceed the limit at the GBT, it is part of this policy that the staff of NRAO Green Bank must power down their PC's and other office equipment on a daily basis when they leave work. This practice provides a lower-risk window for observations in the evening hours.

2) Non-installed equipment:

Automobiles, and portable unintentional radiators are not regulated in Zone 2, except by the regulations of Zone 3.

### IPG Policy, Zone 3

#### Applicable Rules/Enforcement Authority:

The limits set forth in §37A-1-2 of the West Virginia Code (The Radio Astronomy Zoning Act; Restrictions - Within two miles of the facility), apply in Zone 3. Let it be noted that these restrictions also apply in zones 1 and 2. While it is the responsibility of NRAO to initiate enforcement of these rules in the procedure set forth in this document under "IPG Policy, Zone 3", according to §37A-1-6, the Pocahontas County Prosecuting Attorney, or the WV State Attorney General is the enforcement authority responsible for levying the fines described in §37A-1-5.

The IPG may engage in a public education campaign to raise awareness of local RFI issues using brochures, informational spots in the local paper, discussions/ interviews on the local radio station, etc. The purpose of this campaign is to heighten local awareness of the value of the work done at the Observatory, and its vulnerability to RFI, as well as a reminder of our obligation to mitigate local interference. We believe that a heightened awareness will facilitate voluntary cooperation.

Enforcement must be driven by "interference to observations" according to the Act, so enforcement should proceed as follows:

- 1) Document the interference in Radio Astronomy data; with time, date and (sky) frequency information.
- 2) Locate source of interference
  - a. In certain cases (WIFI example) several sources may be producing interference on the same frequency. In order to get quiet spectra, ALL sources must be located and quieted.
- 3) Visit personally with owner of offending equipment and deliver the "please cooperate" letter. The letter shall state:
  - a. How the interference harms us
  - b. Our legal authority for requesting that the equipment be turned off
  - c. What we are/aren't willing to do to help them comply.



- d. What further action will be taken if they don't comply
- 4) Contact the county prosecuting attorney if they don't comply. Prosecuting attorney can provide "injunctive relief" as described in §37A-1-6.

#### IPG Policy, Zone 4

##### Applicable Rules/Enforcement Authority:

The limits set forth in §37A-1-3 of the West Virginia Code (The Radio Astronomy Zoning Act; Restrictions - Within ten miles of the facility), apply in Zone 4. While it is the responsibility of NRAO to initiate enforcement of these rules in the procedure set forth in this document under "IPG Policy, Zone 4", according to §37A-1-6, the Pocahontas County Prosecuting Attorney, or the WV State Attorney General is the enforcement authority responsible for levying the fines described in §37A-1-5.

The IPG policy for enforcement in Zone 4 is the same as for Zone 3, however, instead of adhering to the (stricter) limit set forth in §37A-1-3, we will enforce the more lenient NRQZ limit; experience has shown that the NRQZ limit has been effective in protecting our observations.

#### IPG Policy, Zone 5 (The National Radio Quiet Zone)

##### Applicable Rules/Enforcement Authority:

The National Radio Quiet Zone (NRQZ) was established by the Federal Communications Commission (FCC) in Docket No. 11745 (November 19, 1958) and by the Interdepartmental Radio Advisory Committee (IRAC) in Document 3867/2 (March 26, 1958) to minimize possible harmful interference to the National Radio Astronomy Observatory (NRAO) in Green Bank, WV and the radio receiving facilities for the United States Navy in Sugar Grove, WV. The administration of the NRQZ is the responsibility of the NRQZ Administrator at NRAO Green Bank. The FCC is the enforcement authority in the event of a violation of the rules.

Policies related to NRQZ management are at the discretion of the NRQZ Administrator at NRAO Green Bank.

Accepted and Agreed:

	Title	Date
Carla M. Beaudet _____	Head, Radio Frequency Interference Group	_____
Paulette W. Woody _____	NRQZ Administrator	_____
Roger D. Norrod _____	Head, Electronics Division	_____
Richard M. Prestage _____	Director, NRAO Green Bank Site	_____

Original Document Date: 11/15/05

<sup>1</sup> Rev. 1: 1/24/06: Changed zone 2 boundary to include the area up to the intersection of the airstrip and the airstrip access road, and bounded by those two features.