608-614 MHz

1. Band Introduction

The 608-614 MHz band a shared band with allocations to the Federal Government for the radio astronomy service and the land mobile limited to (medical telemetry and medical telecommand) service on a primary basis. As specified in footnote US 246, no stations are authorized to transmit in the 608-614 MHz band except for medical telemetry equipment.

2. Allocations

2a. Allocation Table

The frequency allocation table shown below is extracted from the Manual of Regulations & Procedures for Federal Radio Frequency Management, Chapter 4 – Allocations, Allotments and Plans.

Table of Frequency Allocations

United States Table

Federal Table	Non-Federal Table	FCC Rule Part(s)
608-614 LAND MOBILE (medical telemetry and medical telecommand) RADIO ASTRONOMY US74 US246		Personal (95)

2b. Additional Allocation Table Information

US74 In the bands 25.55-25.67, 73.0-74.6, 406.1-410.0, 608-614, 1400-1427 (see US368), 1660.5-1670.0, 2690-2700, and 4990-5000 MHz, and in the bands 10.68-10.7, 15.35-15.4, 23.6-24.0, 31.3-31.5, 86-92, 100-102, 109.5-111.8, 114.25-116, 148.5-151.5, 164-167, 200-209, and 250-252 GHz, the radio astronomy service shall be protected from unwanted emissions only to the extent that such radiation exceeds the level which would be present if the offending station were operating in compliance with the technical standards or criteria applicable to the service in which it operates. Radio astronomy observations in these bands are performed at the locations listed in US311.

US246 No station shall be authorized to transmit in the following bands:

73-74.6 MHz,
608-614 MHz, except for medical telemetry equipment,1
1400-1427 MHz,
1660.5-1668.4 MHz,
2690-2700 MHz,
4990-5000 MHz,
10.68-10.7 GHz,
15.35-15.4 GHz,
23.6-24 GHz,
31.3-31.8 GHz,
50.2-50.4 GHz,
52.6-54.25 GHz,
86-92 GHz,
100-102 GHz,
109.5-111.8 GHz,
114.25-116 GHz,
148.5-151.5 GHz,
164-167 GHz,
182-185 GHz,
190-191.8 GHz,
200-209 GHz,
226-231.5 GHz,
250-252 GHz.

1 Medical telemetry equipment shall not cause harmful interference to radio astronomy operations in the band 608-614 MHz and shall be coordinated under the requirements found in 47 CFR. 95.1119.

3. Federal Agency Use

3a. Federal Agency Frequency Assignments Table

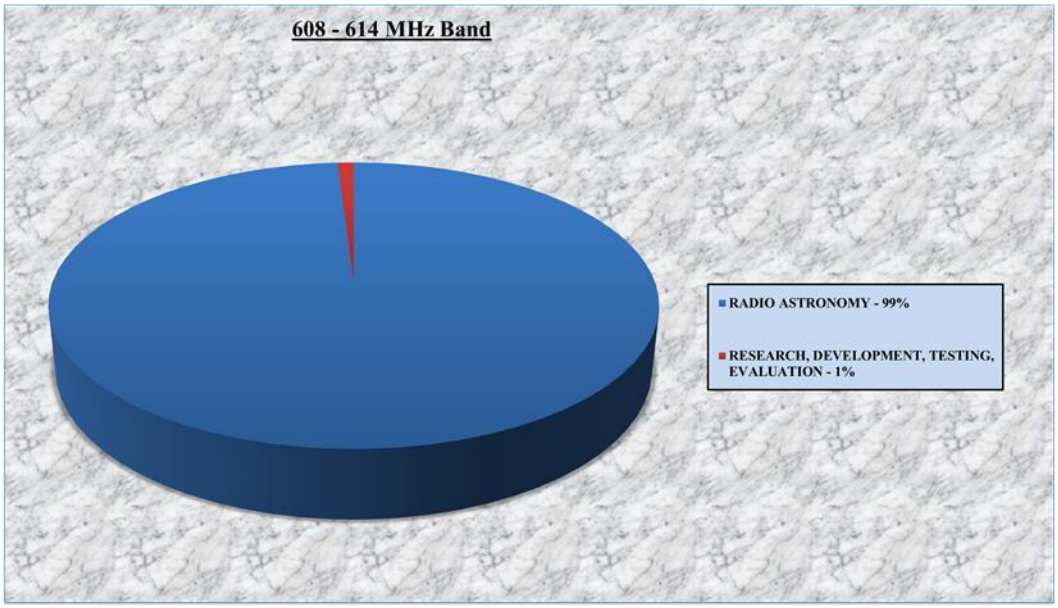
The following table identifies the frequency band, types of allocations, types of applications, and the number of frequency assignments by agency. [1]

Federal Frequency Assignment Table

608-614 MHz Band							
SHARED BAND							
	LAND MOBILE (medical telemetry and medical telecommand) RADIO ASTRONOMY						
	TYPE OF APPLICATION						
	RADIO ASTRONOMY					RESEARCH, DEVELOPMENT, TESTING EVALUATION	TOTAL
AF	2					1	3
NASA	2						2
TOTAL	4					1	5
The number of actual systems, or number of equipments, may exceed and sometimes far exceed, the number of frequency assignments in a band. Also, a frequency assignment may represent, a local, state, regional or nationwide authorization. Therefore, care must be taken in evaluating bands stgrictly on the basis of assignment counts or percentages of assignments.							

[1] Passive use does not require authorization. Therefore, assignment counts in passive bands may not represent accurately the use.

3b. Percentage of Frequency Assignments Chart



4. Frequency Band Analysis By Application

4a. Radio Astronomy Service

Radio astronomy is defined as astronomy based on the reception of radio waves of cosmic origin.[1] The service is unique in that it involves only passive systems. Since the signals received emanate from natural sources, radio astronomers have no control over the power, the frequency, or other characteristics of the emissions. The spectrum used is based on physical phenomena rather than expected growth, as is the case for most other radio services. Using terrestrial radio telescopes, radio astronomers can observe cosmic phenomena at frequencies ranging from 15 MHz to over 800 GHz. To meet the needs of radio astronomy, frequencies at regular intervals across this range must be protected from interference in the vicinity of the radio astronomy observatories. The basic plan of spectrum management for radio astronomy is to protect small bands across the range for continuum observations, while choosing those bands so they contain the spectral lines of greatest scientific interest.[2] Radio astronomy has contributed much to the science of

[1] NTIA Manual §6.1.1 at 6-12.

[2] The preferred frequency bands for continuum and spectral line observations are specified in International Telecommunication Union-Radiocommunication Sector Recommendation RA.314-10.

astronomy and has produced numerous technical innovations that have benefitted radiocommunications and humankind in general. It has provided information on the atmospheric absorption of radio waves, important in the area of telecommunications and communications technology.[3]

The 608-614 MHz band is used to perform continuum observations employing Very Long Baseline Interferometry (VLBI) techniques.[4] The observations in the 608-614 MHz band are performed using the Very Long Baseline Array (VLBA) a system of ten radio telescopes controlled remotely from the Array Operations Center in Socorro, New Mexico by the National Radio Astronomy Observatory. The array works together as the world's largest dedicated, full-time astronomical instrument using the technique of VLBI. Data from the VLBA antennas are combined, synthesizing a single telescope 5000 miles in diameter. The measurements performed in the 608-614 MHz band are essential for understanding the long-term contribution of changing solar activity to global climate change on the Earth.

Federal and university radio astronomy research activities are interrelated and complementary. A list of the radio astronomy facilities that perform observations in the 608-614 MHz band are provided in Table 1. Sites associated with the VLBA are noted.

Facility	Latitude	Longitude
Arecibo, PR	18-20-38 N	66-45-09 W
Socorro, NM	34-04-43 N	107-37-04 W
Green Bank, WV	38-25-59 N	79-50-23 W
Pie Town, NM (VLBA)	34-18-00 N	108-07-00 W
Kitt Peak, AZ (VLBA)	31-57-00 N	111-37-00 W
Los Alamos, NM (VLBA)	35-47-00 N	106-15-00 W
Fort Davis, TX (VLBA)	30-38-00 N	103-57-00 W
North Liberty, IA (VLBA)	41-46-00 N	91-34-00 W
Brewster, WA (VLBA)	48-08-00 N	119-41-00 W
Owens Valley, CA (VLBA)	37-14-00 N	118-17-00 W
Saint Croix, VI (VLBA)	17-46-00 N	64-35-00 W
Mauna Kea, HI (VLBA)	19-49-00 N	155-28-00 W
Hancock, NH (VLBA)	42-56-00 N	71-59-00 W

[3] An overview of applications of astronomical techniques and devices that benefit the public is contained in National Telecommunications and Information Administration, NTIA Report 99-35, *Radio Astronomy Spectrum Planning Options* (April 1998) at Appendix B.

[4] VLBI is a type of astronomical interferometry used in radio astronomy to allows observations of an object that are made simultaneously by many telescopes to be combined, emulating a telescope with a size equal to the maximum separation between the telescopes.

Table 1.

Radio astronomers employ radio telescopes, highly sensitive receivers with large, high-gain antennas, to detect the weak signals from space. Because the desired signals are so weak and the receivers are so sensitive, radio telescopes are highly susceptible to interference.[5] A typical radio astronomy telescope receives only about one-trillionth of a watt even from the strongest cosmic source. Radio astronomers can only control the electromagnetic signal environment at the receiver and this creates a potential incompatibility with other spectrum users. Radio observatories are usually built in remote locations with surrounding terrain that provides natural shielding from interference sources. Nonetheless, effective spectrum management is critical to protect the radio telescopes from harmful interference. Sources of potential interference are spurious, harmonic, and adjacent band emissions from satellite and airborne transmitters, and aggregate interference from licensed and unlicensed ground-based transmitters. Spectrum contours for the facilities shown in Table 1 can be computed based on the maximum permissible interference level necessary to protect radio astronomy service receivers. The maximum permissible interference level necessary to protect a radio astronomy service receiver is specified in an International Telecommunication Union recommendation.[6] The spectrum contours are computed using a 0 dBi gain for the radio astronomy receive antenna[7]; a maximum allowable equivalent isotropically radiated power level of 10 dBW/MHz for a ground-based transmitter;[8] and a terrain dependent propagation model.[9] The statistical and environmental parameters used with the terrain profile in calculating the propagation loss are shown in Table 2.

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[5] The receivers used by radio astronomers can detect signals that are typically 60 dB below thermal noise, whereas the signal levels for normal radiocommunication systems are typically 20 dB above thermal noise.

[6] Recommendation ITU-R RA.769-1, *Protection Criteria Used For Radioastronomical Measurements* (1995).

[7] Recommendation ITU-R RA.1031-1, *Protection of the Radioastronomy Service in Frequency Bands Shared with Other Services*.

[8] This equivalent isotropically radiated power level is consistent with levels permitted for mobile systems used in the Advanced Wireless Systems service, Personal Communications Service, and Cellular service.

[9] The propagation loss for the spectrum contours are computed using the Irregular Terrain Model in the point-to-point mode and three second U.S. Geological Survey topographic data. A detailed description of the Irregular Terrain Model is available at http://flattop.its.bldrdoc.gov/itm.html.

Parameter	Value
Refractivity	301 N-units
Conductivity	0.005 S/M
Permittivity	15
Humidity	10
Reliability	50 percent
Confidence	50 percent
Radio Climate	Continental Temperate
Antenna Polarization	Vertical
Transmit Antenna Height	3 meters
Receive Antenna Height	Extracted from Terrain Database

Table 2.

The radio astronomy facility latitude and longitude in Table 1 represents the center point for the contour.

The spectrum contours for the radio astronomy facilities performing observations in the 608-614 MHz band are shown in Figures 1 through 8.

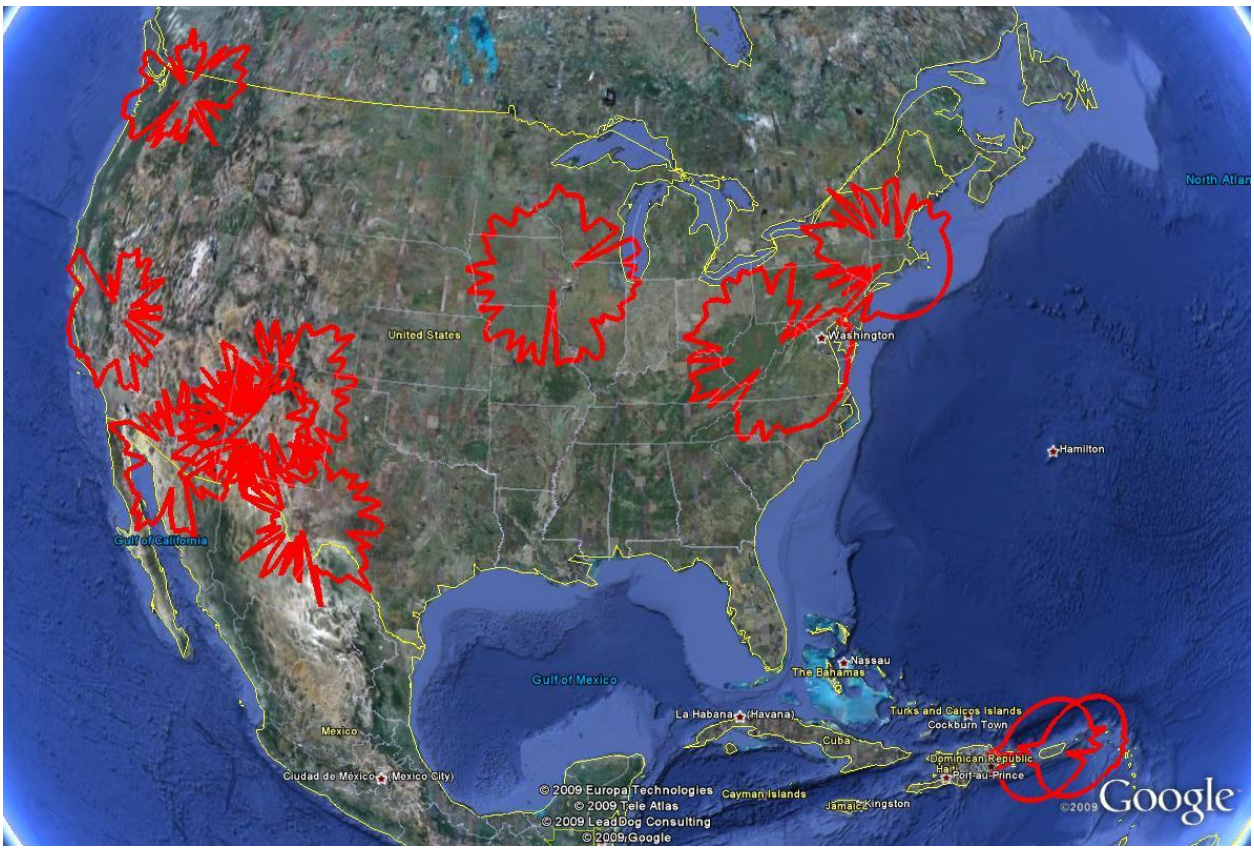


Figure 1.

608-614 MHz
Radio Astronomy Spectrum Contours

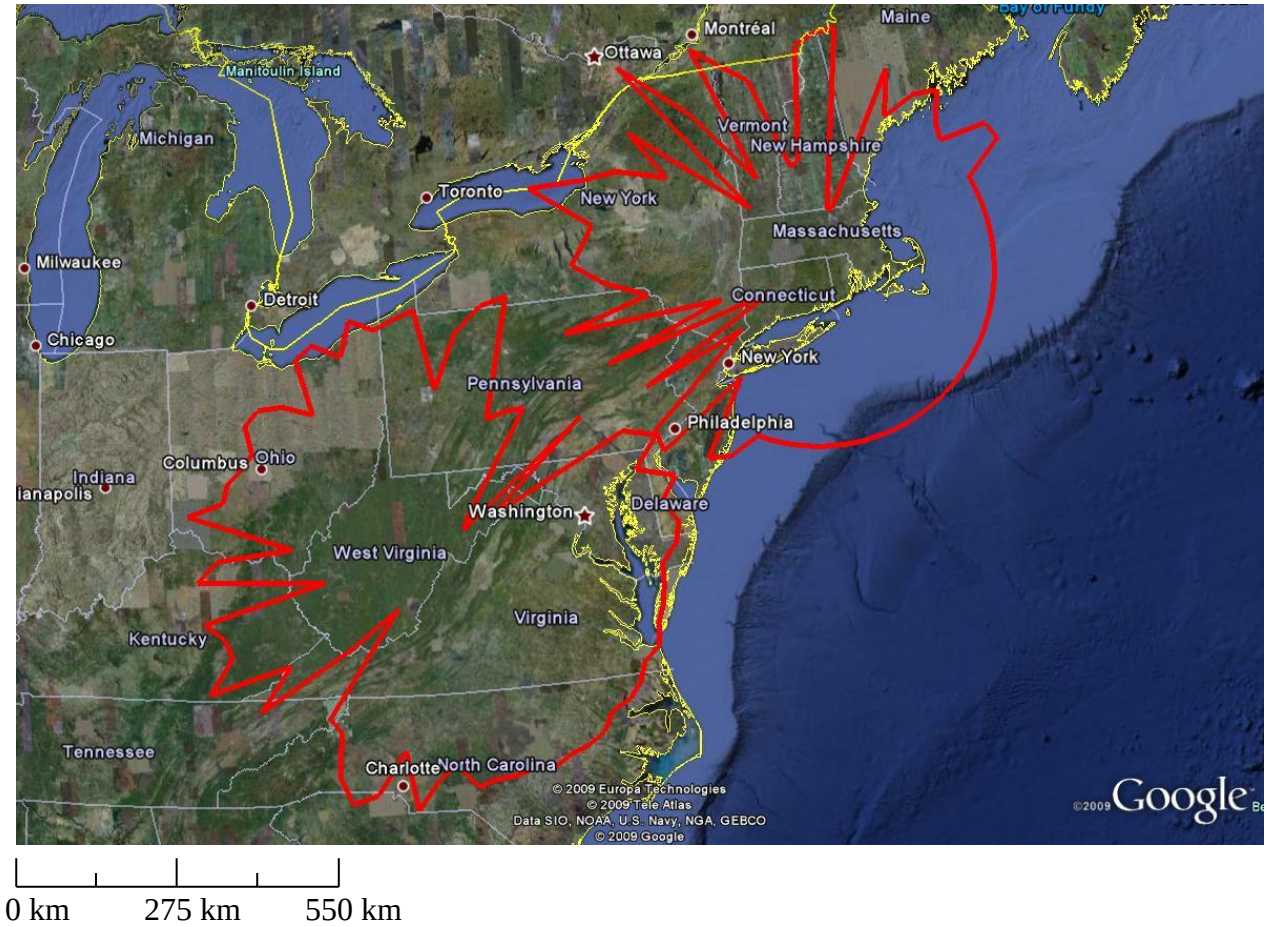


Figure 2.

Hancock, NH and Green Bank, WV
608-614 MHz
Radio Astronomy Spectrum Contours

Figure 3.

North Liberty, IA
608-614 MHz
Radio Astronomy Spectrum Contour

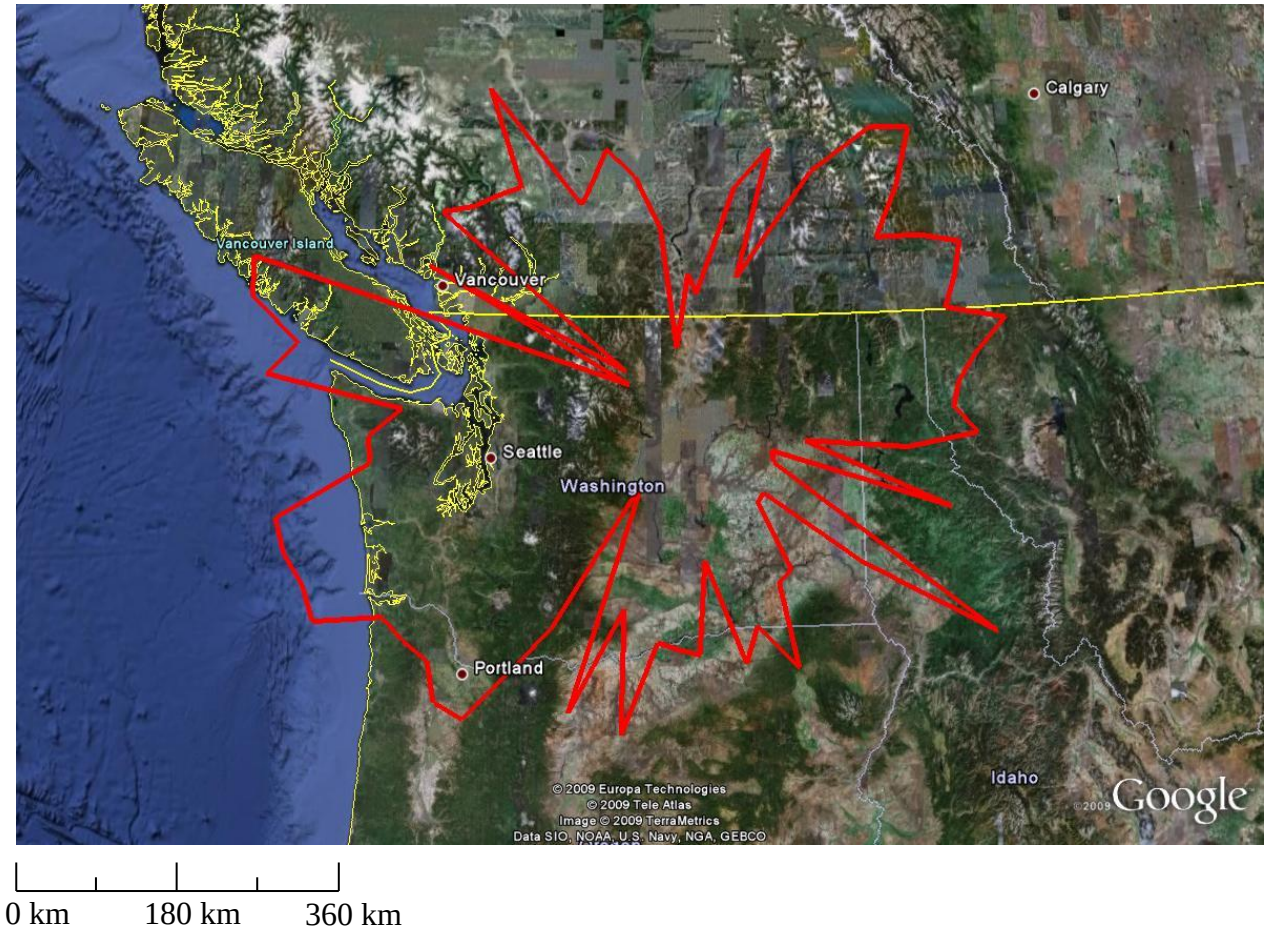


Figure 4.

Brewster, WA
608-614 MHz
Radio Astronomy Spectrum Contour

Figure 5.

Owens Valley, CA
608-614 MHz
Radio Astronomy Spectrum Contour

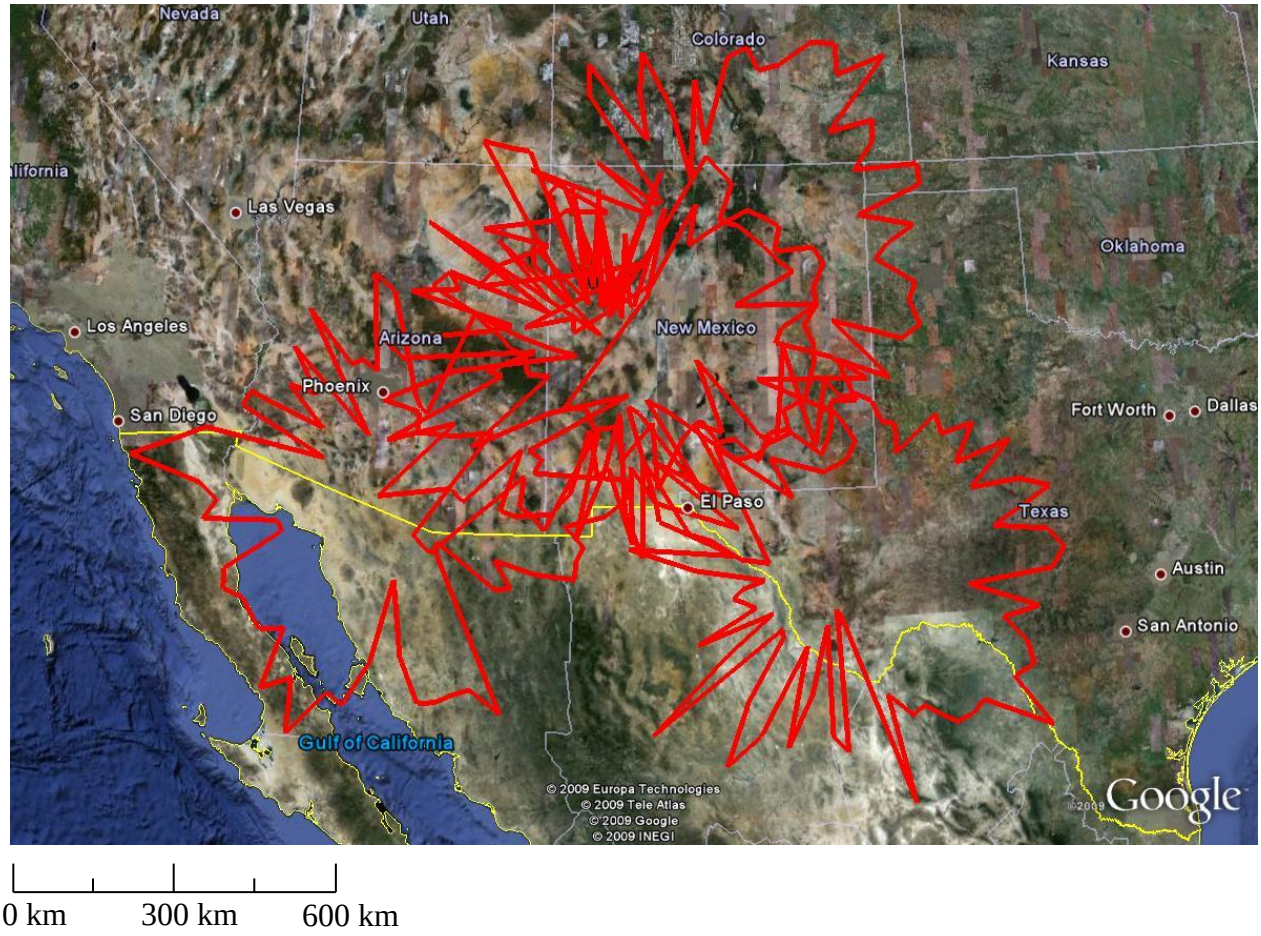


Figure 6.

Kitt Peak, AZ, Pie Town, NM, Socorro Los Alamos, NM, and Fort Davis, TX
608-614 MHz
Radio Astronomy Spectrum Contours

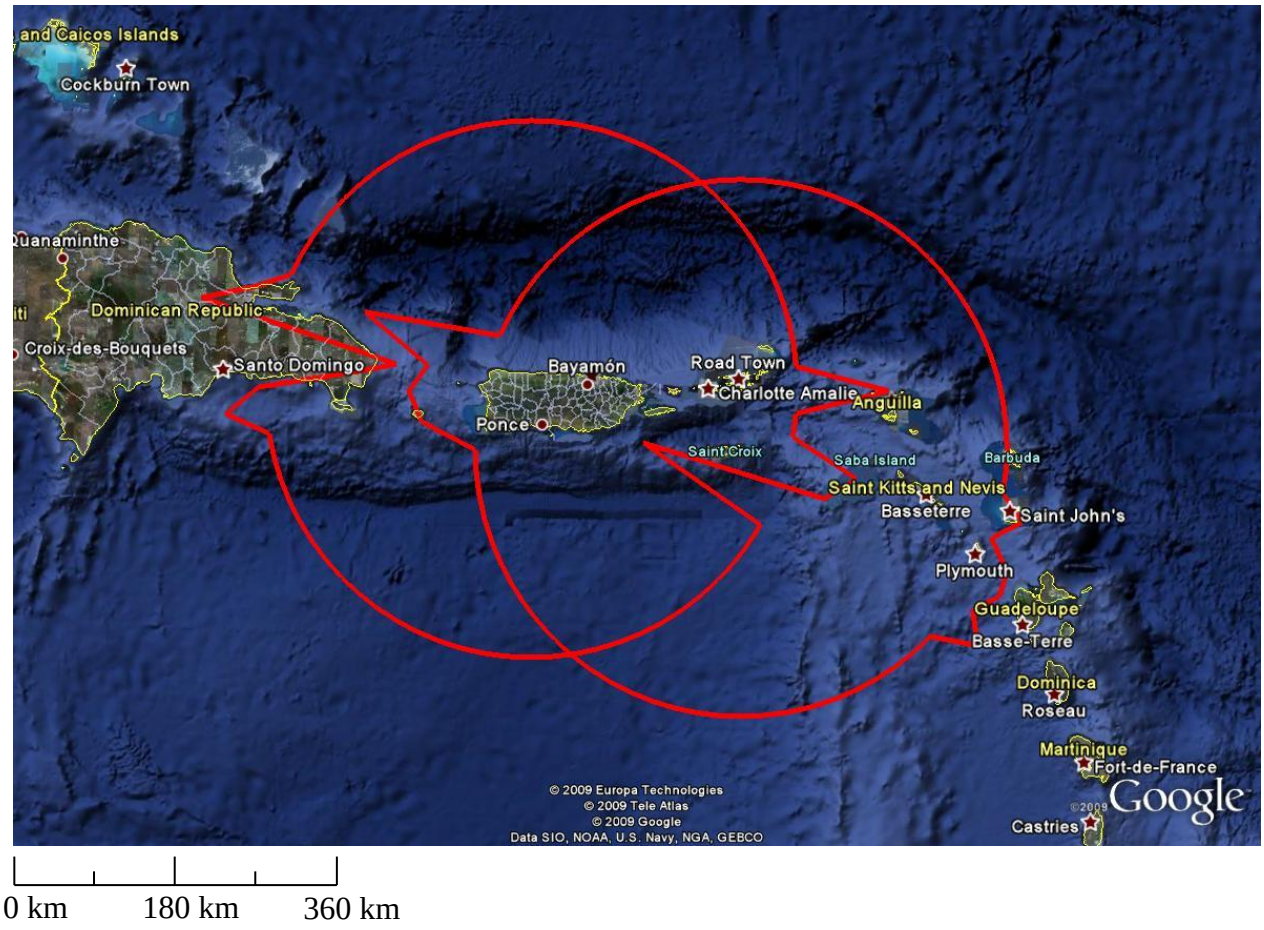
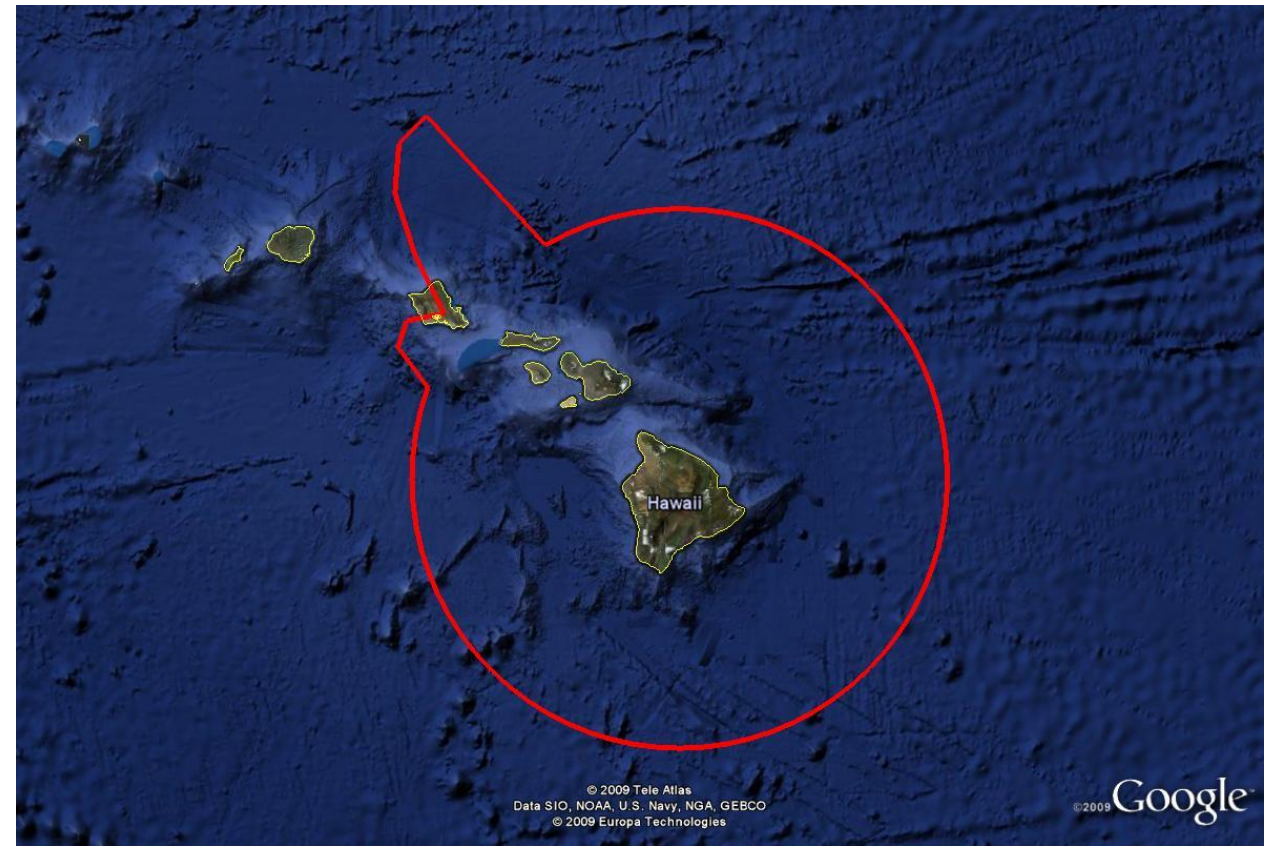


Figure 7.

Arecibo, PR and Saint Croix, VI
608-614 MHz
Radio Astronomy Spectrum Contours



0 km 180 km 360 km

Figure 8.

Mauna Kea, HI
608-614 MHz
Radio Astronomy Spectrum Contour

4b. Land Mobile (Medical Telemetry and Medical Telecommand) Service

In June of 2000, the Federal Communications Commission (FCC) established the Wireless Medical Telemetry Service (WMTS).[10] In doing so, the FCC designated the 608-614 MHz, 1395-1400 MHz, 1427-1429.5 MHz bands to be used for medical telemetry. Medical telemetry equipment is used in hospitals and health care facilities to monitor a patient's electrocardiograms and other physiologic parameters, such as hemoglobin oxygen saturation and blood pressure, and transmit this information via radio frequency signal to a central station display and/or to a bedside receiver for monitoring and analysis by clinical personnel.

Medical telemetry equipment operating in the 608-614 MHz band is authorized under Part 95 of the FCC rules.[11] The FCC designated the American Society for Healthcare Engineering (ASHE) as the manager of WMTS frequencies. The FCC rules governing the use of the 608-614 MHz band mandates that parties deploying telemetry systems must first register the specific deployments with and obtain authorization from ASHE. Operation of medical telemetry equipment in the 608-614 MHz band must not cause interference to sensitive radio astronomy operations, and users are required to coordinate their operation with the facilities shown in Table 2.[12]

The primary Federal users of medical telemetry equipment are the military and the Department of Veterans Affairs (VA). The VA has more than 1300 facilities throughout the contiguous United States, Alaska, Hawaii, Philippines, Guam, American Samoa, Puerto Rico, and the Virgin Islands. These locations include Veterans Health Administration Medical Centers, Outpatient Clinics, Community Based Outpatient

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[10] *See Report and Order* in ET Docket No. 99-255 and PR Docket No. 92-235 (Amendment of Parts 2 and 95 of the Commission's Rules to Create a Wireless Medical Telemetry Service), 15 FCC Rcd 11206 (2000).

[11] *See* 47 C.F.R. Part 95 Personal Radio Services.

[12] *See* footnote US 246 to the Table of Allocations.

Clinics, and Veteran Centers.[13] The VA is in the process of transitioning medical telemetry equipment from the unprotected 450-470 MHz band to the 608-614 MHz band.[14] VA is currently not using the 1395-1400 MHz and 1427-1429.5 MHz bands because equipment is not available.

Section 7.5.9 of the Manual of Regulations and Procedures for Federal Radio Frequency Management provides guidance to Federal agencies operating medical telemetry devices operating in the 608-614 MHz band pursuant to the FCC rules.

Medical telemetry equipment operating in the 608-614 MHz band are licensed by rule and do not require an assignment in the Government Master File.

5. Planned Use

Radio astronomy attaches considerable importance to maintaining an allocation in the 608-614 MHz band since without it, there would be a large gap between the 410 MHz and 1400 MHz allocations, in one of the most interesting parts of the spectrum. This band is of special value for worldwide VLBI observations. The allocation for radio astronomy will be needed indefinitely.

The allocation for the WMTS is expected to be needed indefinitely.

[13] Locations of VA facilities can be found at http://www2.va.gov/directory/guide/home.asp?isFlash=1.

[14] Department of Veterans Affairs, *Update of the Veterans Affairs Strategic Spectrum Plan* (January 2008), available at http://www.ntia.doc.gov/osmhome/spectrumreform/2007_Agency_Plans.html.