

## 2290-2300 MHz

### 1. Band Introduction

The operations in the 2290-2300 MHz band consist of deep-space, mobile, and fixed point-to-point microwave radio relay communications. This band is essential to the National Aeronautics and Space Administration (NASA) for communications on various deep space missions for the exploration of the solar system and the universe. Other uses of the band are military research, law enforcement video surveillance, control of robotic systems for explosive ordnance neutralization and disposal, and the testing of robotic ground vehicles.

### 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*

<b>Federal Table</b>	<b>Non-Federal Table</b>	<b>FCC Rule Part(s)</b>
2290-2300 FIXED MOBILE except aeronautical mobile SPACE RESEARCH (deep space) (space-to-Earth)	2290-2300 SPACE RESEARCH (deep space) (space-to-Earth)	

#### 2b. Additional Allocation Table Information

*There is no additional information for this band.*

**3. Federal Agency Use:**

**3a. Federal Agency Frequency Assignments Table:**

The following table identifies the frequency band, type(s) of allocation(s), types of application, and the number of frequency assignments by agency.

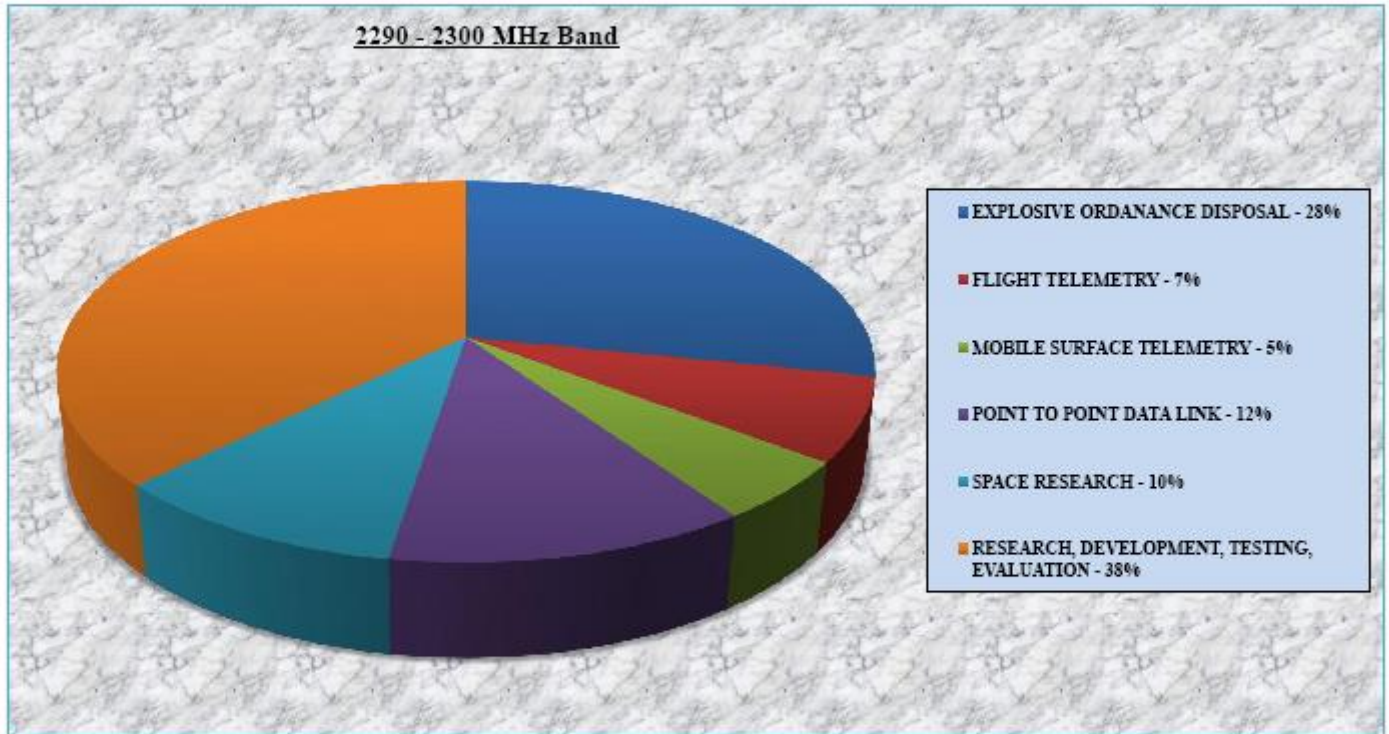
*Federal Frequency Assignment Table*

2290 - 2300 MHz Band							
SHARED BAND							
AGENCY	FIXED MOBILE (except aeronautical mobile) SPACE RESEARCH (deep space) (space-to-Earth)						
	EXPLOSIVE ORDNANCE DISPOSAL	FLIGHT TELEMETRY	MOBILE SURFACE TELEMETRY	POINT TO POINT DATA LINK	SPACE RESEARCH	RESEARCH DEVELOPMENT TESTING EVALUATION	TOTAL
AF	16					8	24
AR			1			1	2
DHS				2			2
DOE				1		1	2
DOJ				1			1
N		1					1
NASA		2			6		8
<b>TOTAL</b>	<b>16</b>	<b>4</b>	<b>1</b>	<b>4</b>	<b>6</b>	<b>10</b>	<b>40</b>

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 strictly on the basis of assignment counts or percentages of assignments.

### 3b. Percentage of Frequency Assignments Chart

The following chart displays the percentage of frequency assignments for the systems operating in the frequency band 2290-2300 MHz.

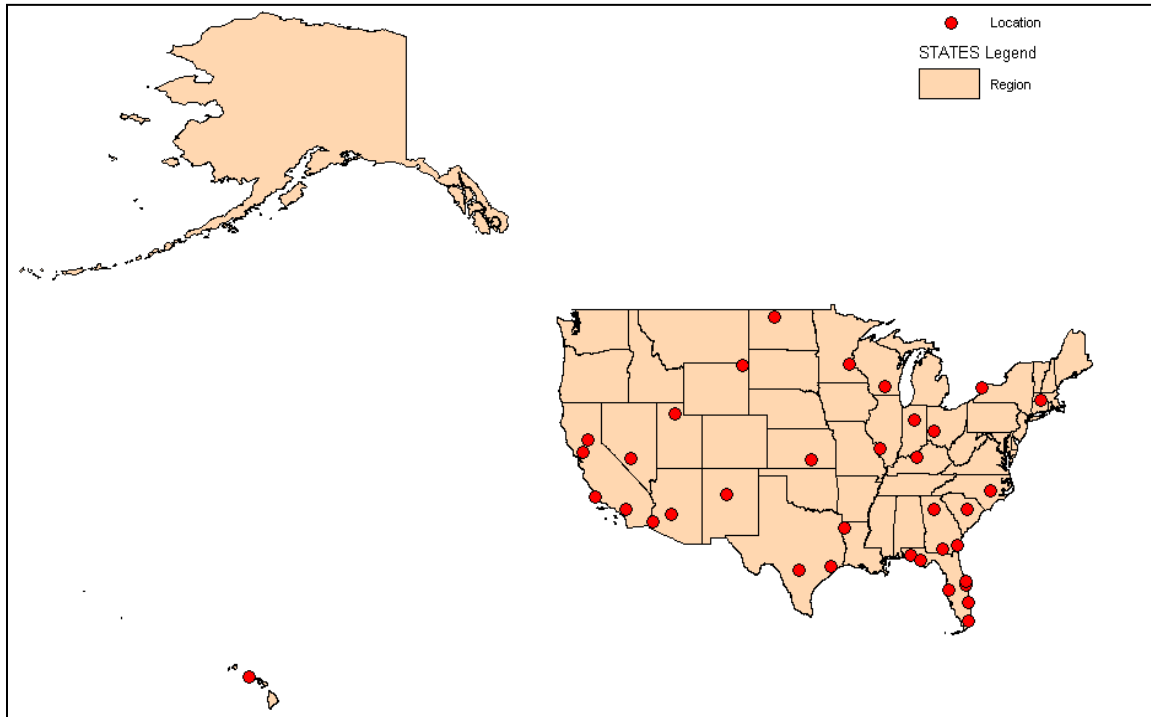


### 4. Frequency Band Analysis by Application

## 2290-2300 MHz

The 2290-2300 MHz band is used by federal agencies for deep-space communications, and mobile and fixed point-to-point microwave radio-relay communications.

Figure 1 presents the geographic locations of the federal assignments in the United States.



*Figure 1. Federal Government Usage in the 2290-2300 MHz Band in the United States*

### 4a. Deep-Space Communications

NASA operates the Deep-Space Network (DSN) in this band. The DSN is an international network of extremely sensitive low-noise receivers and very large parabolic-reflector antennas used for deep-space, interplanetary spacecraft missions; and radio and radar astronomy observations for the exploration of the solar system and the universe. The DSN is used to support scientific-exploration spacecraft whose missions are beyond 1-million miles from Earth, such as missions operating on or around other planets. The DSN system is extremely sensitive and is capable of tracking and receiving data from spacecraft travelling more than 10 billion miles from Earth.<sup>2</sup> The DSN also supports selected Earth-orbiting missions.

<sup>2</sup> See the NASA DSN website at: <http://deepspace.jpl.nasa.gov/dsn/antennas/index.html>

The DSN currently consists of three deep-space communications facilities placed approximately 120 degrees apart around the world: at Goldstone, CA; near Madrid, Spain; and near Canberra, Australia. The strategic placement permits constant observation of spacecraft as the Earth rotates, and makes the DSN the largest and most sensitive scientific telecommunications system in the world. The DSN sites use the following types of antennas with the sensitive receivers.<sup>3</sup>

- One 34-meter (111-foot) diameter high-efficiency antenna
- One 34-meter beam-waveguide antenna  
(Three at the Goldstone complex and two in Madrid)
- One 26-meter (85-foot) antenna
- One 70-meter (230-foot) antenna

The receivers, antennas, and data acquisition communications systems make it possible to: 1) gather scientific data of the solar system including other planets, moons, asteroids, comets, etc.; 2) acquire operational telemetry data from spacecraft at distances of many millions of miles; 3) track spacecraft position and velocity; 4) perform very-long-baseline interferometry observations; 5) measure variations in radio waves for radio science experiments; and 6) monitor and control the performance of the network.

Among other systems, NASA uses the DSN system in this band for scientific data collection and tracking of the: 1) Cassini-Huygens spacecraft that is exploring Saturn and its moons; 2) deep space probes Voyager 1 (Jupiter and beyond), Voyager 2 (Jupiter, Saturn, and beyond); Pioneer; and the Curiosity Mars spacecraft. NASA also provides data-collection support in the band to the European Space Agency on their deep-space Mars Express spacecraft and the Rosetta spacecraft projects.

Figure 2 is a photo of the 230-foot diameter antenna at Goldstone, CA. The sensitive site is located in a remote desert area to preclude interference from other signals and from electrical noise.

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<sup>3</sup> Ibid.



*Figure 2. 230-Foot Diameter Antenna at Goldstone, CA<sup>4</sup>*

#### **4b. Fixed Services**

The military services and Federal law-enforcement agencies use this band for point-to-point microwave communications systems including video surveillance systems. Furthermore, fixed-site communications systems are used by the military services to interconnect telephone switching networks to support joint-agency network operations. The Army has 18 fixed frequency assignments for Multiple Subscriber Equipment (MSE) at 18 locations in the United States.

#### **4c. Mobile Service**

The mobile operations, limited in this band to ground-based systems by the national allocation table, are used mainly for the military Explosives Ordnance Disposal (EOD) projects at specific test and training sites to support testing/operations of unmanned ground vehicles (UGV) via mobile robotic systems. The UGVs are used for neutralizing

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<sup>4</sup> Ibid.

explosive devices and other safety and emergency activities. The frequencies in this band are used to support command and control data for testing or operations EOD units.

NASA has 5 space operation frequency assignments using TDRSS return link pre-launch operations and remote linked simulations/verifications operations.

## **5. Planned Use**

Over the near term of less than five years, the federal government use as described herein is expected to remain nearly the same. Deep space probes and spacecraft frequently have useful operational lifetimes of over 20 years, so the use of the 2290-2300 MHz band will be necessary over the long term. Some increases in law enforcement surveillance activities may occur in 5-10 years if such activities are relocated to this band from bands if the other bands are reallocated to non-Federal Advanced Wireless Services (AWS).