

## 60 GHz Experimental License Application

### 1 Company Introduction

Qualcomm's technologies have powered the smartphone revolution, connecting billions and billions of people. We pioneered 3G and 4G technologies – and now we are leading the way to 5G technology and a new era of intelligent, connected devices. Our products are revolutionizing industries, including automotive, computing, IoT, smart cities, and healthcare, and are allowing devices to connect with each other in ways never before imagined.

Qualcomm Incorporated includes our licensing business, QTL, and the vast majority of our patent portfolio. Qualcomm Technologies, Inc., a subsidiary of Qualcomm Incorporated, operates, along with its subsidiaries, all of our engineering, research and development functions, and all of our products and services businesses, including, our QCT semiconductor business. For more information, visit Qualcomm's website, OnQ blog, Twitter and Facebook pages.

### 2 Experiment Overview

Qualcomm is conducting research into radar technologies for use in vehicular applications. This license is required as the planned experiments require customized hardware restricted to the frequency range of 57-71 GHz.

The goal of these experiments is not to develop the 57-71 GHz band for application in automotive applications, but instead to use RF equipment that operates in this unlicensed band to develop radar applications that will operate in other bands and be designed to improve roadway safety and save lives. To be clear, commercial application of the radar technology developed via these experiments will use different frequency bands that are allocated for vehicular applications.

The experimentation will include two vehicles equipped with an experimental 60 GHz radar system installed on the first vehicle facing the front and/or rear of the second vehicle. The vehicles will be parked or in motion in one of the two possible geographic areas:

- 1) Within 2 km (1.3 miles) around Qualcomm buildings defined in Table 1
- 2) Within 3 km (1.8 miles) around the coordinates in Table 1 that are not located near any commercial or public facilities.

### 3 Transmitter Information

Experimentation will be conducted in the immediate vicinity of the area described in Table 1 and Figure 2. As described in Table 2, the frequency range used for the experiments will be 57-71 GHz with a transmission bandwidth of 1.76 GHz and 100% duty cycle when active.

Up to 2 vehicles outfitted with 60GHz radar transmitters may operate within the operational area. The vehicles will be outfitted with a multi-element beamformed array using an EIRP of 41 dBm or lesser.

Vehicular radar transmitters use a highly directional antenna to steer its beam at ground level for measuring the reflection from other vehicles as shown in Figure 1. The scan parameters are listed in Table 1. The radar antennas are physically small (i.e., diameter less than 15 cm) and will be mounted to the body of the test vehicle, either in the front bumper, on the rear bumper, or on the roof. The narrow beam mitigates the risk of interference to other devices while the radars are active.

Figure 1: Vehicle Radar Beam

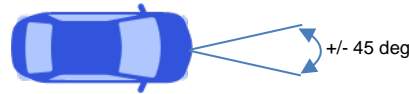


Figure 2: Sorrento Valley, San Diego, CA region of experimental operation.

Table 1 Experiment Area and Antenna Parameters

Tab Site #	Location of BS/UE	County	Latitude (center)	Longitude (center)	Antenna 3dB Beam width	Antenna Scan Azimuth	Antenna Scan Elevation
1	Vehicular radar equipment operating range bounded by each test location within 2 km radius	San Diego, California	32° 53' 46" N	117° 11' 44" W	2 degrees	+/- 45 deg	+/- 10 deg
2	2 mile radius in Miramar	San Diego, CA	32° 52' 16" N	117° 5' 4" W	2 degrees	+/- 45 deg	+/- 10 deg

Table 2 Transmitter Frequency/Power information

Type	Frequency (GHz)	Peak EIRP				Emission designator	Modulation /multiplexing
		dBm	dBW	W EIRP	W ERP		
experimental vehicular radar	57-71 GHz	41	30	1,000	1,000	1G76L0N	Time domain sequences e.g. Golay sequences

## 4 Interference Coordination

Immediate requests for Qualcomm to cease all transmission under this experimental operation should be emailed to [qualcomm.transmitter.shutdown@qualcomm.com](mailto:qualcomm.transmitter.shutdown@qualcomm.com). Alternatively, a shutdown request can be communicated to John Forrester of Qualcomm who can be contacted at 858-845-7428 and [jforrest@qti.qualcomm.com](mailto:jforrest@qti.qualcomm.com).