

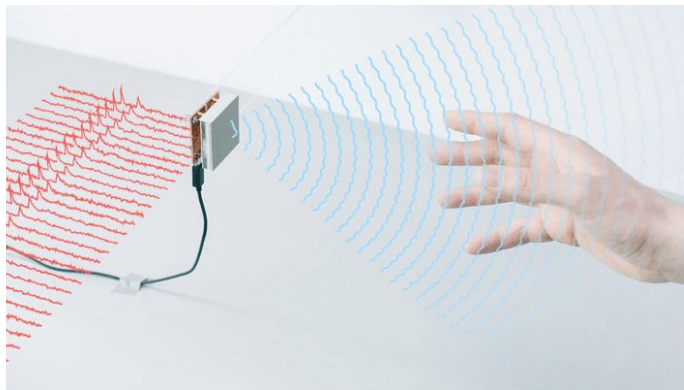


# Project Soli Update

August 2018

# Gesture Sensing Allows Interaction with Device Functions or Features

Uses radar beam at 57-64 GHz to capture motion in 3D space



Designed for space-constrained, battery-operated devices

# Limits on Radars at 60 GHz in the U.S.

Part 15 rules had prohibited/limited mobile field disturbance sensor use since mid-1990s.

*Spectrum Frontiers* (2016): Use in short-range devices for interactive motion sensing allowed at limits for fixed field disturbance sensors (peak conducted output power -10 dBm; peak EIRP 10 dBm).

# FCC Power Levels Reduce Soli Usefulness

Section 15.255(c)(3) power levels too low for user satisfaction

Blind spots  
Missed motions  
Perceived intermittent operation  
Fewer effective interactions

Can't address through design

Shared U.S. & E.U. experience requires higher power levels

# Google Seeks To Operate Soli at Higher Powers Allowed in Europe

FCC Communications Devices	FCC Pre-2016 Radars	FCC Post-2016 Radars	ETSI Levels for Short-Range Devices (Requested In Project Soli's FCC Petition for Waiver)
Max Avg. EIRP: +40dBm	<u>Mobile radars</u> Prohibited	Max. conducted power: -10 dBm	Max conducted power: +10 dBm
Max. EIRP: +43dBm	<u>Fixed radars</u> Max. conducted power: -10 dBm  Max. EIRP: +10 dBm	Max. EIRP: +10 dBm	Mean PSD EIRP: +13 dBm/MHz  Mean EIRP: +20dBm

# Waiver Consistent with Longstanding FCC Policy

Innovative new  
technologies in U.S.

Consistent with FCC intent  
underlying changes to Rule  
15.255(c)(3)

Coexist with other 60 GHz devices

Harmonize FCC  
rules with global  
standards

American technical  
leadership in  
consumer electronics

# No Harmful Effects to EESS and RAS from Airborne Use of Soli

Significant attenuation from inside plane to outside

Mitigating factors such as geometry between passengers and plane windows and satellites, and spatial distribution of planes at altitude, create extremely large interference margins

Unlikely multiple simultaneous use of Soli at low altitudes during landing directly above radio astronomy site

Current EESS sensors protected with 34 dB margin;  
future EESS sensors with 22 dB margin  
RAS sites also protected

## Soli Can Reasonably Coexist With Other 60 GHz Users



60 GHz Wi-Fi only marginally affected  
(around 10% throughput reduction & generally far less, if any at all)

Duty cycling makes effects nearly negligible, including in outlier short range scenarios

Results consistent in simulations & lab tests with commercially available equipment



# Minimums to Enable U.S. Users to Reap Soli's Benefits

	<b>FCC Rule 15.255(c)(3)</b>	<b>ETSI Non-specific SRD EN 305 550</b>	<b>Minimum for U.S.-Europe Operational Equivalence</b>
<b>Peak EIRP</b>	+10dBm	+20dBm	+13dBm
<b>Peak transmitter conducted power</b>	-10dBm	+10dBm	+10dBm
<b>Average power-spectral density</b>	Not specified	+13dBm/MHz	+13dBm/MHz
<b>Maximum transmit duty cycle</b>	Not specified	Not specified	18% in any 100ms interval