

mmWave phased array radio



Customizable reference design for a mmWave phased array radio with two 16 element arrays, operating at 28 GHz

Introduction

While mmWave spectrum provides almost unlimited bandwidth for data hungry 5G applications, it hasn't been widely deployed in the past due to limited propagation distance. Today, by using a phased antenna array with beamforming, the radiated power and propagation distances have been vastly improved. This improvement introduces another challenge of cost due to the need for complex RF chipsets and cooling technology for the mmWave phased array radios.

Flex solution

Realizing that this was challenge for our customers, we developed a reference design for a mmWave phased array radio incorporating:

- Single board RF frontend with commercially available PCB material and RF chipsets, to reduce cost and reliance on more expensive/exotic materials
- Low loss and matched feed network between the RF chipsets and the patch antenna array, on the reverse side of the board, to maximize transmitted power
- Unique coupling solution between the RF frontend board and the aluminum enclosure, to dissipate heat and provide RF shielding between components

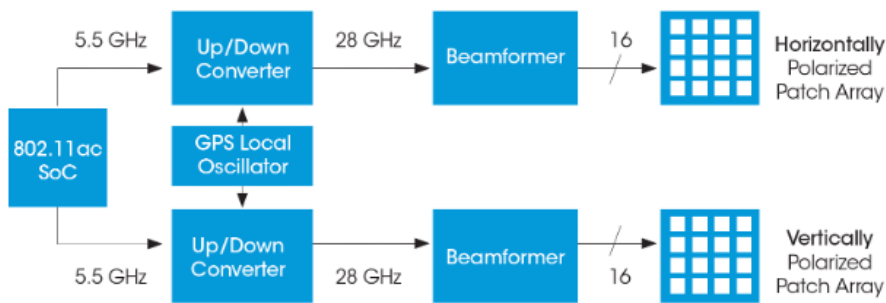
During the design phase, we used RF simulation software to complete the phased array and feed network design and iteratively enhance the performance. Several prototype units were built and were tested in an anechoic (echo free) test chamber to fully characterize the mmWave radio unit.

The 16 element array forms the foundation from which larger arrays with 64, 256 or 512 elements can be quickly developed by Flex. The key specifications are listed in the table below. These can all be customized in accordance with your requirements.

Band	n261 (28 GHz)	3 dB beam width	25°
Transmit power	37 dBm EIRP per array	Baseboard	IEEE 802.11ac (upgradeable to 5G)
Phased array	2 x 16 elements (cross polarized)	Cooling	Convection
Beamforming	Analog, SW defined	Power	12V DC

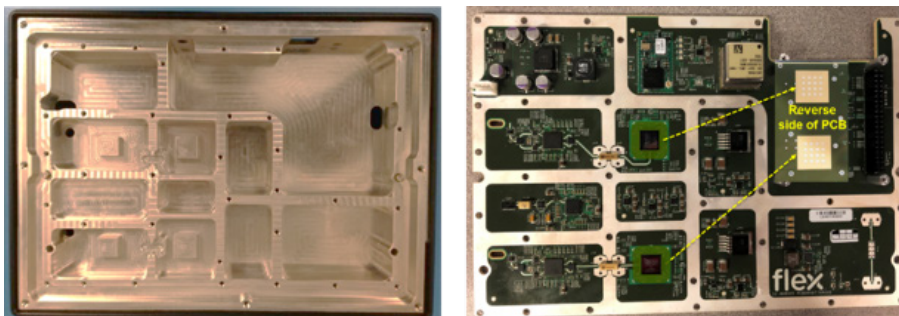
System architecture

The high-level system architecture is shown in the figure below. Considering the transmit flow, the Wi-Fi baseband (802.11ac) outputs two 5.5 GHz signals, which are upconverted to 28 GHz and fed to the two beamformers. These adjust the phase and amplitude of the signals for beam steering/shaping, and outputs 16 signal streams which are fed to the 16-element patch array on the reverse side of the board via an intricate feed network.



Aluminum enclosure and PCB layout

One eight-layer PCB contains all the mmWave components as shown in the photo below. An aluminum enclosure houses the PCB where the cavity walls align with the silver tracks on the PCB for RF shielding between mmWave components and improved heat dissipation.



Partner with Flex

Accelerate your time to market and reduce initial investment by partnering with Flex on your next 5G mmWave product. The mmWave reference design can be customized to meet your specific requirements with our experienced wireless design team. We'll share our knowledge and experience in the design, development and manufacturing of mmWave products, and the materials and components you need to build them.

Our design and manufacturing services can help you develop your next 5G mmWave product, scale to volume production and provide the supporting supply chain and forward/reverse logistics. Our global scale also provides regional presence to tailor your tax and trade structures.

Our advantage

- Accelerate time to market and reduce initial investment by tapping into our mmWave phased array reference design
- Move quickly from design to NPI to mass production with our best-in-class manufacturing capabilities
- Scale fast with our global sourcing and supply-chain expertise, combined with worldwide distribution, service, repair, and logistics capabilities

Learn more about the mmWave reference design in our [white paper](#)

Learn more at flex.com

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