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# Interesting fact: There's more analog in a digital handset than in an analog model

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Here's a showstopper: There's more analog circuitry in a current-generation digital handset than there was in the earlier generation analog models. When I first heard this theory, I laughed it off as, "No way." But the more I thought about it, the more truth there seemed to be. So I did a little bit of investigation. Oddly enough, it's actually true.

If you look at the analog phones from maybe 10 ten years ago, the FM modulation that was used on them was the same FM that's been used for FM radio broadcast for 50 years. It was generated by taking an audio amplifier, and taking the output voltage to vary the capacitance of a varacter diode which varied the frequency in the transmission. The FM receiver had a low-noise amplifier, a down converter, and a limiter, just like the one in your car radio.

In a digital handset, you convert the voice signal to a digital stream (with an "analog" ADC). But before you can convert it, you have to filter it (using an analog filter). What comes out to your ear must be converted from digital to analog. And there's an analog filter there to clean up that signal.

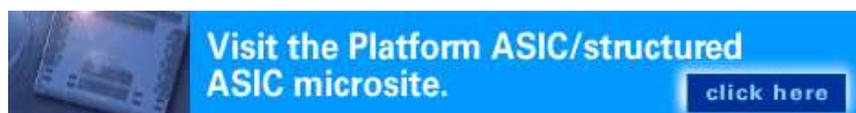
Getting the signal up onto the RF carrier, particularly in systems that are time slotted like GSM and TDMA, requires a more elegant system that turns on all the radio circuits, including the power amplifier (PA), bringing it up on a controlled ramp. You have to control the profile of the turning on and off, as opposed to an analog phone that turns on and stays on for the duration of the call.

Some analog circuitry is needed to control the PA to ramp it up and down, and to control the power, because most of the digital cellular systems use a power controller loop between the base station and the handset for accurate control.

Putting the signal up on the air waves generally requires turning bits into a modulated carrier, which usually requires DACs and some filters (more analog parts). On the receive side, what comes down from the RF carrier is a modulated signal that needs ADCs to decompose the signal into quadrature components.

Don't forget the battery and power management that's needed to handle all the new digital "stuff" that's being packed into the newer models, like things to manage a color display, and the backlighting for it, high-performance audio, and so on.

Note: Thanks to Doug Grant at Analog Devices for setting me straight on this issue.



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