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# (12) United States Patent

### Kumar et al.

# (54) TECHNIQUES AND APPARATUSES FOR PEAK TO AVERAGE RATIO (PAR) BASED POWER MANAGEMENT

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See application file for complete search history.

# (56) References Cited

# U.S. PATENT DOCUMENTS

В1	3/2003	Petsko
B2	7/2014	Tadano
B2	2/2016	Henshaw et al.
A1*	12/2008	Haim H04W 52/146
		455/522
A1*	6/2011	Chan H03G 3/3042
		455/127.2
A1*	8/2012	Camuffo H03F 1/0255
		375/224
A1	11/2014	Pourkhaatoun et al.
A1	4/2016	Khlat
	B2 B2 B2 A1* A1* A1*	B2 7/2014 B2 2/2016 B2 7/2016 A1* 12/2008 A1* 6/2011 A1* 8/2012 A1 11/2014

#### OTHER PUBLICATIONS

International Search Report and Written Opinion—PCT/US2017/035441—ISA/EPO—dated Oct. 4, 2017.

\* cited by examiner

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### (57) ABSTRACT

Certain aspects of the present disclosure generally relate to wireless communications. In some aspects, a device may determine a peak to average ratio (PAR) value for a portion of a wireless transmission. In some aspects, the device may cause, based on the PAR value, a voltage to be applied to a power amplifier of the device to cause the device to transmit the portion of the wireless transmission.

# 30 Claims, 13 Drawing Sheets

