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Shiban Kishen Koul · Karthikeya G. S.

Antenna Architectures for Future Wireless Devices

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Dedicated to

The unfulfilled dreams of Jeevan

Preface

Due to massive hike in smartphone users and their respective data consumption, experts believe that future wireless devices need to be built at mmWave frequencies. To realize this makeover, the entire cellular hardware infrastructure must be revamped, which includes the devices involved in the communication link. Antennas are probably one of the most critical pieces of the wireless device design puzzle. Often, antenna design decides the integrity of the data link. Traditional antenna designs for commercial wireless devices are well-known and have established design principles, but integration of antennas for mmWave-based transceiver radios is a topic of active research across the globe.

This book introduces the readers to the reality of millimetre wave links and various aspects of the communication link design. Special emphasis on the role of antennas in a mmWave link is illustrated comprehensively. Design requirements of antenna integration for modern commercial devices such as smartphones, dongles, and access points are elaborated in this book. Practical use-case scenarios of smartphone and the design process of the antenna system for the same are introduced. Several design examples with experimental results are also included. The feasibility of scaling up sub-6 GHz to mmWave antennas is also discussed in detail followed by a plethora of design examples which could be panel mounted to modern-day commercial smartphones. The unique requirement of gain switchability is introduced in this book, with feasible practical antenna designs. High-efficiency antennas for 5G base stations are introduced along with a design example on planar all-metallic antenna. Beam switchability requirement for base station is illustrated with a couple of compact antenna system examples. Variety of feeding techniques for mmWave antennas is elaborated next. Low-cost antenna designs for future wireless devices are also illustrated in this book.

New Delhi, India
Bangalore, India

Shiban Kishen Koul
Karthikeya G. S.

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Abbreviations

1G	First generation
2G	Second generation
3G	Third generation
4G	Fourth generation
5G	Fifth generation
ACS	Asymmetric coplanar stripline
AM	Additive manufacturing
CAD	Computer-aided design
CMOS	Complementary metal oxide semiconductor
CNC	Computer numerically controlled
CPS	Coplanar stripline
CPW	Coplanar waveguide
CST	Computer simulation technology
DC	Direct current
DMLS	Direct metal laser sintering
ECC	Envelope correlation coefficient
EDM	Electrical discharge machining
EMI	Electromagnetic interference
ENZ	Epsilon near zero
FPC	Fabry–Pérot cavity
FTBR	Front to back ratio
GCPW	Grounded coplanar waveguide
GPS	Global positioning system
HFSS	High-frequency structure simulator
LCD	Liquid crystal display
LTE	Long-term evolution
LWA	Leaky wave antenna
MIMO	Multiple input multiple output
mmWave	Millimetre wave
MTM	Metamaterial
MWS	Microwave studio

NR	New radio
OPD	Orthogonal pattern diversity
PC	Personal computer
PCB	Printed circuit board
PD	Pattern diversity
PET	Polyethylene terephthalate
PLA	Polylactic acid
PRG	Printed ridge gap
RF	Radio frequency
RFIC	Radio frequency integrated circuit
RMS	Root mean square
RSSI	Received signal strength indicator
SAR	Specific absorption rate
SIW	Substrate integrated waveguide
SLM	Selective laser melting
SLS	Selective laser sintering
SMA	Sub-miniature A
SMP	Sub-miniature push-on
SoC	System on chip
SP3T	Single pole triple throw
SPDT	Single pole double throw
Tx/Rx	Transmitter/receiver
VNA	Vector network analyzer
VoIP	Voice over Internet protocol
VR	Virtual reality
VSWR	Voltage standing wave ratio
WiFi	Wireless fidelity
WPAN	Wireless personal area network