A Wire-Free Home Healthcare Solution Based on the Combination of FTTR and mmWave Technologies

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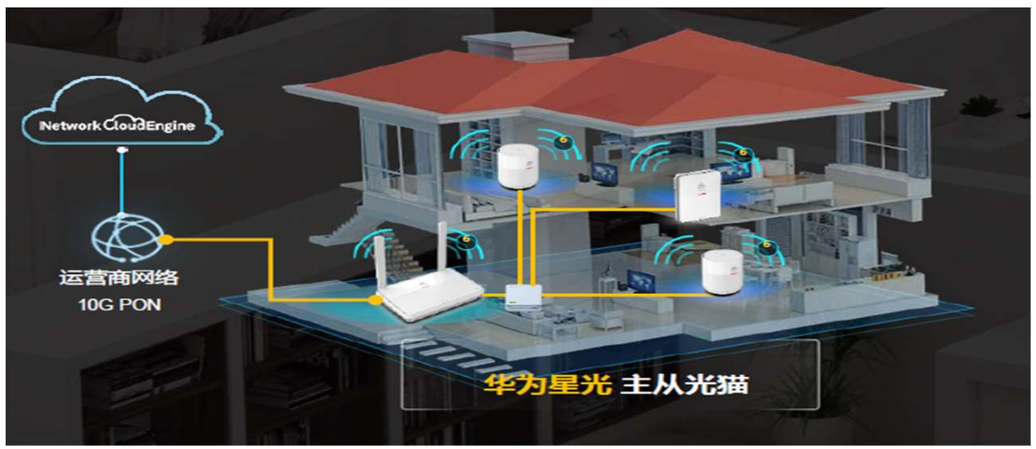
1 Presentation Outline

1. An overview on FTTR and mmWave technologies
2. Wire-free healthcare applications at home
3. Suggested deployment scenarios and roadmap
4. Brief introduction on Chipsemi’s product lines

2 The Evolution of FTTR

FTTR Is the Next Stage in the Evolution of Fiber Technology

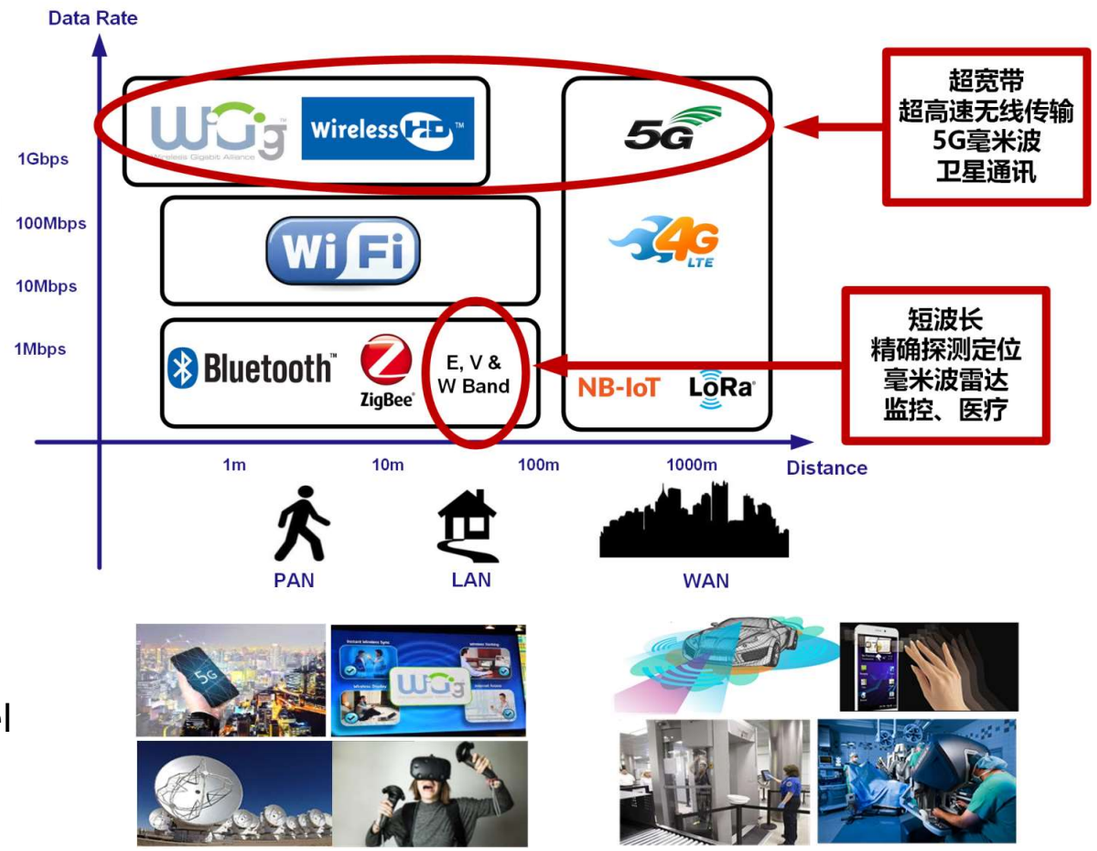


- **FTTR is the fiber coverage evolution from home to room**
  1. FTTR replaces network cable, more reliable, support for continuous upgrade
  2. Rate x10, time delay x1 / 10, life span x3, power consumption x1 / 3
- **National standards, Complete supply chain, Successful commercialization**
  1. Becoming national standard
  2. A total of 45 local operators in China have launched packages, and 35 contracted operators, real estate and home decoration companies. In 2022,4 million contracted customers, 10 million in 3 years, and 100 million in 5 years
  3. American Verizon, Sprit, AT & T, T-Mobile optical fiber home is also worth looking forward to.

3 mmWave Technology

The core technology for wireless communication, precision detection and chip design

1. Millimeter-wave technology, also known as UHF technology, is a general term for communication and detection technology using the 30G-300GHz frequency band and a signal wavelength of millimeter level
2. Ultra-broadband, short wavelength, low delay, anti-interference and other advantages
3. Wireless communication applications: ultra-bandwidth, rich spectrum resources, provide gigabit transmission capacity, millisecond delay
4. Accurate detection application: short wavelength, millimeter level precision detection and positioning
5. The commanding heights of chip technology, wireless communication technology, radio frequency front-end and intelligent antenna, SoC integration and performance algorithm, the most cutting-edge technology in IC developement



Security check radar, imaging radar, medical radar, gesture recognition recise positioning, detection technology

4 FFTR and Q-Band

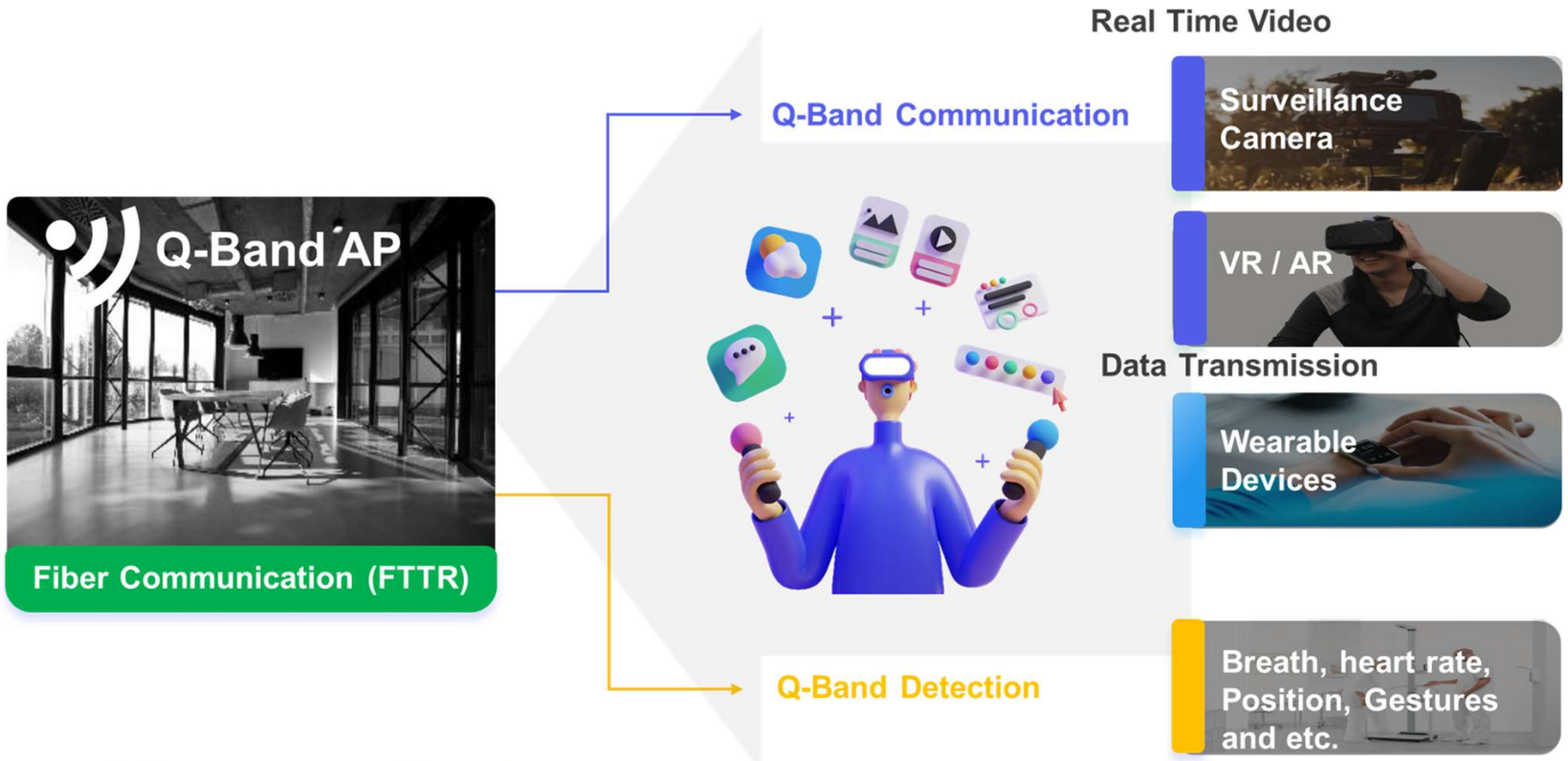
MCS index	Modulation	R	N_{CBPS}	Data rate (Mb/s)	
				Long GI	Short GI
1	π/2-BPSK	1/2	1	1320.00	1540.00
2	π/2-QPSK	1/2	2	2640.00	3080.00
3	π/2-QPSK	3/4	2	3960.00	4620.00
4	π/2-16-QAM	1/2	4	5280.00	6160.00
5	π/2-16-QAM	3/4	4	7920.00	9240.00
6	π/2-64-QAM	5/8	6	9900.00	11550.00
7	π/2-64-QAM	3/4	6	11880.00	13860.00
8	π/2-64-QAM	13/16	6	12870.00	15015.00

工作参数	工作范围
频率范围	42.3~47 GHz, 47.2~48.4 GHz
工作带宽	540 MHz, 1080 MHz
天线数量	4
频率稳定性要求	100×10^{-6}
发射功率	<10 dBm
带外抑制	>40dB

FFTR and Q-Band become perfect match

1. Q-Band offers ultra-wide channel bandwidth and fully utilizes the high data rate of the fiber communication
2. Fiber to the room solve the coverage issues raised by line-of-sight transmission of the Q-Band signal
3. FTTR+Q-Band avoid the interferences commonly seen in WiFi applications and offer data protection
4. FTTR+Q-Band offers high data rate coverage, easily over 10Gbps
5. FTTR+Q-Band allows low power transmission and greatly improves spectrum and power efficiency

5 Health Care Applications



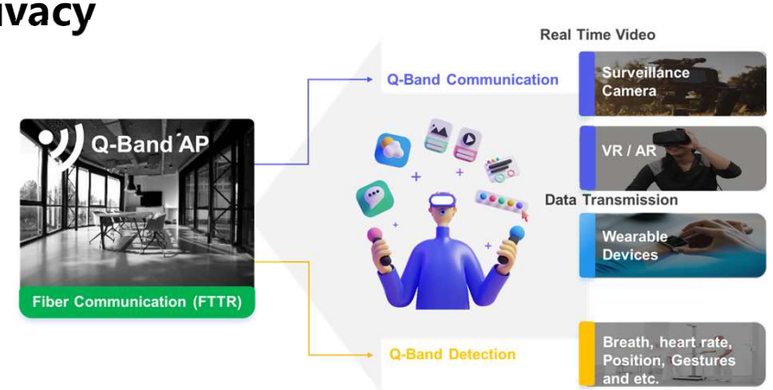
Home health care applications

1. Both communication and detection are required in the health care application
2. Communication covers real time video transmission and data transmission
3. Vital data collection, position and gesture detections are needed for medical care

6 The Advantages

FTTR+Q-Band Offers Perfect Solutions

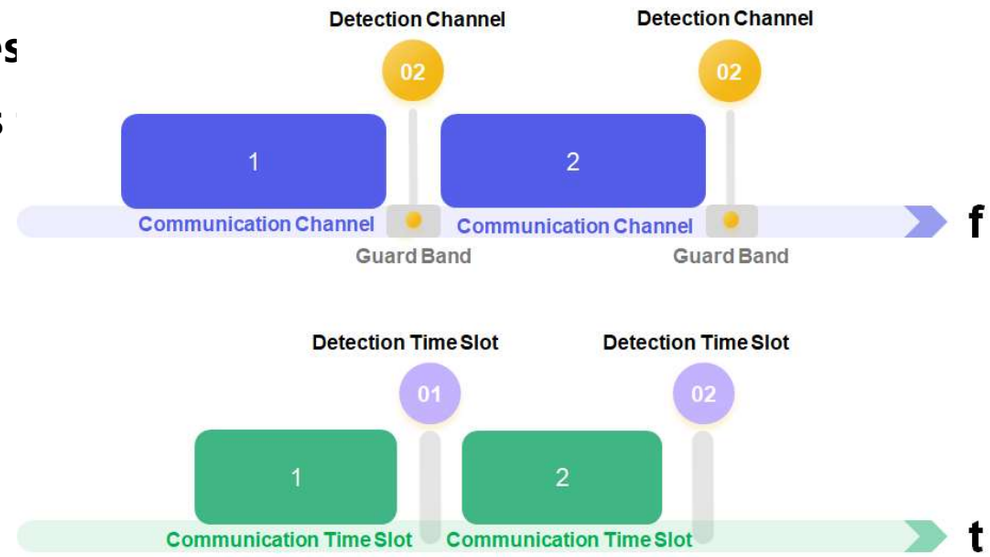
1. FTTR offers Gbps gateway, Q-Band offers Gbps radio coverage
2. The broadband data communication capacity enables real-time high-res video transmission and in term supports surveillance, AR/VR applications
3. Flexible data communication satisfies the wide variety demands in medical data transmission
4. Q-Band also makes high resolution detection possible
5. Q-Band radar offers wearable or non-invasive detection of vital signs, such as breath, heart rate, movement, gesture and etc.
6. Limited signal propagation avoids interferences and offers data privacy
7. Positioning information can also be used for roaming assistance



7 Q-Band 2-in-1 Solution

Communication and Detection

1. Q-Band provides ready solutions to both communication and detection
2. Dual mode IC solution can also be available
3. Frequency division multiplexing, using the communication guard band to conduct the detection
   - Communication and detection can be done simultaneously
   - Need to have separate hardware implementations
   - Spectrum arrangement and possible interferences
4. Timing division multiplexing, using different time slots communication and detection
   - Communication and detection to be done sequentially
   - Possible hardware re-use
   - Timing arrangement might add complexity



8 IC Development

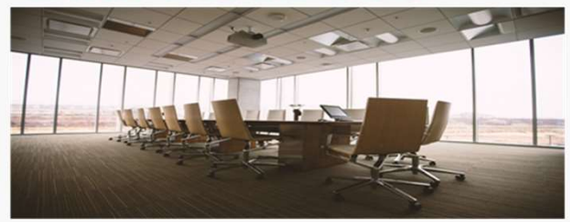
Possible Roadmap for the IC Development

Q-Band

Communication SoC

Q-Band

Dual-mode Soc



Q-Band

Radar SoC

9 WiHD Products

Module Specifications

- Use frequency band of 59.4GHz-63.56GHz
- Channel bandwidth is 1.76GHz
- Line of sight transmission distance above 10m
- HRP Radiated Power (EIRP) 28dBm
- HRP antenna gain 18dBi
- Receiver sensitivity -72dBm
- PHY transmission latency less than 2m second
- Single 5V supply through USB Micro B port
- Module dimension 80mmx29.5mm
- Video port, HDMI Type A
- Max operation temperature, 60°C

10 WiGig PTP Backhaul

- **Last Mile Access**
- **Smart City**
- **Ports and Stations**

Features and Specs

- Offers broadband connection, over 1.3Gbps data throughput under TCP/IP at a distance of 200m can be achieved;
- Support both point-to-point and relay transmission configuration;
- Support frequency and spatial re-use, increase network capacity;
- ±30°direction coverage for beam tracking, make easy deployment possible;
- Link quality and MCS setting can be monitored;
- Line-of-sight transmission.

Items		Specs			Unit
		Min	Typ	Max	
GigaRay Modules	Standard	IEEE 802.11ad, WiGig			
	Frequency Bands	59		64	GHz
	Max Down Link Throughput[1]		1.3		Gbps
	Max Dual Link Throughput[1]		1.5		Gbps
	Down Link Throughput @50m[1]		1.3		Gbps
	Down Link Throughput @200m[1]		1.0		Gbps
	Down Link Throughput @300m[1]	0.3			Gbps
	TX EIRP			39.4	dBm
	RX Sensitivity	-83			dBm
	Horizontal Directional Coverage[2]		±30		°
[1] Data throughput is tested under TCP/IP protocal					
[2] Test distance at 50m					

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