2022 Wireless Connectivity Market Analysis
Report Summary

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**About the report**

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**Research Items**

- **<Wireless LAN>**
  Market Forecast and Break down by Application, Standard/Radio Band (2.4/5/6GHz), WiFi Chip and Module Market Share, Vendor Trend
- **<Bluetooth/BLE>**
  Market Forecast and Break down by Application, BLE, Bluetooth/LE Audio, BLE location, automotive... Bluetooth/BLE Chip Market Share, IC Vendor Trend

* Sample report is available.
  Please inquiry sample report to Takeshi Niwa (niwa@t-s-r.co.jp)
IC Supply constraint
2021: IC supply shortage/ strong IC demand across all major end market. Severe shortage for IoT and Auto.
2022: Supply balance differs by applications. Smartphone, PC, CE market shrink. IC supply will ease in 2022. Silicon wafer, material cost remains high. Wireless chipset price will be stable or slight increase in 2022.

2022 Growing applications
• Bluetooth: Home/Building automation, Remote controller, HID, Healthcare device, Wearable, Automotive accessories…
• WiFi: AP/Router/Gateways, Embedded/IoT, Home Appliance, IP Camera, Lighting…

Standard/ Regulation
• 6GHz WiFi market start picking up in 2022-2023. USA will be the main market in 2022. China will not allocate 6GHz for WiFi, therefore 6GHz WiFi diffusion will be limited. 6GHz WiFi will account 19% of total WiFi market in 2027.
• WiFi 7 draft chipset will be introduced in 2022, devices in 2023, volume pick up in 2024. WiFi 7 shipment will overtake WiFi 6E in 2025.
• Bluetooth LE Audio: chipset released in 2021, end devices in 2022, volume pick up in 2023. By 2026, 80% of Bluetooth audio will support LE audio (single mode or dual mode)

Wireless IC vendors
• Bluetooth Audio: Bestechnic is growing in mid/high segment. Realtek shrinks. Qualcomm, Airoha, Apple positioned as mid/high end supplier.
• BLE: Nordic keeps leadership position. Market share fragmented.
• WiFi: MediaTek keeps top market share. Qualcomm, Broadcom, MediaTek leads in WiFi 7 chip roadmap. IoT WiFi market is fragmented, but Espressif keeps top share.
• Because of IC shortage, chip process migration, foundry diversification is facilitated.
• In IoT market (IoT WiFi, BLE), more IC suppliers provide module.
## 1. Wireless Connectivity Chip and Application

<table>
<thead>
<tr>
<th>Wireless Chip</th>
<th>Application</th>
<th>Main Suppliers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bluetooth integrated Feature Phone SoC: Feature Phone, Wearable</td>
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<tr>
<td></td>
<td>Bluetooth Audio SoC: Headset, Earbud, Audio speaker, audio transmitter, toy...</td>
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<tr>
<td>BLE Single Mode Chip</td>
<td>Wearable, healthcare, Tag, HID, RCU, mobile accessory, automotive accessory,</td>
<td>Nordic, Renesas, Telink, Realtek, PhyPlus, Qorvo, ST, Infineon, TI, NXP, SiLabs, Beken, Ambiq, OnMicro, BlueX, Goodix...</td>
</tr>
<tr>
<td>Standalone WiFi Chip</td>
<td>Discrete WiFi Chip: WiFi networking, printer, digital camera...</td>
<td>Broadcom, Qualcomm, MediaTek, Realtek, Infineon, NXP, MaxLinear, On Semi, HiSilicon, Celeno...</td>
</tr>
<tr>
<td></td>
<td>WiFi networking chipset: up to 4x4 scheme, AP+WiFi SoC</td>
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<tr>
<td>MCU embedded WiFi</td>
<td>Home appliance, Air Conditioner, Small Appliance, Home Automation, IP Camera, Industrial terminal, industrial automation, Lighting</td>
<td>Espressif, Realtek, Beken, Infineon, MediaTek, NXP, TI, SiLabs, ASR, BouffaloLab, iComm, UNISOC, Renesas, I&amp;C...</td>
</tr>
<tr>
<td>WiFi Combo Chip</td>
<td>Smartphone, Tablet, PC, TV, OTT box, Smart Speaker, Infotainment, Smart Watch, Printer, Home Appliance, IP Camera... MCU WiFi+Bluetooth: Home Appliance, Smart Watch, IP Camera, Industrial Terminal...</td>
<td>Broadcom, Qualcomm, MediaTek, Realtek, Intel, Infineon, NXP, HiSilicon, Espressif, Beken, Apple, TI...</td>
</tr>
<tr>
<td>Bluetooth/WiFi integrated SoC/AP</td>
<td>Smartphone, Tablet, Smart Watch</td>
<td>Qualcomm, MediaTek, Samsung, UNISOC</td>
</tr>
</tbody>
</table>
2. Wireless Connectivity Chip Market Trend

- 9.9Bil units of Wireless chip shipments in 2021, YoY +15.5% driven by networking Computing and IoT related applications. Bluetooth = 5.6Bil units, WiFi/Combo = 3.2Bil units, WiFi integrated mobile processor = 1.1Bil units.
- Wireless IC market revenue (excluding WiFi integrated mobile processor) is estimated to reach 13.6Bil USD in 2021, +27.7% YoY. Product mix change and IC price increase factored the strong revenue growth.
- Wireless IC ASP is expected to rise continuously thanks to the increase of high end ICs.
- 2022 shipment growth is estimated at 7.7% YoY. Mixed trend by end market. Strong demand continues in IoT/Auto, while demand drops in mobile, PC, and consumer electronics.

- 2023 onwards: assume that supply constraint ease by 2023, possible inventory correction in 2023-2024. Shipment unit growth Mid-single digit. Revenue growth: high single digit to 10%. WiFi 7 will boost WiFi shipment growth after 2024.
3. Wireless Connectivity Module Market Trend

- Definition: WiFi & Bluetooth Module, PCB or SiP module. Excluding WiFi FEM, System on Module (AP+OS + Connectivity), PCBA.

- Total Wireless Module Market volume is estimated at 2.15Bil units in 2021, (YoY 24.1%), thanks to the strong IoT embedded module shipment growth. 2022 unit growth will moderate to 9.6% YoY. Smartphone, PC and consumer market shrink offsets IoT application growth.

- Bluetooth volume applications applies chip on board. Module seen only in small volume project, specific applications such as industrial, medical, lighting…

- Module adoption rate estimated at ~10% of Bluetooth IC, 61-62% of total WiFi IC shipments. Module adoption rate differs by application, project volume, or RF design expertise in end user… Bluetooth is easier to make chip on board than WiFi.
4. Bluetooth Market Forecast by Application

- Revised up Bluetooth audio & Dual mode Data Bluetooth market forecast from 2021 report.


- Bluetooth audio market start to saturate in 2021. Demand for BLE SoC for IoT devices has been very strong during 2021-2022. single mode BLE SoC shipment growth: +43.6% YoY in 2021. BLE SoC market expected to growth by +30% YoY in 2022. IC foundry capacity caps the volume growth in 2021.

- BLE single mode SoC market keeps double digit YoY growth by 2027, thanks to the strong demand in broad IoT applications: wearable, RCU, HID, home, building, industrial and retail automation, asset tracking, lighting, smart access, smart meter…
5. Bluetooth Audio SoC Market

- Revised up low end Bluetooth audio volume from Jieli and Bluetrum. 3Bil units of shipments in 2020, nearly 3.4Bil units in 2022.
- Mid-high end Bluetooth audio SoC expected to gain market share by replacing low end SoC. This product mix change support ASP increase/ revenue growth.
- High end Bluetooth audio will use 12/14/16nm process tech. Apple already uses 16nm process. Airoha, Bestechnic and Realtrek plans to use 12nm in 2022-2023.
- Smart watch rise as new application of high end Bluetooth audio SoC, by adding App MCU/OS + GPU/Display controller. Bestechnic, HiSilicon, Realtrek, Actions, Jielim Bluetrum… introducing BT audio oSoC for wearables.
6. BLE Single Mode Chip Market

- This market forecast covers BLE single mode SoC and BLE/802.15.4 multiprotocol SoC.
- Strong volume growth in 2021 & 2022. 2021 market volume: 1.57Bil units (YoY 43.6%), 2022 2.05Bil units (YoY 30%) but possible upside. Strong demand/ supply shortage. Supply capacity decide the shipment growth and SoC market share.
- Wearable, tag/ beacon, HID, remote controller, healthcare, and home/ building automation are the main volume application. Automotive accessories emerges as new application.
- Single mode LE audio market expected to pick up in 2024-2025.
7. WiFi Market Forecast by Application Segment

- WiFi device shipment unit surpassed 4.3Bil units in 2021, YoY +15.8%. 2022 market growth expected to drop to 4.1% YoY due to the shrink of PC, smartphone, CE market. IoT (embedded) WiFi market grows continuously.
- Mobile devices (phone, tablet, wearable, mobile hotspot, digital camera) accounts biggest share (30% in 2021) in WiFi device market.
- Consumer/ Home market segment grows thanks to the volume growth of home WiFi IoT devices: home appliance, small appliance, lighting, power plug, IP Cam…
8. WiFi Market by Standard/Radio band

WiFi standard migration trend:
WiFi 5 (11ac) to dual band/ tri-band WiFi 6 /7 in broadband applications
WiFi 4 (11n) to dual band WiFi 5/6, or Single Band WiFi 6 in IoT applications or low end broadband devices.

• Single Band WiFi market share shrink from 39% (2021) to 32% (2027) despite WiFi IoT device market grows.
• Dual Band WiFi shift from WiFi 5 to WiFi 6/7. WiFi 6 will overtake WiFi 5 volume in 2023.
• 6GHz tri-band WiFi market start in 2021, and acquire 19% market share in 2027.
• MIMO accounts 42-44% of total WiFi market during 2020-2027. MIMO increase in broadband applications.
9. 6GHz WiFi Market Breakdown

- 6GHz benefits in broadband & streaming applications (PC, smartphone, AP/router/gateway, gaming, TV..), also mission critical applications (factory industrial automation, AGV, line monitoring…)

- Smartphone, PC and AP/router (retail) will be the early adopter, and main volume applications. Tablet, VR HMD, TV follows. Automotive, Industrial IoT expected to adopt 6GHz WiFi (WiFi 6E) in 2024-2025.

- WiFi 7 device shipment start in 2023, overtake WiFi 6E in 2025. WiFi 7 will account 93% of 6GHz WiFi shipments in 2027.

- 6GHz availability & schedule is different by countries. USA is the first adopter, followed by UK, EU, Korea, Middle East, Japan..

- China, The largest WiFi market, currently plans to allocate full 6GHz bands for IMT (5G).

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### 6GHz WiFi Market Forecast by Application, 2021-2027

[Diagram showing market forecast by application for 2021-2027]

### 6GHz Spectrum Status by Country (as of end of 2021)

<table>
<thead>
<tr>
<th>Status</th>
<th>5.925-6.425GHz (U-NII-5) only</th>
<th>5.925-7.125GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Available</td>
<td>EMEA: EU, UK, Norway, Morocco, UAE APAC: Malaysia, Japan</td>
<td>North America: USA, Canada Latin America: Brazil, Chile, Costa Rica Guatemala, Honduras, Peru EMEA: Saudi Arabia APAC: Korea</td>
</tr>
<tr>
<td>Considering</td>
<td>Latin America: Argentina EMEA: Egypt, Oman APAC: New Zealand, India</td>
<td>Latin America: Columbia, Mexico, EMEA: Jordan, Kenya, Qatar, Tunisia, Turkey APAC: Australia</td>
</tr>
</tbody>
</table>

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10. Smartphone WiFi Trend

- 5G accelerates WiFi standard migration, WiFi 5/6, MIMO. WiFi 5/6/7 accounts 93% of smartphone in 2027.
- MIMO is adopted in premium and part of high end segment, with around 40% share in 2021.
- 6GHz WiFi adoption start in 2021. 6GHz will account 1/3 of total smartphone in 2027. (Premium + part of high end)
- First WiFi 7 devices expected to be released in 2H2023 from Android vendors. Volume pick up in 2024.
11. WiFi Networking Market Trend

- Retail segment grew strongly in 2020-2021 thanks to the remote work/remote school which caused home WiFi upgrade. Retail market growth rate return to normal in 2021-2022.
- Service provide market segment grow double digit in 2020 & 2021 thanks to the China market growth, mesh repeater distribution by Chinese operators.
- WiFi 6 is reaching 40-50% of retail router in developed countries in 2021, around 30% in China. EAP and service provide segment is slower. WiFi 6 accounts 25% of total WiFi networking market in 2021. WiFi 6 will catch up WiFi 5 in 2022 and overtake in 2023.
- 6GHz is currently adopted mainly in the USA market. EU market will start to pick up in 2H22. Although WiFi infrastructure demands additional band (6GHz), 6GHz WiFi will account only 25% share in 2027. China will not allocate 6GHz for WiFi. There will be the cost challenge for 6GHz WiFi in emerging market.
- MIMO: 2x2 and 3x3/4x4 accounts majority share. 3x3/4x4 scheme is mainstream in developed, growing in China. Demand for 2x2 scheme also grow for Mesh WiFi repeater. 8x8 big WiFi router remains niche as mesh WiFi market grow.
12. Automotive Connectivity Market Trend

- Infotainment WiFi trend:
  - High end: 11ac > WiFi 6 (2022~), 2*2 MIMO, Dual MAC/Dual Simultaneous. WiFi 6E in 2025
  - Mid end: 11ac > WiFi 6 (2024~), 2*2 MIMO/ SISO, Dual MAC/Dual Simultaneous
  - Low end: WiFi 4 > WiFi 5 (11ac), Single Antenna
- WiFi 6 will overtake WiFi 4/5 in 2025, will accounts 78% of infotainment WiFi in 2027.
- 6GHz WiFi 6E will be launched in 2025 models, only for premium models by 2027.

- Automotive BLE application: Digital key, Tire Pressure Monitoring System (TPMS) and Battery Management System (BMS), other sensors, steering switch, button...
- Digital key: increase adoption in 2022. several different solutions: BLE + secure MCU, BLE + UWB + NFC, BLE AoA and BLE HADM. In average, 3-3.5 pcs of BLE IC are used for digital key.
- Bluetooth TPMS: mainly adopted in aftermarket product now. Gradual increase in 2025/ later. Competition with legacy LF.
- Bluetooth BMS: market adoption expected to start in 2024. around 10 chips/car. Competition with LF/UHF, subGHz and 2.4GHz.
13. MCU WiFi Market Forecast by Application

- Others: small appliance, kitchen appliance, home/Building automation (sensor, door lock, remote controller/switch..), Drone, Consumer Toy, Medical device…
- Industrial: handheld device, POS terminal, industrial computer, sensor, meter, robot…
- Strong unit growth in through 2021-2022. nearly 800Mil units of MCU WiFi shipments.
- Home appliance (especially Air conditioner), Home IoT (smart plug, lighting, IP Camera…), and industrial are considered the main volume applications.
- Single Band WiFi is mainstream, but the demand for dual band WiFi 5 is growing in developed countries, industrial IoT devices.
- demand for BLE combo chip is growing across broad applications for provisioning..
### 14. Wireless Chip Supplier Market Share Position

<table>
<thead>
<tr>
<th>Segment</th>
<th>Mobile (Smartphone/Tablet)</th>
<th>Networking (AP/Router/Gateway)</th>
<th>CE (TV, OTT, Smart Speaker, Game Console)</th>
<th>IoT (MCU WiFi)</th>
<th>Automotive WiFi</th>
<th>Bluetooth Audio</th>
<th>Bluetooth Data (BLE + Dual Mode)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021 TAM IC solution</td>
<td>AP SoC+RF, WiFi/BT Combo Chip</td>
<td>1572M units</td>
<td>416M units</td>
<td>556M units</td>
<td>795M units</td>
<td>74.9M units</td>
<td>325MMI Units</td>
</tr>
<tr>
<td>Market Share</td>
<td>30+ %</td>
<td>MediaTek</td>
<td>MediaTek</td>
<td>MediaTek</td>
<td>ESPRESSIF</td>
<td>QUALCOMM</td>
<td>JAT</td>
</tr>
<tr>
<td>20-30%</td>
<td>Qualcomm</td>
<td>Broadcom</td>
<td>Qualcomm</td>
<td>Realtek</td>
<td>Infineon</td>
<td>NXP</td>
<td>Nordic</td>
</tr>
<tr>
<td>15-20%</td>
<td>Broadcom</td>
<td>Realtek</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-15%</td>
<td>UNISOC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-10%</td>
<td>OnSemiconductor</td>
<td>Infineon</td>
<td>UNSIOC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5%</td>
<td>Samsung</td>
<td>HiSilicon</td>
<td>MaxLinear</td>
<td>AMLogic</td>
<td>Synaptics</td>
<td>Mediatek</td>
<td>TI</td>
</tr>
<tr>
<td>New Entry</td>
<td>Renesan</td>
<td>SiFlower</td>
<td>Broadcom</td>
<td>Apple</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

- In Mobile, PC and CE area, SoC vendors (MediaTek, Qualcomm, Intel...) has major market share in each end market. SoC and connectivity is typically bundled or integrated. Realtek is working with multiple AP vendors.
- High performance WiFi is required in WiFi networking (AP/router/gateway) segment. MediaTek, Qualcomm and Broadcom accounts major market share. Realtek for low end, OnSem and MaxLinear for high end market. NXP shrinks. Chinese start-up (SiFlower, ZunPai) try to participate the supply chain.
- Automotive: Qualcomm, Infineon, NXP are the main WiFi suppliers. TI and NXP takes lead in automotive BLE.
- IoT WiFi: market share fragmented. Espressif maintains leadership thanks to the firm eco-system. Realtek and Beken grows significantly in low end segment. New suppliers emerges in China. Infineon keeps strong position in high end. NXP gains market share.
- Bluetooth audio: Low end market share concentrated to Jieli and Bluetrum. Qualcomm, Apple keep leadership position in mid/high end. Bestechnic and Airoha/MediaTek grows in the mid/high segment.
- BLE: Market share fragmented. Nordic keep leadership position with strong eco-system in broad market. Telink, Renesan (Dialog), Realtek, Phyplus, Qorvo, ST, SiLabs, Infineon, TI, NXP..follows Nordic. In Dual mode Bluetooth SoC market, YiChip has big market share.
15. Chipset process node, integration trend

**Process Node**
- WiFi 7 start to use 6/7nm process. Broadcom and MediaTek leads in migration. Other tier-1 suppliers will follow. Cost challenge for smaller suppliers.
- Lower end WiFi for IoT, cliantedevices employs 22/28-40nm.
- BLE: 40/55/65nm is mainstream. High end SoCs start to employ 22/28nm.
- Fab diversification considered by several IC vendors to stabilize the supply.

**Integration**
- BLE: Apps MCU, AI, Sensor IF, Security. PLL and Algorithm (MCU) for HADM.
- Bluetooth Audio: Dual core DSP/Al, Sensor IF, ANC. GPU/display I/F for watch SoC.
- WiFi Networking: Network processor + WiFi Modem + FEM.