



BHW Technologies (博泓微科技有限公司)



Advanced RF IC, Antenna, Filter, RF Front-End
and Wireless System Solutions

BHW AppNote #028

Use BHWM252 Cascade to Extend Range of
2.4GHz Wireless Systems with Single-Port SoCs

Rev. 1.7

www.bhw-tech.com

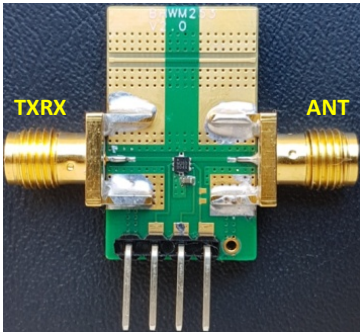
BHW Solutions for 2.4GHz Range Extension: RF IC Line-Up



BHWM253
for Rx Sensitivity



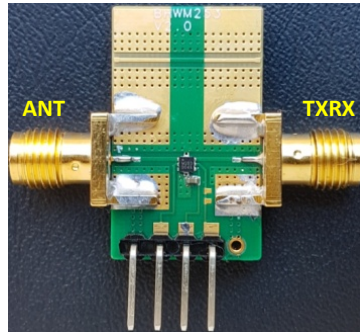
Tiny DFN6-1.5x1.5



BHWM253
for Tx Power



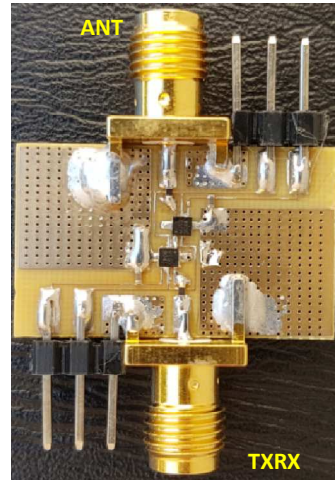
Tiny DFN6-1.5x1.5



BHWM253 Cascade
for Tx & Rx Improvement



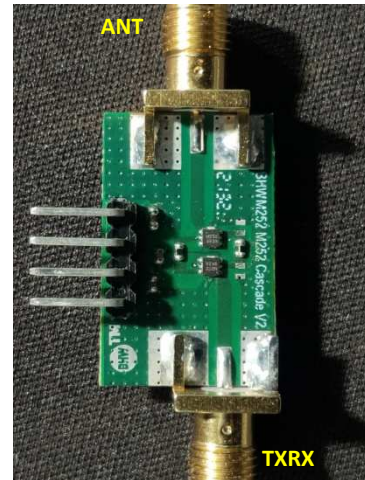
Tiny DFN6-1.5x1.5



BHWM252 Cascade
for Tx & Rx Improvement



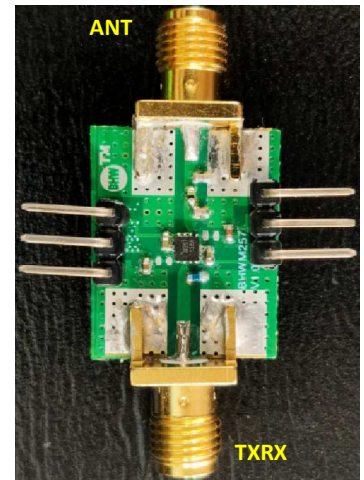
Tiny DFN6-1.5x1.5



BHWM257
for Tx & Rx Improvement



Compact DFN8-2x2



Rx NF: 1.8dB
Tx Pout: N/A
Switch IL: 1.3dB
Reference:
BHWM253 AppNote

Tx Pout: 12~14dBm
Vdd: 3.3~4.2V
Rx: N/A
Switch IL: 1.3dB
Reference:
BHWM253 AppNote

Tx Pout: 11~13dBm
Vdd: 3.3~4.2V
Rx NF: 1.8dB
Reference:
BHW AppNote #001

Tx Pout: 13~15dBm
Vdd: 3.3~4.2V
Rx NF: 1.7dB
Reference:
BHW AppNote #028

Tx Pout: 13~15dBm
Vdd: 3.3~4.2V
Rx NF: 1.8dB
Reference:
BHWM257 AppNote

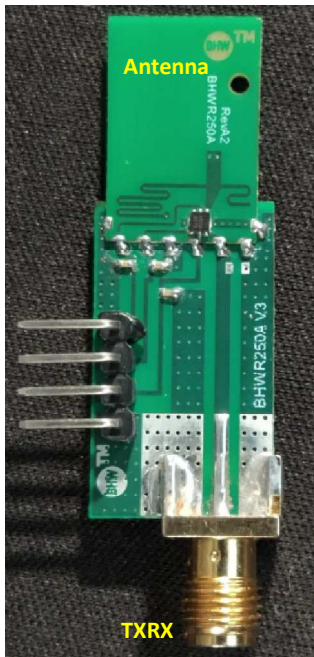
Notes:

- All solutions provide direct interface with single-port 2.4GHz SoCs, without the need for additional switches
- The PA inside BHWM252 or M253 can use Vdd up to 4.2V to maximize output power
- Harmonic rejection filters for FCC compliance (if applicable) can be implemented before the antenna switch, resulting in lowest Rx NF and receive sensitivity

BHW Solutions for 2.4GHz Range Extension: RFAiA Line-Up

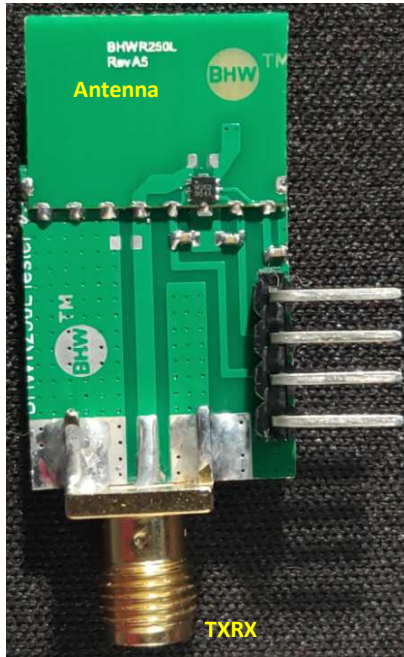


BHWR250A for Increasing Tx Power



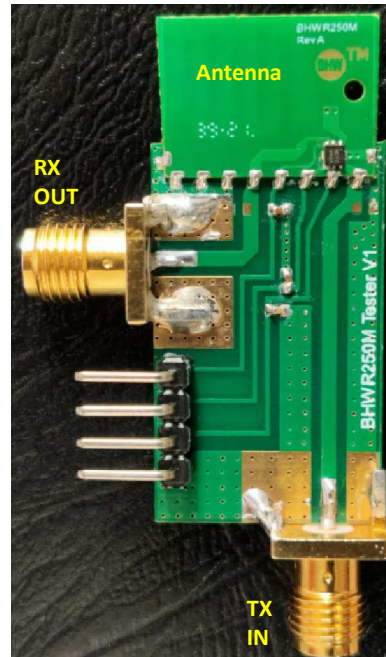
Size: 12x18x0.6mm
 Tx Pout: 12~14dBm
 Vdd: 3.3~4.2V
 Rx: N/A
 Switch IL: 1.3dB
 Reference:
 BHWR250A AppNote

BHWR250L for Improving Rx Sensitivity



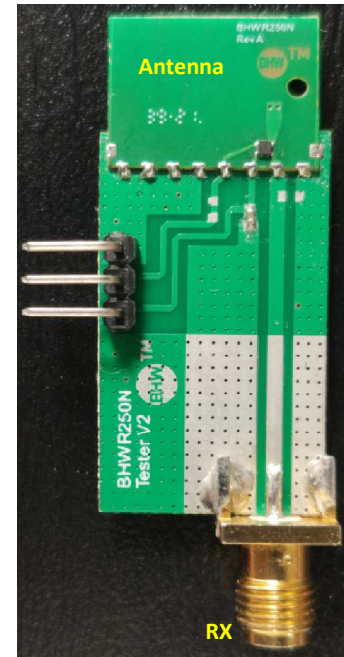
Size: 16x12x0.6mm
 Rx NF: 1.8dB
 Tx Pout: N/A
 Switch IL: 1.3dB
 Reference:
 BHW AppNote #020

BHWR250M for Improving both Tx & Rx



Size: 16x12x0.6mm
 Rx NF: 1.7dB
 Tx Pout: N/A (Port for
 Ext. PA or BHWM252)
 Switch IL: 0.7dB
 Reference:
 BHW AppNote #021

BHWR250N for AoA/AoD



Size: 16x12x0.6mm
 Rx NF: 1.0dB
 Low Current: ~7mA
 Reference:
 BHW AppNote #022

BHWR250 Slot Array Antenna



BHWR250:
 12x57x0.6mm Slot Array
 Reference:
 BHW AppNote #025

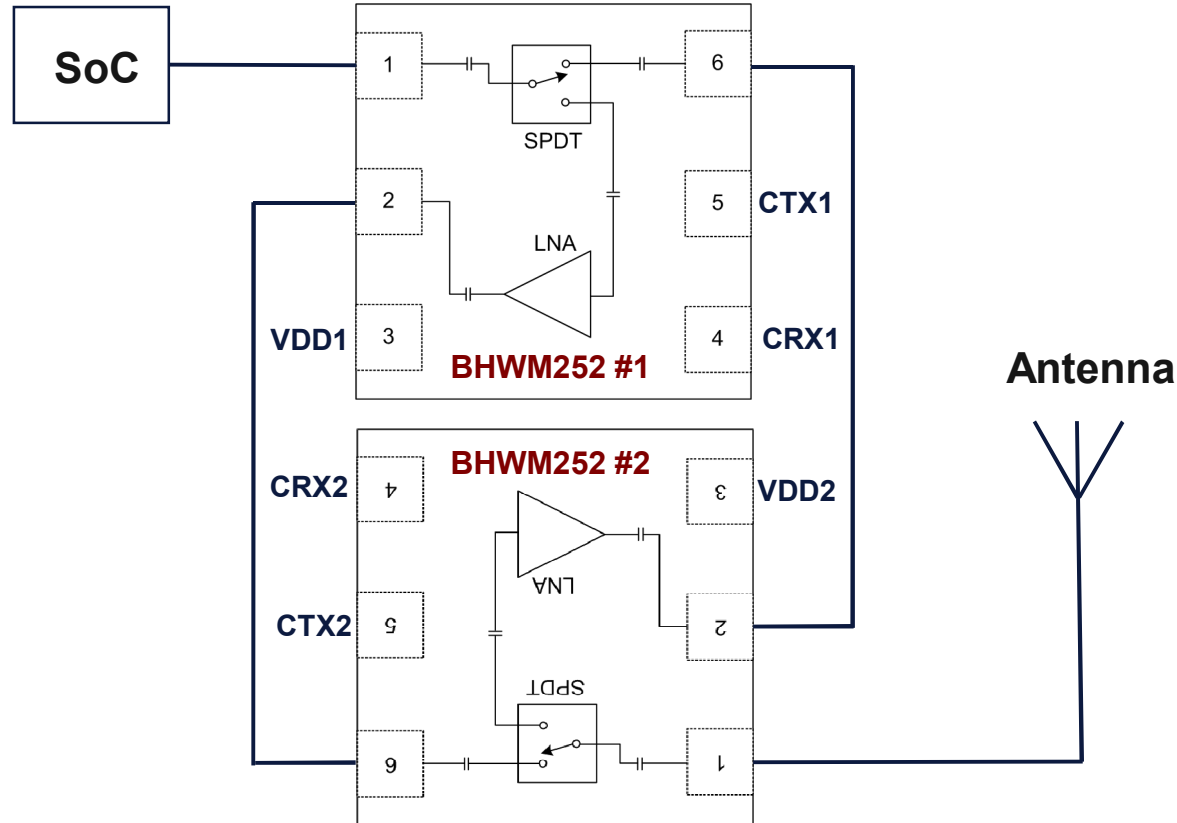
Notes:

- The antennas for BHW RFAiA are based on patented slot antenna architecture and less sensitive to PCB and plastic cover effects
- BHWR250 can be used as FPC antenna replacement and attached to the inner wall of the product cover for cost saving and better ID aesthetics

BHWM252 Cascade for Single-Port Application

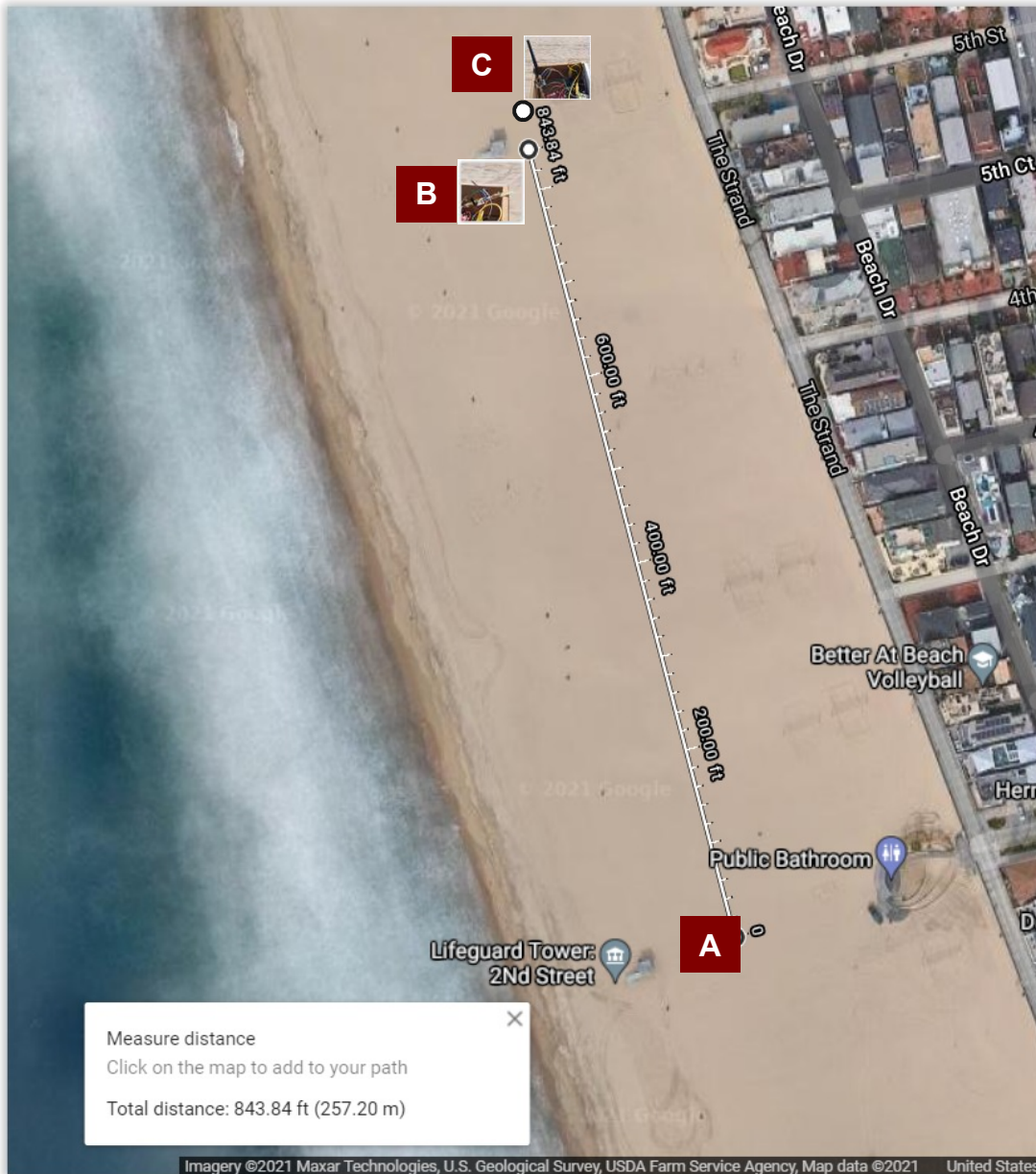


BHWM252 Cascade Topology & Advantages



- BHWM252 1.5x1.5mm DFN内部集成了放大器和开关。放大器可以用作LNA提升接收灵敏度，或者用作PA提升发射功率
- 如果需要同时提升收发性能，可以如上图所示级联两颗M252，推荐电压VDD1=3.3~4.2V, VDD2=1.8~3.3V
- 接收: CTX1=CRX2=1.8~3.3V, CRX1=CTX2=0, 电流约6~12mA, NF约1.7dB, 可实现几个dB的灵敏度提升 (SoC不同稍有差异)。由于开关损耗在LNA后级，接收灵敏度跟单独使用一颗M252几乎不变。
- 发射: CRX1=CTX2=1.8~3.3V, CTX1=CRX2=0, 天线端发射功率约13dBm时电流约25mA(3.3V)。虽然跟单独使用一颗M252相比，发射功率因后级开关损耗约0.7dB, 总体可实现5~10dB的发射功率提升 (SoC不同稍有差异)。
- 谐波抑制: 可以按传统方式在天线端设置Pi型低通滤波器 (接收灵敏度稍有降低) ; 也可以在第1/第2个M252之间实现谐波抑制, 满足发射模式时 FCC等验证要求, 保持接收NF~1.7dB不变

Qualcomm QCC3021 Rx Range Improvement Test #1



Source for Music Streaming:

Samsung Galaxy S10e

Placement: ~1.5m Tripod above Ground, Horizontal

Music Playback:

QCC3021 BLE Module with BHWM252 Cascade,
Vdd=3.2V, BHW250 57mm Slot & 100mm Dipole

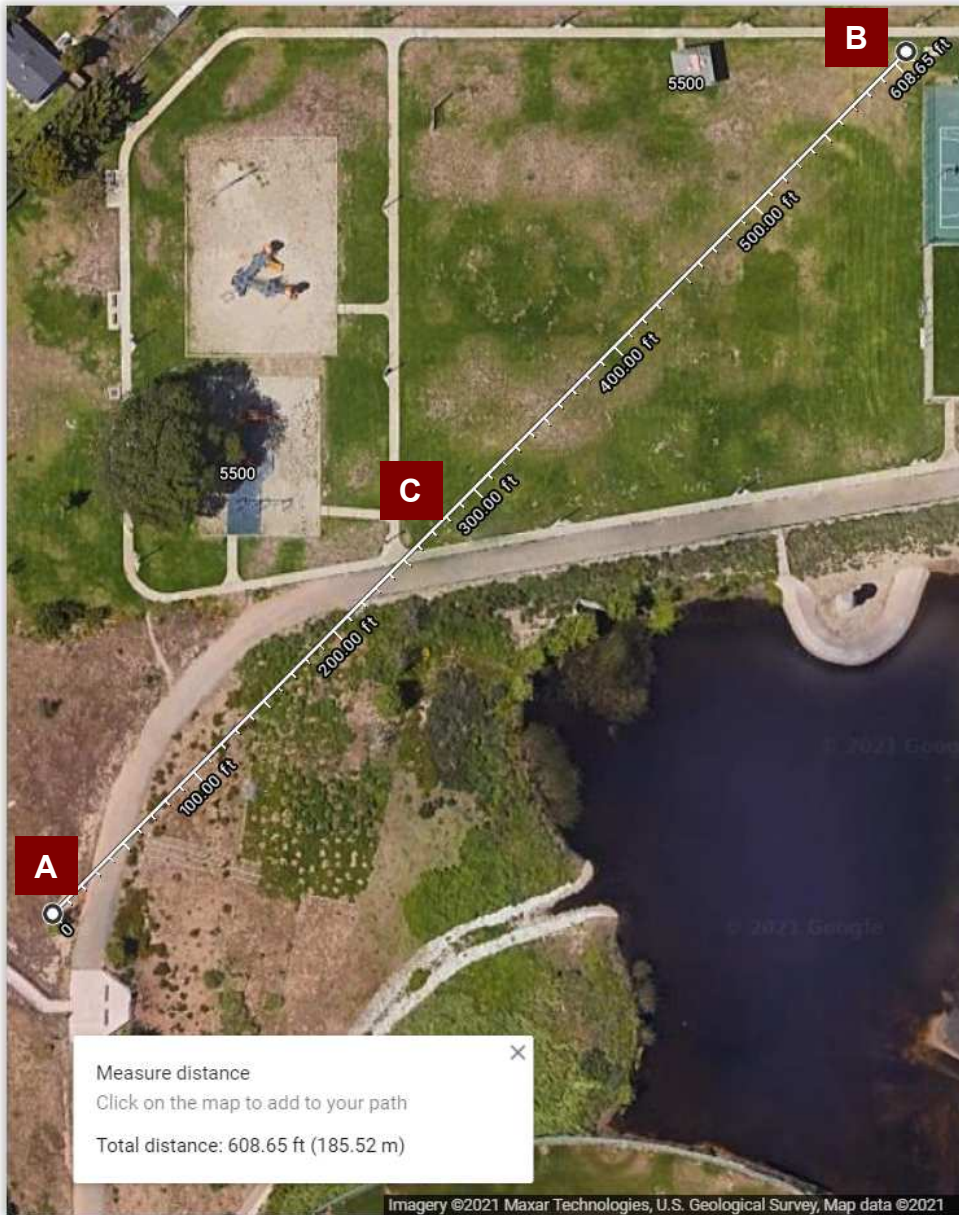
Range Test Result:

Site B (57mm Antenna): Maximum Range for Music
Playback ~257m, Open Space, Line-of-Sight

Site C (100mm Dipole Antenna): Maximum Range
~275m (Larger Antenna Has Higher Gain)



Qualcomm CSR8675 Tx Range Improvement Test



Source for Music Streaming:

Samsung Galaxy Connected to Vikefon in Tx Mode
Placement: Site A, ~1.5m above Ground, BHWR250 Antenna Oriented Vertically

Music Playback:

Boltune BT-BH010 Headphone Paired with Vikefon

Range Test Result:

Site B: ~185m, Max. Range for Music Playback

Site C: ~80m, Almost no Intermittency with Headphone on Ears and 360 Degree Rotation

Max. Range is Shorter than Rx Improvement, as Expected, due mainly to Blocking Effect with Headphone Test.



Site A: Audio Source & Tx, ~1.5m above Ground



Headphone for Receive, On Both Ears during Test

BHW RF Front-End AppNote Library



This is an abridged version of BHW AppNote #028. Please contact BHW Support or your local sales rep/distributor for a complete copy of the document and other related information.

BHW RF Front-End Solutions AppNote Library



In addition to standard datasheets and EVB/BOM info, BHW publishes an AppNote series that address various topics on RF front-end design and performance over a wide frequency range from 300MHz to 6GHz, as an effort to assist customers in developing cutting-edge, cost-competitive products:

- BHW AppNote #001 - Cross-Over Cascade of BHWM253 to Boost Tx Power and Rx Sensitivity of 2.4GHz Systems
- BHW AppNote #002 - Accurate Benchmark of GNSS CNO Using the Power-Splitter Method
- BHW AppNote #003 - Boosting Wi-Fi Tx Power and Rx Sensitivity with BHWA251 and BHWM252
- BHW AppNote #004 - UHF 900MHz RF Front-End Solution Using BHWA251 Half-Watt PA and BHWL160 Sub-1dB-NF LNA
- BHW AppNote #005 - Sub-1GHz Applications of BHWA350 2-in-1 Wideband Fully Matched Amplifier
- BHW AppNote #006 - Low-Noise High-IIP3 LNB Architecture for Dual-Band High-Precision GNSS Using Cascade of BHWL160
- BHW AppNote #007 - UWB RF Front-End Solution Using BHWA350 and BHWM552
- BHW AppNote #008 - High-Power 5.8GHz RF Front-End Solution Using BHWA555 and BHWM552 for ETC, V2X and Wireless Video
- BHW AppNote #009 - 5.8GHz RF Front-End Using BHWA350 and BHWM552 for Wireless Audio
- BHW AppNote #010 - Multi-Constellation GNSS Active Antenna Using BHWL161 Cascade and Single-Fed Dual-Band Antenna
- BHW AppNote #011 - BHWL161 Super-Compact Low-Power Low Noise Amplifier for Range Extension of 2.4GHz RC and IoT
- BHW AppNote #012 - Enabling Cost-Effective High-Precision GNSS Using BHWL161 and Linear-Polarization PCB Antenna
- BHW AppNote #013 - GNSS Noise Floor vs Receiver Architecture
- BHW AppNote #014 - Designing Ultra Low-Power High-Performance GNSS Products Using BHWL160 GaAs PHEMT LNA
- BHW AppNote #015 - BHWL161 GNSS Full-Band High-Performance LNA in Super-Compact 1x1mm DFN with Relaxed Pin Pitch
- BHW AppNote #016 - Improving GNSS NF Measurement Accuracy Using Broadband LNA BHWL161 as Pre-Amp
- BHW AppNote #017 - High-Efficiency, Low-NF 2.4GHz Front-End Solution for IoT Using BHWA251 and BHWM252
- BHW AppNote #018 - Optimizing BHWA555 Wideband One-Watt PA for Long-Range 5.8GHz Transmitter Applications
- BHW AppNote #019 - Miniature 2.4GHz RF Front-End with Integrated Chip Antenna and BHWM253 for TWS and IoT
- BHW AppNote #020 - Multiplying the Range for 2.4GHz Music Streaming with BHWR250L Active Integrated Antenna (AiA)
- BHW AppNote #021 - Range Extension for 2.4GHz Wireless Systems with BHWR250M Active Integrated Antenna (AiA)
- BHW AppNote #022 - Enabling Long-Range Angle-of-Arrival for High-Precision Indoor Positioning with BHWR250N RF AiA
- BHW AppNote #023 - Extend the Range for 5.8GHz Audio/Video Streaming with BHWR580M Active Integrated Antenna (AiA)
- BHW AppNote #024 - Improving 5.8GHz Radio Link Budget with BHWR580L Active Integrated Antenna (AiA)
- BHW AppNote #025 - Improving Range and Throughput of 2.4GHz Wi-Fi with BHWR250 Array Antenna
- BHW AppNote #026 - Improving Range and Throughput of 5GHz Wi-Fi with BHWR550 Array Antenna
- BHW AppNote #027 - Multi-Band High-Accuracy GNSS Solutions Using BHWP150 DFN1x1 Ultra-Compact Power Divider & Combiner
- BHW AppNote #028 - Use BHWM252 Cascade to Extend Range of 2.4GHz Wireless Systems with Single-Port SoCs
- BHW AppNote #029 - Improving Range of 2.4GHz Wireless Microphones and Audio Systems with BHWR250A Active Integrated Antenna (AiA)
- BHW AppNote #030 - Simultaneous Improvement in Range and Battery Life of 2.4GHz Wireless Systems with BHWR250M AiA

Contact support@bhwtechnologies.com or BHW distributors/representatives for your copy of the above and new up-coming documents.