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 #013

GNSS Noise Floor vs Receiver Architecture

Rev. 1.1

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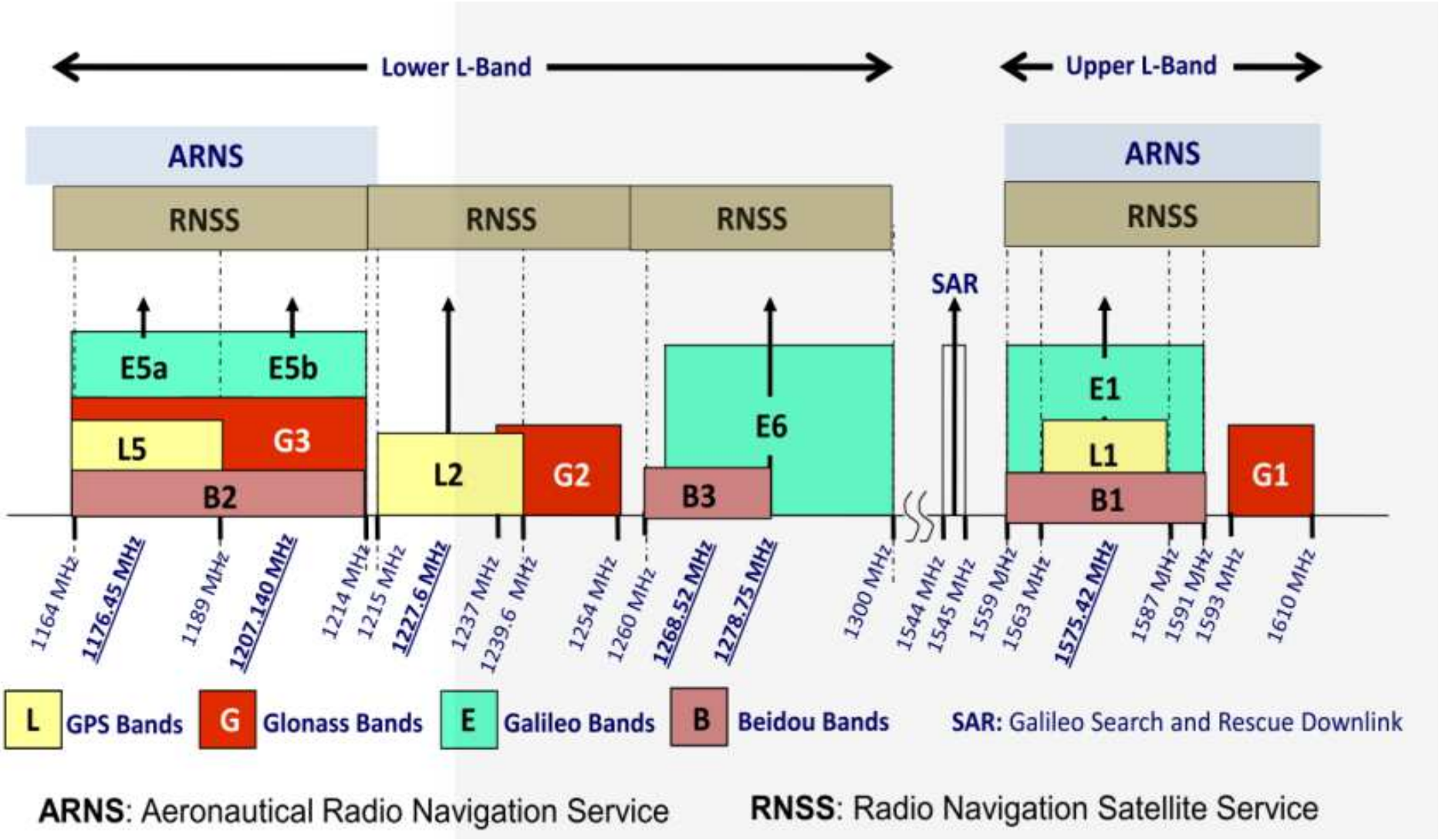
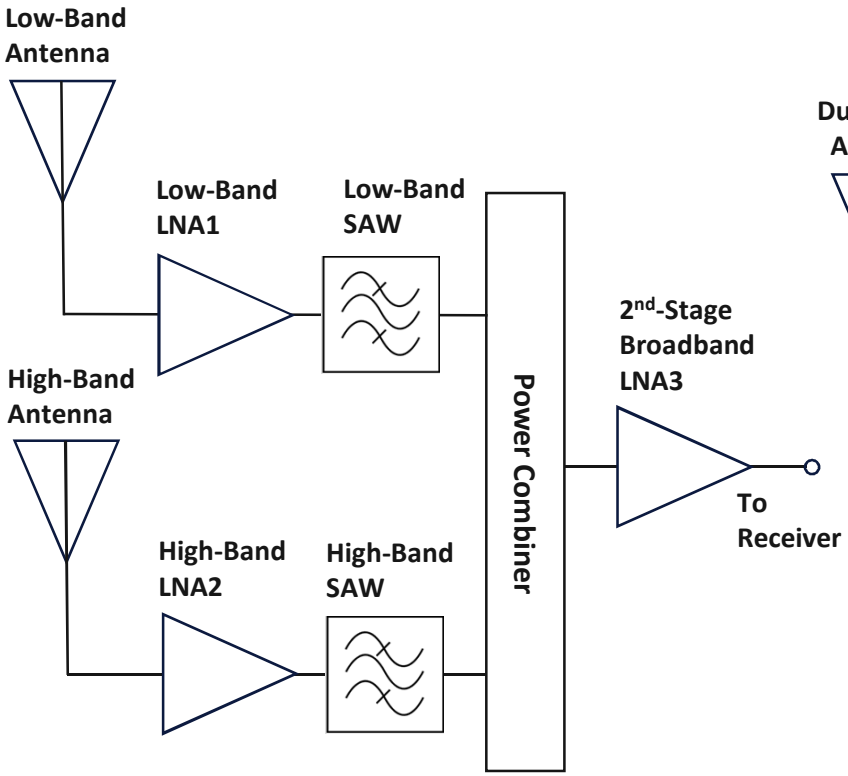
ARNS/RNSS Bands for GNSS

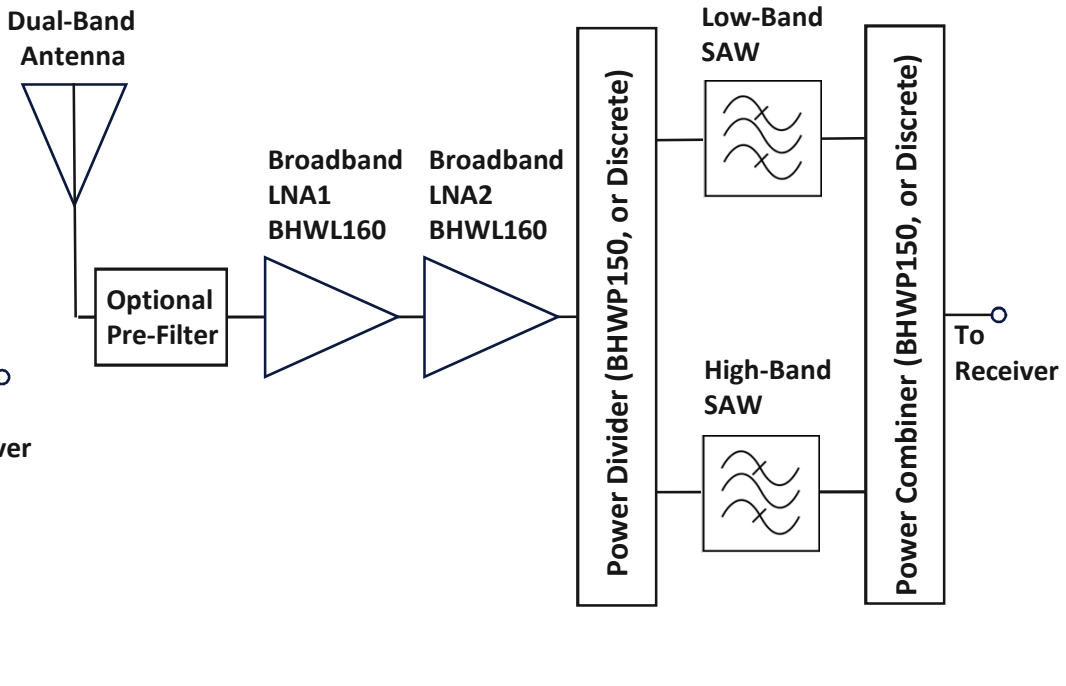


Receiver Topologies for Dual/Multi-Band GNSS

Conventional Topology A
Dual-Antenna/Dual-LNA



BHW Proposal Topology B
Single-Antenna/Broadband-LNA

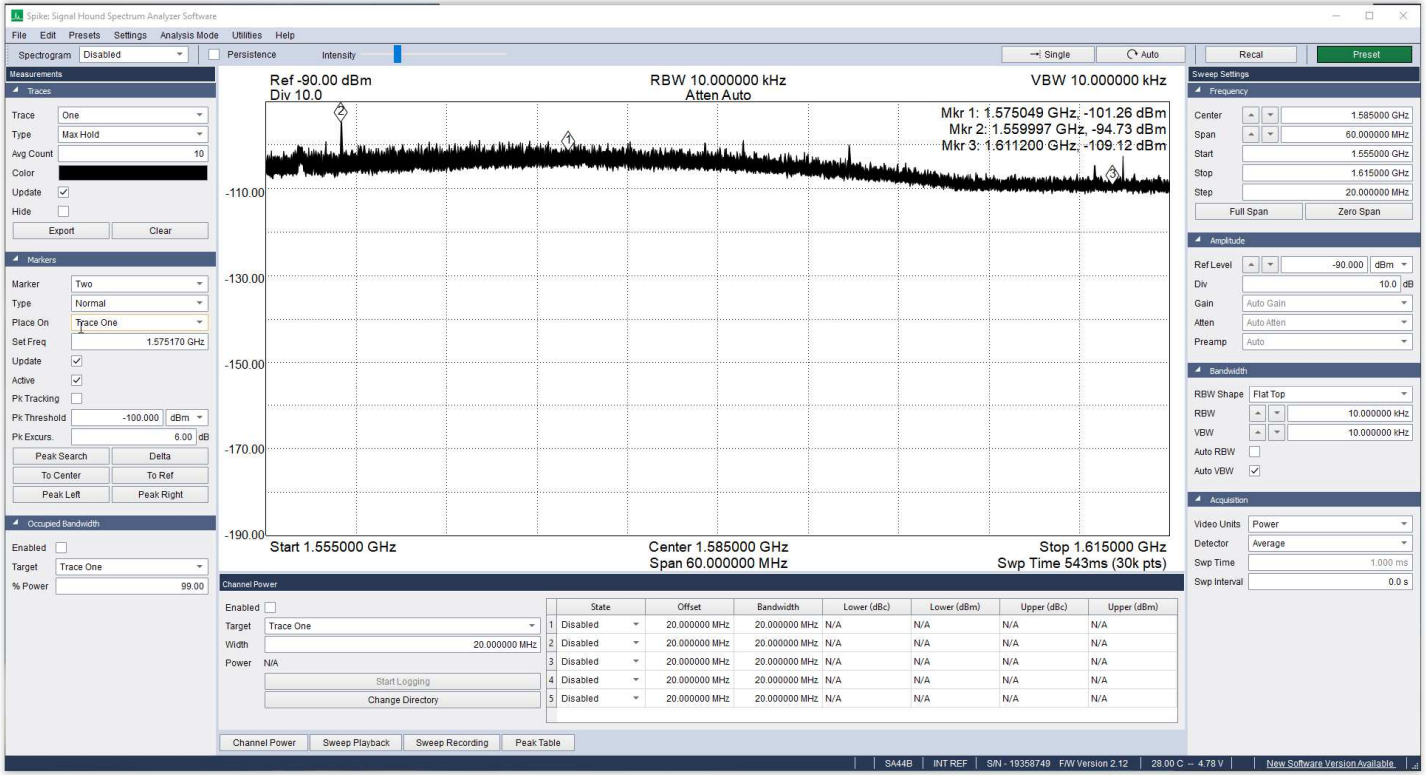


Notes:

- Most current dual-band GNSS designs use Topology A, based on separate antennas and LNAs for low and high band
- Dual/Multi-Band GNSS receiver with broadband antenna and LNA (Topology B) has huge size and cost advantages over dual-antenna/ dual-LNA based topology
- Full-band all-constellation LNAs with state-of-art RF performance are available today, such as BHWL160/BHWL161
- Concerns over potential interference/desensitization for broadband design is address by high input P1dB/IIP3 of the LNA
- Topology B takes full advantage of BHWL160/BHWL161's broadband, low-NF, moderate gain and outstanding IIP3 to enable multi-band GNSS LNBs (Low Noise Block) with best system NF and IIP3 at minimal device count, power, and BOM cost
- An optional double-notch pre-filter can be added between the antenna and LNA to further improve anti-jamming capability of the GNSS system significantly, while causing only very minor degradation in C/N0 and TTFF from cold start

GPS L1 Noise Floor vs Receiver Architecture

Noise Floor with GPS L1 Antenna followed by BHWL160 and SAW Filter
In-Band Noise Floor ~ -141dBm/Hz at ~1575MHz
OOB Noise Floor ~ -149dBm/Hz at ~1612MHz



SA: Signal Hound USB-SA44B, Range 1555-1615MHz RBM=VBW=10KHz, MaxHold

GPS L1 Noise Floor vs Receiver Architecture

Noise Floor with GPS L1 Antenna followed by SAW then BHWL160
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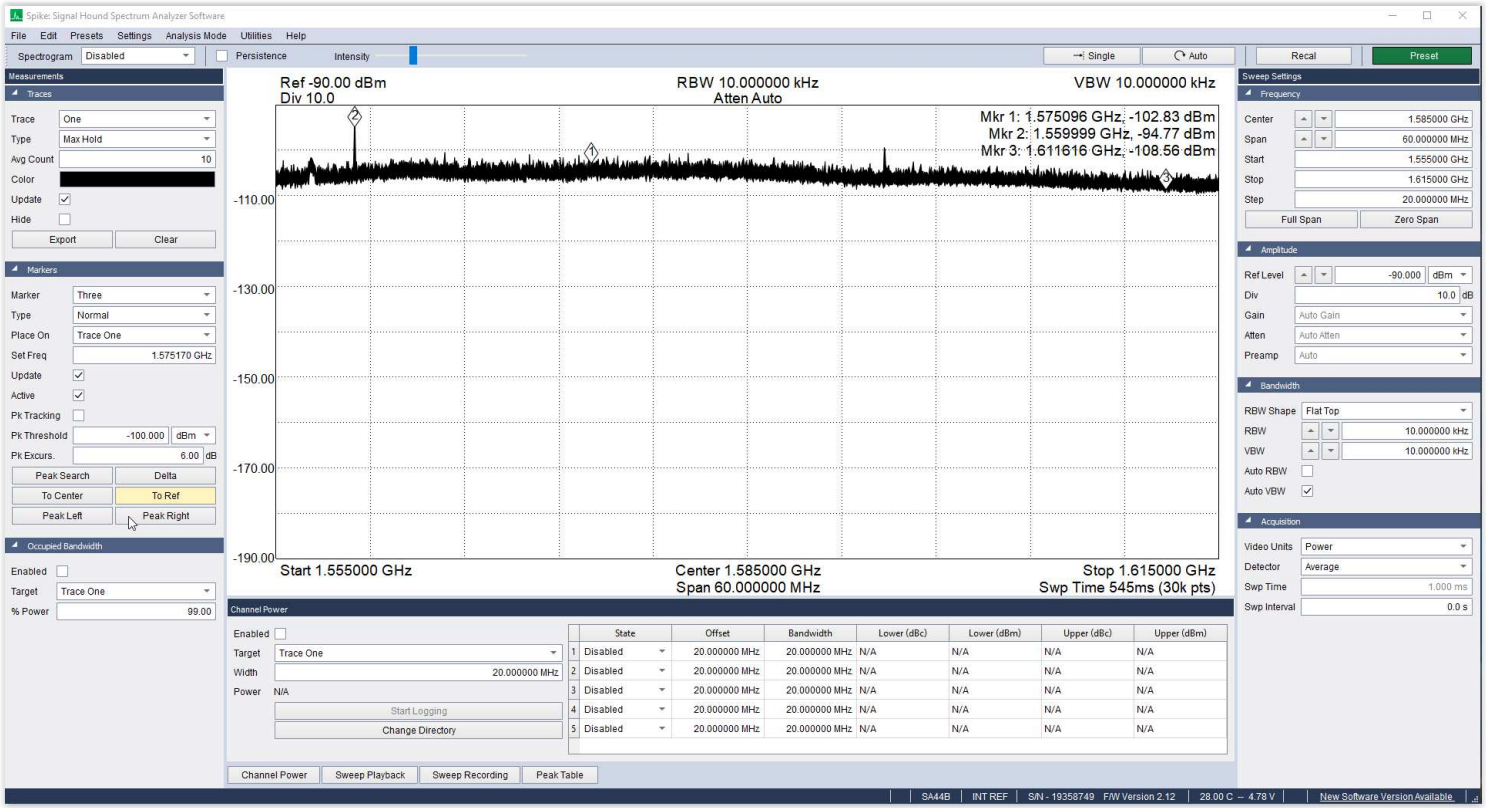

SA: Signal Hound USB-SA44B, Range 1555-1615MHz RBM=VBW=10KHz, MaxHold

GPS L1 Noise Floor vs Receiver Architecture

Summary

- GPS receiver architecture with SAW preceding LNA has slightly lower in-band noise floor but much higher noise figure (~1.5dB including ~1dB/SAW and ~0.5dB/LNA)

- GPS receiver architecture with LNA preceding SAW has slightly higher in-band and similar OOB noise floor, but much lower NF (~0.5dB for BHWL160)

- GPS receiver architecture with SAW preceding LNA is much more complicated and expensive since low/high-band selection/filtering has to be implemented before low-noise amplification, resulting in higher system NF and lower C/N0

- GPS dual/multi-band receiver architecture with single-fed antenna, single broadband LNA (BHWL160/L161) can greatly relief the burden on SAW selection, providing the most cost-effective solution while achieving best-class performance at the same time

- GPS dual/multi-band receivers based on BHWL160/L161 has consistently delivered maximum C/N0 of 52~53dB in both L5 and L1 bands, beating industry's state-of-the-art performance (50dB or lower for dual-band receivers)

BHW RF Front-End AppNote Library

This is an abridged version of BHW AppNote #013. 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 CN0 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

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