BHW Technologies (博泓微科技有限公司)

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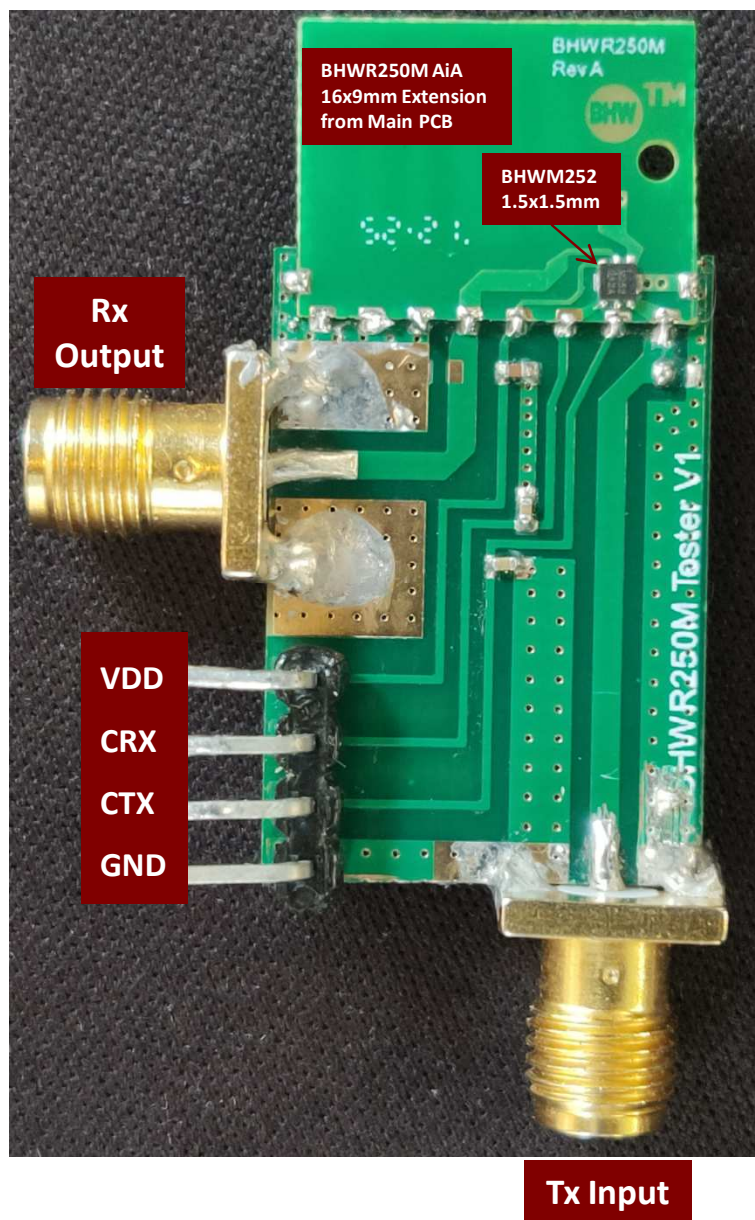
RF Chips & Beyond

BHW AppNote #021

Range Extension for 2.4GHz Wireless Systems with BHWR250M Active Integrated Antenna (AiA)

Rev. 3.3

www.bhw-tech.com

BHWR250M AiA for 2.4GHz System Range Extension

BHWR250M AiA 16x9mm Extension from Main PCB

BHWM252 1.5x1.5mm
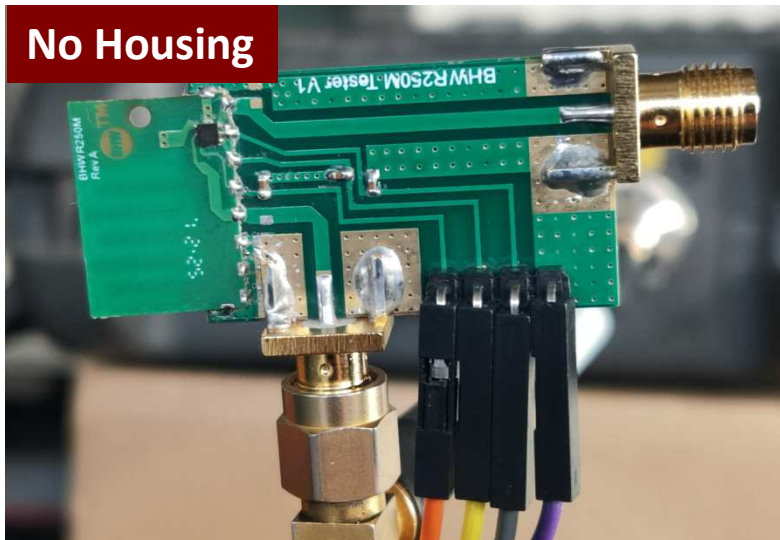
Rx Output

VDD
CRX
CTX
GND

Tx Input

Features & Benefits:

➢ Innovative, Patented RF Active Integrated Antenna (RFAiA™) Architecture

➢ Compact Size: 16x12x0.6mm Total Size, Including Antenna and BHWM252 Front-End IC

➢ Simple Surface-Mount Interface to Main Product PCB

➢ 12x9mm Extension from Edge of Main PCB

➢ Minimum and Relaxed RF Design for Main PCB

➢ Comparable Antenna Efficiency to Much Larger Dipoles

➢ Industry-Leading Noise Figure: ~1.7dB at Antenna

➢ Low Insertion Loss for Tx Switch: ~0.7dB

➢ Significant Improvement in Rx Sensitivity (4~6dB)

➢ Option to Combine with a Second BHWM252 for Complete Tx/Rx FEM with PA/LNA for Single-Port SoCs

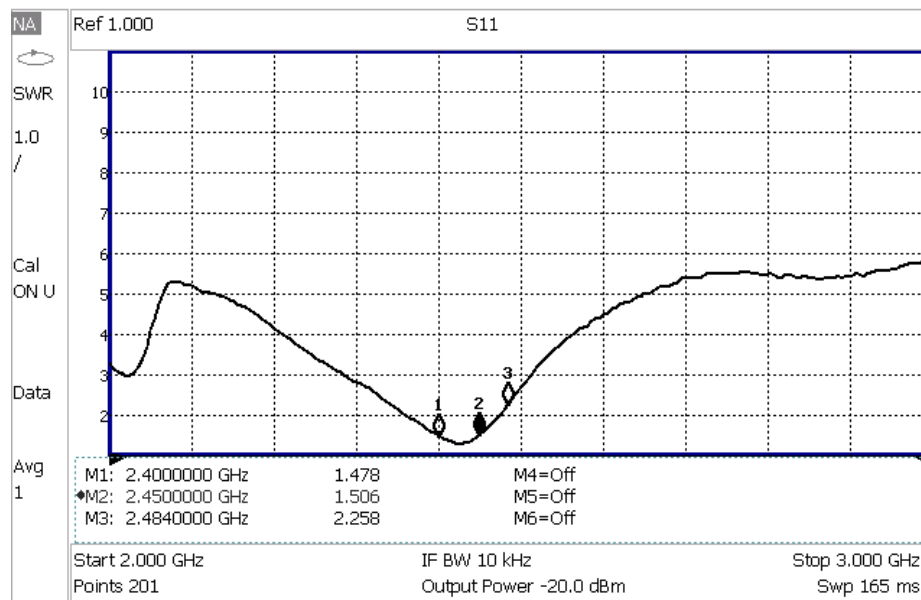➢ Maximum Range of >300 Meters Achieved for Audio Streaming with BHWR250M & BHWM252 Combo
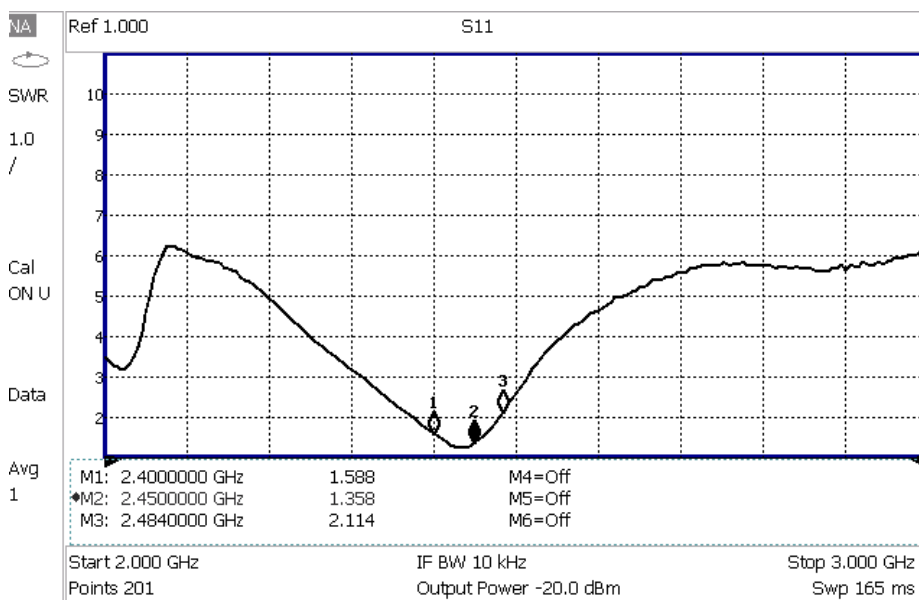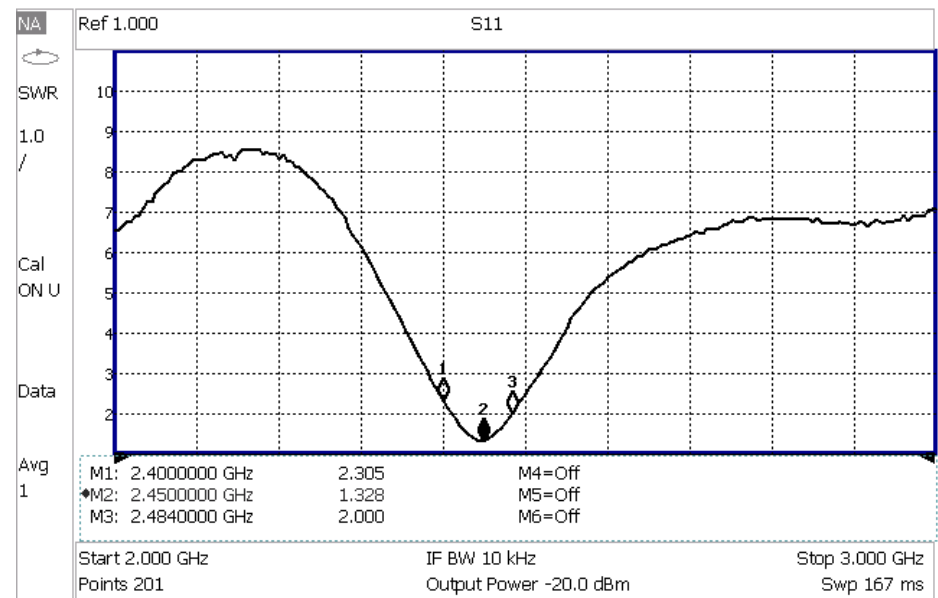
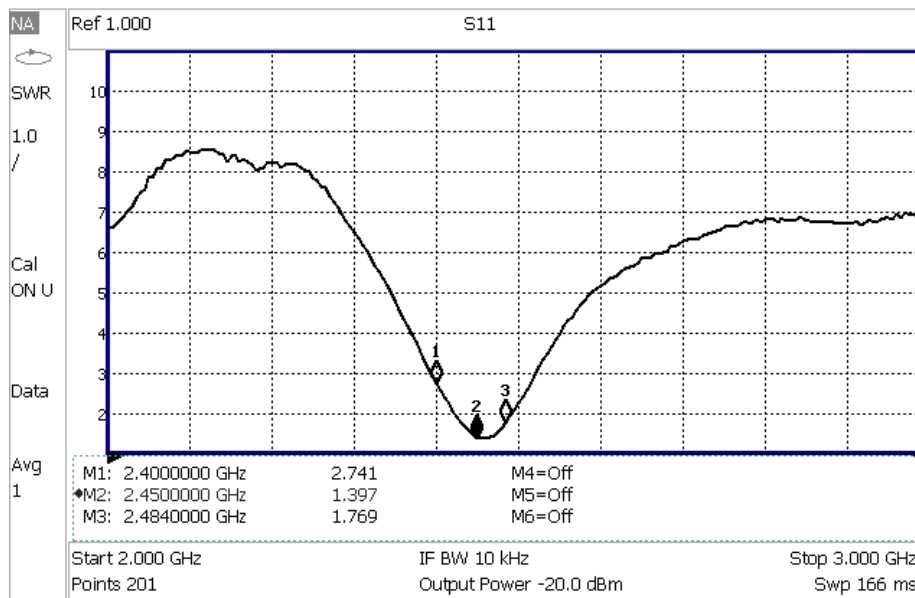# BHWR250M Input VSWR for Rx Mode

No Housing

With Housing

No Housing S11 measurement:

M1: 2.4000000 GHz	1.588	M4=Off
M2: 2.4500000 GHz	1.358	M5=Off
M3: 2.4840000 GHz	2.114	M6=Off

Ref 1.000   S11   SWR 1.0 /
Cal ON U
Data
Avg 1
Start 2.000 GHz   IF BW 10 kHz   Stop 3.000 GHz
Points 201   Output Power -20.0 dBm   Swp 165 ms

With Housing S11 measurement:

M1: 2.4000000 GHz	1.478	M4=Off
M2: 2.4500000 GHz	1.506	M5=Off
M3: 2.4840000 GHz	2.258	M6=Off

Ref 1.000   S11   SWR 1.0 /
Cal ON U
Data
Avg 1
Start 2.000 GHz   IF BW 10 kHz   Stop 3.000 GHz
Points 201   Output Power -20.0 dBm   Swp 165 ms

Note: Vdd=CRX=3.3V, CTX=0V

BHWR250M Input VSWR for Tx Mode

No Housing

With Housing
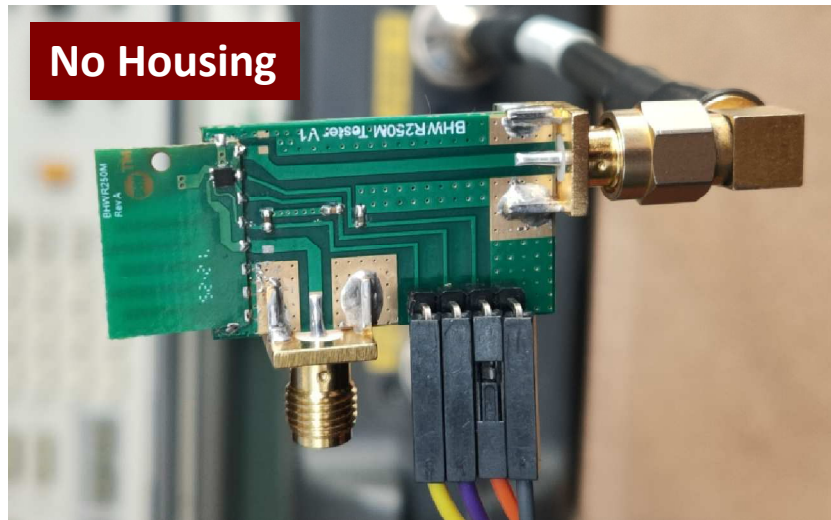
Note: Vdd=CTX=3.3V, CRX=0V

BHWR250M Radiation Pattern: 3D Plots

BHWR250M
2400MHz

BHWR250M
2450MHz

BHWR250M
2500MHz
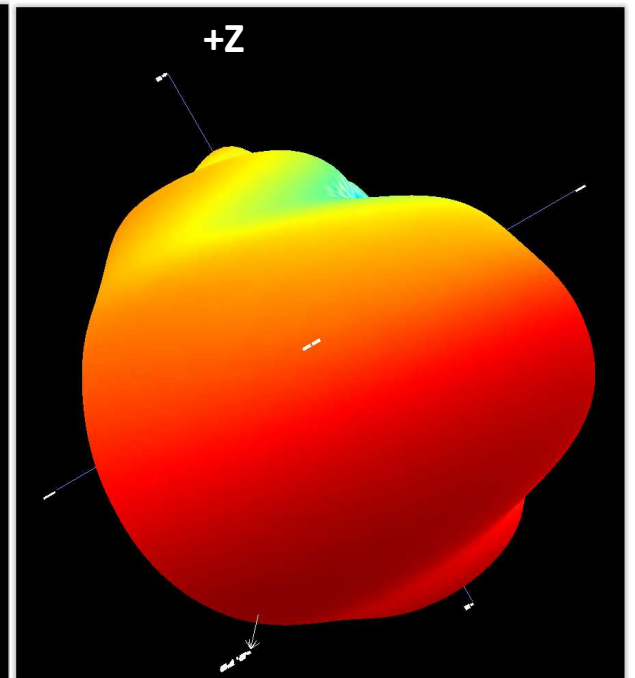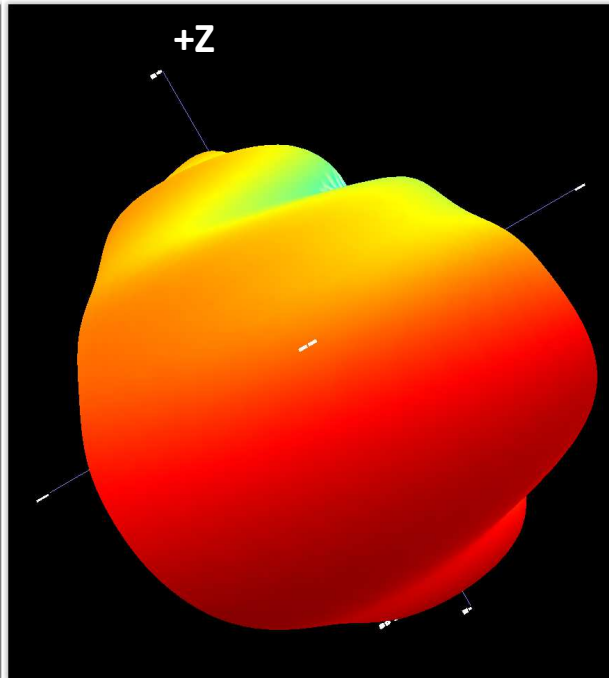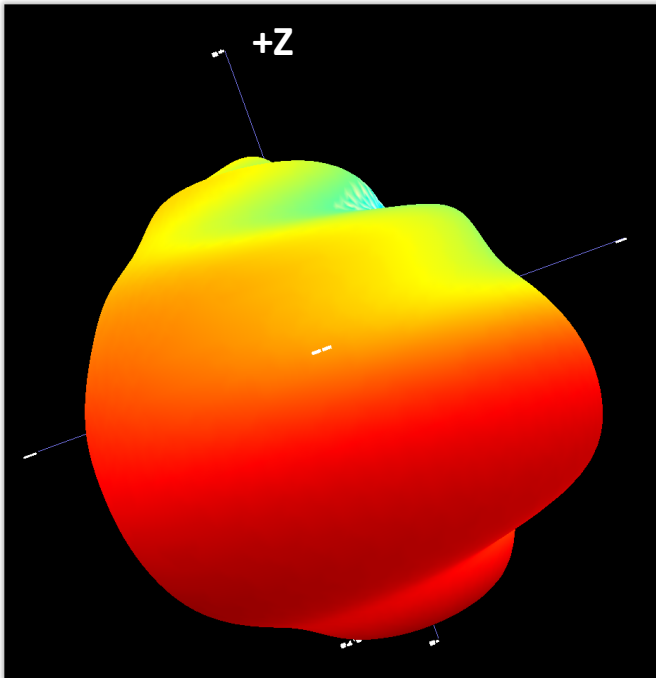
Note: mwShowOGL 3D plot setting: X=90, Y=210, Z=0.
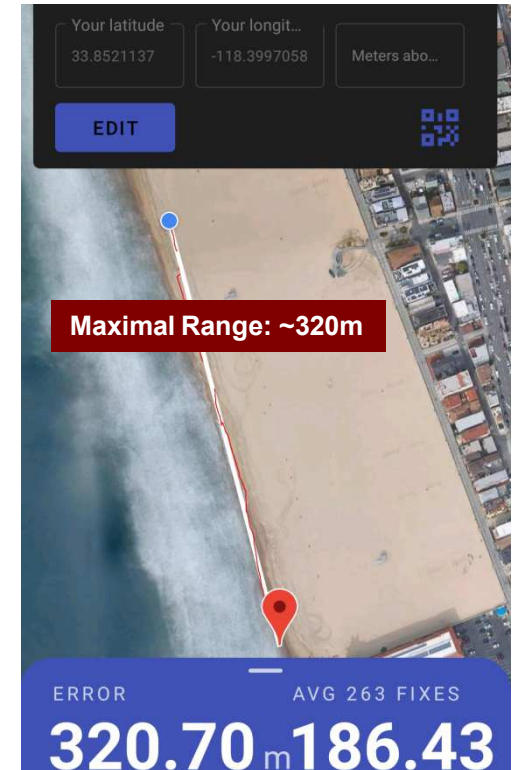
Case Study: BHWR250M+M252 BLE Range Extender

Transmitter Antenna Height: ~1.5m

Tx Antenna Vertical Orientation

Tx Antenna Horizontal Orientation

Your latitude	Your longit...	
33.8521137	-118.3997058	Meters abo...

EDIT

Maximal Range: ~306m

ERROR — AVG 359 FIXES
306.06m 181.03

Your latitude	Your longit...	
33.8521137	-118.3997058	Meters abo...

EDIT

Maximal Range: ~320m

ERROR — AVG 263 FIXES
320.70m 186.43
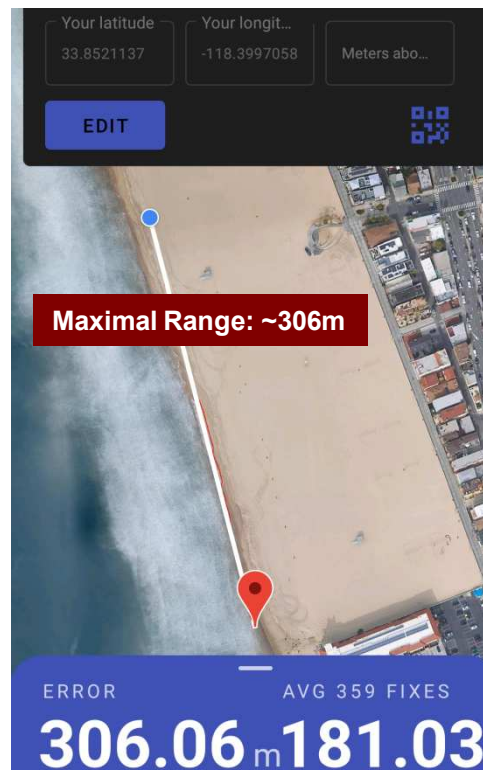
Note: Boltune BT-BH010 headphone used for audio receive. Test result for maximum range depends on RF front-end performance and antenna orientation of the receiver.

BHW RF Front-End AppNote Library

This is an abridged version of BHW AppNote #021. 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

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