# WiFi Network Extension Equipment Guide

## For 3-5km Range in Zimbabwe

---

## Project Overview

**Current Setup:** We have a Mikrotik hAP ac² router serving authenticated WiFi users at our main location.

**Goal:** Extend internet connectivity to a remote location 3-5km away without running physical cables.

**Solution:** Create a wireless bridge (like an invisible Ethernet cable through the air) using outdoor antennas.

---

## Complete Equipment List

### STARTING POINT: Our Mikrotik hAP ac²

**What we already have:** - Mikrotik hAP ac² router - Active internet connection - User authentication system configured

**What it does:** - Manages all users and authentication - Assigns IP addresses (DHCP) - Provides security and firewall - Remains the "brain" of our network

**What changes:** - Nothing! It stays exactly as configured - We simply connect one outdoor antenna to any available LAN port

---

### 1. ETHERNET CONNECTION FROM MIKROTIK

**Outdoor-Rated Ethernet Cable** **Why we need it:** Connects our Mikrotik router inside our building to the outdoor antenna on our roof/pole. Regular indoor cables deteriorate in sun and rain.

**Specifications:** - **Type:** Cat5e or Cat6 Outdoor-rated (UV resistant, gel-filled or solid core) - **Length:** Measure the distance from our Mikrotik to where we'll mount the antenna (usually 20-50 meters) - **Connectors:** RJ45 connectors on both ends (pre-made or crimp our own)

**Options:** 1. **Pre-made outdoor patch cable** - Ready to use, weatherproof connectors - Price: ~$1.00 per meter

2. **Bulk outdoor cable + connectors** - For custom lengths
   - Cable price: ~$0.50-0.80 per meter
   - RJ45 connectors: ~$0.50 each (need 2)
   - Crimping tool: ~$10-15 (one-time purchase)

**Recommended brand:** AMP, Belden, or generic outdoor-rated Cat6

**Quantity needed:** 1 cable (length depends on our building)

---

### 2. OUTDOOR WIRELESS BRIDGE UNITS (Main Equipment)

**Why we need these:** These are specialized outdoor antennas that create a focused, long-distance wireless link. Think of them as two megaphones pointing at each other - one "shouts" our internet signal, the other "listens" and receives it perfectly over 3-5km.

**We need 2 units:** One at our main location (transmitter) and one at the remote location (receiver).

---

### OPTION A: UBIQUITI (Most Popular, Easy to Configure)

**Ubiquiti NanoBeam 5AC Gen2 Model Number:** NBE-5AC-Gen2

**Why this model:** - Purpose-built for point-to-point links up to 5km+ - Very easy to configure (web interface in English) - Excellent in Zimbabwe climate (tested in similar conditions) - Strong signal even in light rain - Great value for money

**Technical Specifications:** - **Frequency:** 5GHz (5150-5875 MHz) - **Antenna Type:** Integrated 19 dBi directional dish antenna - **Maximum Throughput:** 450+ Mbps real-world speed - **Range:** 3-5km (up to 10km in ideal conditions) - **Power:** 24V Passive PoE (PoE injector included in box) - **Weatherproof Rating:** Outdoor rated, -30°C to +70°C - **Mounting:** Integrated pole mount bracket included - **Interface:** 1x Gigabit Ethernet port - **Configuration:** Web-based (airOS), smartphone app available - **Beam Width:** 30° (focused, not wide spread)

**What's in the box:** - NanoBeam antenna unit - PoE injector with power cable - Pole mounting bracket - Quick start guide

**Setup difficulty:** Easy (rate: 2/5)

**Price per unit:** $80-110 USD

**Quantity needed:** 2 units (one for main location, one for remote)

**Total cost:** $160-220 USD

---

**Ubiquiti NanoBeam 5AC Gen2 with Long Range Model Number:** NBE-5AC-19

**Why this model:** - Same as Gen2 but optimized for maximum distance - Best choice if your link is close to 5km or has obstacles

**Technical Specifications:** - **Frequency:** 5GHz - **Antenna:** 19 dBi directional - **Range:** Up to 15km capable - **Everything else:** Same as Gen2 above

**Price per unit:** $90-120 USD

**Quantity needed:** 2 units

**Total cost:** $180-240 USD

---

**OPTION B: MIKROTIK (Budget-Friendly, Professional)**

**Mikrotik LHG 5 Model Number:** RBLHG-5nD

**Why this model:** - Same brand as our main router (familiar interface) - Lower cost than Ubiquiti - Excellent build quality - Larger dish = better signal in bad weather - Works perfectly with our hAP ac²

**Technical Specifications:** - **Frequency:** 5GHz (4900-6100 MHz) - **Antenna Type:** Integrated 24.5 dBi parabolic dish antenna - **Maximum Throughput:** 300 Mbps - **Range:** 3-5km easily (tested up to 15km) - **Power:** 802.3af/at PoE (PoE injector included) - **Weatherproof Rating:** IP55 (fully outdoor rated) - **Mounting:** U-bolt mount included (fits 30-80mm poles) - **Interface:** 1x Gigabit Ethernet port - **Configuration:** RouterOS (same as your hAP ac²) - **Beam Width:** 7° (very focused beam)

**What's in the box:** - LHG 5 antenna unit - 24V PoE injector with power cable - Pole mounting kit (U-bolts) - RouterOS license Level 3

**Setup difficulty:** Medium (rate: 3/5) - requires RouterOS knowledge, but we already know this!

**Price per unit:** $60-85 USD

**Quantity needed:** 2 units

**Total cost:** $120-170 USD

---

**Mikrotik LHG XL 5 Model Number:** RBLHGR&R11e-LTE

**Why this model:** - Larger dish (27 dBi) = maximum possible range - Best for exactly 5km or difficult terrain - Premium Mikrotik option

**Technical Specifications:** - **Antenna:** 27 dBi parabolic dish (larger physical size) - **Range:** Excellent for 5km+ - **Everything else:** Similar to LHG 5

**Price per unit:** $90-120 USD

**Quantity needed:** 2 units

**Total cost:** $180-240 USD

---

**OPTION C: TP-LINK (Budget Option)**

**TP-Link CPE710 Model Number:** CPE710

**Why this model:** - Most affordable option for 5km - Easy setup (similar to home routers) - Good enough for basic needs - TP-Link Pharos app for smartphone setup

**Technical Specifications:** - **Frequency:** 5GHz (5150-5875 MHz) - **Antenna Type:** 23 dBi directional panel - **Maximum Throughput:** 450 Mbps - **Range:** Up to 5km - **Power:** Passive PoE (PoE adapter included) - **Weatherproof Rating:** IP65 - **Mounting:** Pole mount kit included - **Interface:** 1x Gigabit Ethernet port - **Configuration:** Web interface (very simple)

**What's in the box:** - CPE710 unit - Passive PoE injector - Power adapter - Mounting kit - Reset tool

**Setup difficulty:** Very Easy (rate: 1/5)

**Price per unit:** $50-75 USD

**Quantity needed:** 2 units

**Total cost:** $100-150 USD

**Note:** Slightly less reliable than Ubiquiti/Mikrotik in harsh weather

---

**3. POWER INJECTION (PoE)**

**Why we need it:** Outdoor antennas need power, but running separate power cables is dangerous and impractical. PoE (Power over Ethernet) sends both data AND power through the same Ethernet cable.

**What's included:** All outdoor antennas above come with PoE injectors in the box.

**How it works:** 1. PoE injector plugs into AC power outlet (220V in Zimbabwe) 2. One Ethernet port connects to our Mikrotik 3. Other port connects to outdoor antenna 4. Power travels through the Ethernet cable to the antenna

**Additional PoE injectors only needed if:** - Our package is missing one - We're buying second-hand equipment

**Backup PoE injector options:** - Ubiquiti compatible: Any 24V passive PoE injector (~$10-15) - Mikrotik compatible: Any 802.3af/at PoE injector (~$15-25) - TP-Link compatible: Passive PoE adapters (~$8-12)

---

### 4. LIGHTNING & SURGE PROTECTION

**Why you need it:** Zimbabwe has intense thunderstorms. Lightning can travel through Ethernet cables and destroy your equipment. A $20 surge protector can save $500+ in equipment.

**How it protects:** Diverts electrical surges to ground before reaching your equipment.

**Ubiquiti Ethernet Surge Protector Gen2** **Model Number:** ETH-SP-G2

**Specifications:** - **Protection:** Gas discharge tube + surge protection - **Ports:** In/Out Ethernet (passthrough) - **Grounding:** Requires proper ground connection - **Speed:** Gigabit passthrough (no speed loss) - **Weatherproof:** Yes, outdoor rated

**Installation:** Connect between PoE injector and outdoor antenna

**Price:** $15-20 USD each

**Quantity needed:** 2-4 units - Minimum: 1 at each outdoor antenna (2 total) - Recommended: 1 at each end of every outdoor cable (4 total)

**Total cost:** $30-80 USD

**Alternative Options:** **APC/Belkin Ethernet Surge Protectors** - Price: $10-15 each - Widely available in Zimbabwe

**Mikrotik RBGESP** - Price: ~$25 USD - Built specifically for Mikrotik devices

---

### 5. MOUNTING HARDWARE

**Why we need it:** Our outdoor antennas must be mounted high (roof/pole) with clear line-of-sight to each other. No trees, buildings, or hills blocking the path.

**What you need at EACH location (x2): A. Mounting Pole/Mast** - **Type:** Galvanized steel pipe - **Diameter:** 32-50mm (1.25-2 inches) - **Length:** 2-4 meters (depends on our building height) - **Why:** Raises antenna above roof line for clear signal path

**Where to buy:** Local hardware stores, steel fabricators **Price:** $10-20 USD per pole

---

**B. Roof/Wall Mounting Brackets** - **Type:** Heavy-duty L-brackets or tripod base - **Material:** Galvanized steel or stainless steel (rust-proof) - **Includes:** Bolts, nuts, washers

**Where to buy:** Hardware stores, satellite TV installers **Price:** $8-15 USD per set

---

**C. Guy Wires (for tall poles)** - **Type:** Steel cable or galvanized wire - **When needed:** If pole is taller than 3 meters - **Why:** Prevents pole from bending in strong wind

**Price:** $5-10 USD per location

---

**D. U-Bolts and Clamps** - **Usually included** with antennas, but good to have extras - **Size:** Match our pole diameter

**Price:** $2-5 USD per set

---

**E. Weatherproofing Materials** - **Self-amalgamating tape:** Seals cable connections - **Cable ties:** UV-resistant (black, not white) - **Silicone sealant:** For entry points into buildings

**Price:** $5-10 USD for complete weatherproofing kit

---

**Total mounting cost per location:** $30-60 USD **Total for both locations:** $60-120 USD

---

### 6. WIFI ACCESS POINT FOR REMOTE LOCATION

**Why we need it:** The outdoor antenna receives the signal, but users can't connect directly to it. We need a regular WiFi access point at the remote location for phones, laptops, etc. to connect.

**OPTION A: Outdoor Access Point (Recommended)**

**TP-Link EAP110-Outdoor** **Model Number:** EAP110-Outdoor

**Why this model:** - Weatherproof (can mount outside) - Wide coverage (100+ meters radius) - Easy setup - Good for outdoor or semi-outdoor spaces

**Specifications:** - **Frequency:** 2.4GHz - **Speed:** 300 Mbps - **Range:** Up to 200 meters outdoor coverage - **Power:** Passive PoE (adapter included) - **Weatherproof:** IP64 rated - **Users:** Up to 100 simultaneous connections - **Mounting:** Pole or wall mount

**Price:** $35-50 USD

**Quantity needed:** 1 unit (or more depending on coverage area needed)

---

**Ubiquiti UniFi AP AC Mesh** **Model Number:** UAP-AC-M

**Why this model:** - Professional grade - Weather resistant - Managed through smartphone app - Matches Ubiquiti bridge quality

**Specifications:** - **Frequency:** Dual-band 2.4GHz + 5GHz - **Speed:** 867 Mbps (5GHz) + 300 Mbps (2.4GHz) - **Power:** 802.3af PoE (adapter included) - **Weatherproof:** Yes - **Management:** UniFi Controller app

**Price:** $80-110 USD

**Quantity needed:** 1 unit

---

**OPTION B: Indoor Access Point (Budget)**

**TP-Link TL-WA801N** **Model Number:** TL-WA801N

**Why this model:** - Very affordable - Simple setup - Good for indoor remote location - Multiple operation modes

**Specifications:** - **Frequency:** 2.4GHz - **Speed:** 300 Mbps - **Power:** Standard AC adapter (no PoE) - **Indoor use only** - **Range:** 50-100 meters indoors

**Price:** $20-30 USD

**Quantity needed:** 1-2 units depending on coverage needed

---

**Mikrotik hAP lite** **Model Number:** RB941-2nD

**Why this model:** - Matches our main router brand - Can do basic routing if needed - Very reliable - Multiple LAN ports for wired connections too

**Specifications:** - **Frequency:** 2.4GHz - **Speed:** 300 Mbps - **Ports:** 4x Ethernet ports - **Power:** Standard adapter - **Configuration:** RouterOS (we already know this!)

**Price:** $25-35 USD

**Quantity needed:** 1 unit

---

### 7. ADDITIONAL CABLES & ACCESSORIES

**Ethernet Cables (Indoor/Patch)** **Why we need them:** Connect PoE injectors to our Mikrotik, and connect access points at remote location.

**Specifications:** - **Type:** Cat5e or Cat6 patch cables - **Lengths needed:** - Main location: 1-3 meters (Mikrotik to PoE injector) - Remote location: 1-5 meters (outdoor antenna to indoor AP)

**Quantity needed:** 3-4 cables of various lengths

**Price:** $2-5 USD each

**Total:** $10-20 USD

---

**Power Strips & Extension Cords** **Why we need them:** Organize power connections for PoE injectors and equipment.

**Recommended:** - Surge-protected power strips (1 at each location) - Outdoor-rated extension cords if needed

**Price:** $10-20 USD per location

**Total:** $20-40 USD

---

**Cable Management** **Items:** - Cable clips/staples for running cables along walls - Conduit or trunking for protection (if running cables outdoors on building exterior) - Labels for identifying cables

**Price:** $10-20 USD

---

**Tools (If we don't have them)** **Basic installation tools:** - Drill with masonry bits - Adjustable wrench - Cable tester (optional but helpful) - Ladder or scaffolding - Compass or smartphone (for pointing antennas)

**Most can be borrowed or rented locally**

---

## COMPLETE BUDGET BREAKDOWN

### CONFIGURATION 1: Budget Setup (TP-Link)

| Item | Model | Qty | Unit Price | Total |
|---|---|---|---|---|
| Outdoor Bridge | TP-Link CPE710 | 2 | $65 | $130 |
| Remote AP | TP-Link TL-WA801N | 1 | $25 | $25 |
| Surge Protection | Generic Ethernet Surge | 2 | $12 | $24 |
| Outdoor Cat6 Cable | 50m | 1 | $40 | $40 |
| Patch Cables | Various | 4 | $3 | $12 |
| Mounting Hardware | Complete kit | 2 | $40 | $80 |
| Weatherproofing | Tape, ties, sealant | 1 | $10 | $10 |
| Power strips | Surge protected | 2 | $10 | $20 |
| **TOTAL** | | | | **$341** |

---

### CONFIGURATION 2: Balanced Setup (Ubiquiti + TP-Link)

| Item | Model | Qty | Unit Price | Total |
|---|---|---|---|---|
| Outdoor Bridge | Ubiquiti NanoBeam 5AC Gen2 | 2 | $95 | $190 |
| Remote AP | TP-Link EAP110-Outdoor | 1 | $42 | $42 |
| Surge Protection | Ubiquiti ETH-SP-G2 | 4 | $18 | $72 |
| Outdoor Cat6 Cable | 50m | 1 | $50 | $50 |
| Patch Cables | Various | 4 | $3 | $12 |
| Mounting Hardware | Complete kit | 2 | $45 | $90 |
| Weatherproofing | Professional kit | 1 | $15 | $15 |
| Power strips | Surge protected | 2 | $12 | $24 |
| **TOTAL** | | | | **$495** |

---

### CONFIGURATION 3: Professional Setup (All Mikrotik)

| Item | Model | Qty | Unit Price | Total |
|---|---|---|---|---|
| Outdoor Bridge | Mikrotik LHG 5 | 2 | $72 | $144 |
| Remote AP | Mikrotik hAP lite | 1 | $30 | $30 |
| Surge Protection | Mikrotik RBGESP | 2 | $25 | $50 |
| Outdoor Cat6 Cable | 50m | 1 | $50 | $50 |
| Patch Cables | Various | 4 | $3 | $12 |
| Mounting Hardware | Complete kit | 2 | $45 | $90 |
| Weatherproofing | Professional kit | 1 | $15 | $15 |
| Power strips | Surge protected | 2 | $12 | $24 |

| Item | Model | Qty | Unit Price | Total |
|---|---|---|---|---|
| **TOTAL** | | | | **$415** |

---

**CONFIGURATION 4: Premium Setup (All Ubiquiti)**

| Item | Model | Qty | Unit Price | Total |
|---|---|---|---|---|
| Outdoor Bridge | Ubiquiti NanoBeam 5AC Gen2 | 2 | $95 | $190 |
| Remote AP | Ubiquiti UniFi AP AC Mesh | 1 | $95 | $95 |
| Surge Protection | Ubiquiti ETH-SP-G2 | 4 | $18 | $72 |
| Outdoor Cat6 Cable | 50m premium | 1 | $60 | $60 |
| Patch Cables | Various | 4 | $4 | $16 |
| Mounting Hardware | Professional kit | 2 | $50 | $100 |
| Weatherproofing | Professional kit | 1 | $15 | $15 |
| Power strips | Premium surge | 2 | $15 | $30 |
| **TOTAL** | | | | **$578** |

---

## MY RECOMMENDATION FOR ZIMBABWE

**Best Value: Configuration 2 (Ubiquiti + TP-Link) - $495**

**Why:** - Ubiquiti NanoBeam is most reliable for 3-5km in all weather - Very easy to configure (even without technical experience) - TP-Link outdoor AP gives good coverage at remote location - Professional surge protection (important for Zimbabwe storms) - Total cost is reasonable for the quality you get

**Alternative if budget is tight: Configuration 1 (All TP-Link) - $341** - Will work well in good weather - Slightly less reliable in heavy rain - Still gets the job done at 60% of the cost

---

## WHERE TO BUY IN ZIMBABWE

**Local Suppliers:**

1. **TechSales Zimbabwe**
   - Location: Harare
   - Phone: +263 4 706501
   - Stock: Mikrotik, Ubiquiti
   - Website: Check locally
2. **Econet Business Solutions**
   - Multiple branches nationwide

- Good for general networking equipment
- May stock TP-Link

3. **Local IT Shops in Harare/Bulawayo**
   - Most stock TP-Link products
   - Some carry Mikrotik
   - Ask for outdoor wireless bridge equipment

---

**Online Options (Ship to Zimbabwe):**

1. **Pinnacle (South Africa)**
   - Website: pinnacle.co.za
   - Stock: Ubiquiti, Mikrotik, TP-Link
   - Ships to Zimbabwe
2. **Synergy Computing (South Africa)**
   - Website: synergycomputing.co.za
   - Excellent for Mikrotik products
   - International shipping
3. **BDCom (South Africa)**
   - Website: bdcom.co.za
   - Good prices on networking equipment
4. **Official Manufacturers:**
   - ui.com (Ubiquiti) - Direct purchase
   - mikrotik.com (Mikrotik) - Direct purchase
   - tp-link.com (TP-Link) - Check Zimbabwe distributors
5. **Amazon / AliExpress**
   - Ships internationally
   - Longer delivery time (3-6 weeks)
   - Often cheaper but check import duties

---

**Cross-Border Shopping:**

**Option:** Order to South African address, use courier - **Couriers:** DHL, Aramex, PostNet - **Advantage:** Access to full range of products - **Cost:** Add $30-50 for shipping

---

## IMPORTANT NOTES

**Compatibility with Our Mikrotik hAP ac²:**

**All options listed are 100% compatible** with our existing Mikrotik hAP ac$^2$

Our hAP ac² doesn't care what brand the outdoor antennas are - it just sees them as a cable connection. The outdoor bridge is transparent to our Mikrotik.

---

**What Doesn't Change:**

- Our Mikrotik configuration stays the same
- Our user authentication keeps working
- Our firewall rules remain active
- Our DHCP server continues assigning IPs
- Users authenticate the same way as before

---

**What We're Adding:**

- Just extending the physical reach of our network
- Like adding a very long Ethernet cable (but wireless)
- The remote location becomes part of our existing network

---

## NEXT STEPS

1. **Measure our distance** - Use Google Maps to confirm it's within 3-5km
2. **Check line-of-sight** - Visit both locations, ensure we can see across
3. **Choose configuration** - Based on budget and requirements
4. **Contact suppliers** - Get current prices and availability
5. **Purchase equipment** - Order everything at once to avoid delays
6. **Schedule installation** - Best done in dry season (April-October)

---

## QUESTIONS TO ASK SUPPLIER

When contacting suppliers, ask:

1. "Do you have [exact model number] in stock?"
2. "Is the PoE injector included in the box?"
3. "What is the warranty period?"
4. "Do you provide technical support after purchase?"
5. "Can you deliver to [our location]?"
6. "What is the total price including VAT?"
7. "Do you have mounting brackets/hardware?"

---

## FINAL CHECKLIST

Before purchasing, confirm we have:

- ☐ 2x outdoor bridge antennas (transmitter + receiver)
- ☐ 1x WiFi access point for remote location

- ☐ 2-4x surge protectors
- ☐ Outdoor-rated Ethernet cable (correct length)
- ☐ 3-4x indoor patch cables
- ☐ 2x complete mounting kits (poles, brackets, hardware)
- ☐ Weatherproofing materials
- ☐ 2x surge-protected power strips

**Our Mikrotik hAP ac² doesn't need anything - it's ready to go!**

---

*Document prepared for WiFi network extension project in Zimbabwe*
*All prices in USD are estimates as of January 2025*
*Confirm current pricing with local suppliers before purchasing*