Obai Sukar

Masjid Omar — Outdoor PA Addition

Client: Masjid Omar, Flushing MI

Engineer: Obai Sukar

Date: April 2026

Pricing

Invoice #MO-2026-001

Date: April 11, 2026
Valid: 30 days from issue

PHASE	WHO	HOURS	RATE	SUBTOTAL
Site survey & acoustic study	Obai Sukar	3	~~$150/hr~~ **$100/hr**	$300
Sourcing & purchasing	Obai Sukar	2	~~$150/hr~~ **$100/hr**	$200
Installation	Obai Sukar	5	~~$150/hr~~ **$100/hr**	$500
Installation assist	Technician	5	**$25/hr**	$125
			Labor Subtotal	**$1,125**

Standard rate $150/hr discounted to $100/hr for Masjid Omar — savings of $250 on Obai's 5 install hours alone, plus reduced rates across all phases.

Bill of Materials

Qty	2
Item	JBL CSS-H15
Spec	15W, 70V, weatherproof horn
Cost	$200

Qty	1
Item	16/2 Speaker Cable
Spec	CL3 direct-burial/UV, 125 ft roll
Cost	$95

Qty	1
Item	Sennheiser EW-D 835-S
Spec	Digital UHF wireless handheld, e835 capsule
Cost	$550

Qty	1 kit
Item	Mounting Hardware
Spec	1/4" x 2.5" SS lag screws, neoprene washers, silicone, step bit
Cost	$45

Qty	2 sets
Item	Weatherproof J-Boxes + Misc
Spec	Outdoor j-box, gaskets, zip ties, heat shrink
Cost	$50

Qty	1
Item	Equipment Rack Enclosure
Spec	12U wall-mount, vented front door, cable management, 18" depth
Cost	$300

Parts Subtotal
$1,240

Parts subtotal	$1,240
Labor subtotal	$1,125
Project Total	**$2,365**

> **Phase 2 optional add-on:** dbx AFS2 feedback eliminator + labor, approximately $420. Only if feedback persists after Phase 1 installation.

Site Analysis

- **Building:** 1980s light commercial pre-fab, single story, approximately 10-12 ft eave height
- **Exterior:** Aluminum board-and-batten siding + aluminum fascia wrap installed over original wood plank siding (1x8 T&G pine/cedar). Confirmed via torn-corner inspection — wood substrate is structural and intact.
- **Overflow area:** Right-hand side of building, approximately 60-80 ft long x 15-20 ft deep, sidewalk + grass strip between building and parking lot. Used for summer overflow prayer.
- **Speaker zones:** Men's prayer zone covered by 2 of 4 ceiling speakers (one directly above minbar); women's area covered by the other 2. All 4 must remain active — disabling the minbar speaker to break the feedback loop is not an option.
- **Landscape:** 18-24" gravel/rock drainage strip along base of building
- **Mihrab/Minbar:** Ceiling speaker directly above imam position, measured 12 ft mic-to-speaker
- **AV rack location:** Current AV equipment sits on an open shelf to the left of the mihrab with no enclosure. Scope now includes supplying and installing a proper 12U equipment rack at the same location.
- **Climate:** Flushing, MI — cold winters, humid summers, direct sun on right wall. All hardware must be weatherproof + UV-rated.

Current Rack Inventory

- **Tascam MZ-123BT** — 3-zone commercial mixer/zone router, BT, 3 mic in / 3 zone out
- **Harbinger M60** — 60W 4-ch powered mixer (legacy/unused)
- **JBL CSA 280Z DriveCore** — 2x80W commercial amp, 70V/100V capable, currently driving 4 ceiling speakers split 2+2 across AMP 1 / AMP 2, Hi-Z ON
- **Yamaha MG10XU** — 10-ch analog mixer w/ FX and USB
- **Sennheiser XS Wireless 1** — entry-level handheld/lavalier (the feedback culprit)
- **Shure GLXD4+ Z2** — 2.4 GHz wireless receiver

- **BOYA gooseneck** — wired podium mic on minbar

Existing 70V load: 4 ceiling speakers at approximately 6W tap each = approximately 24W total. JBL CSA 280Z = 80W/channel. Plenty of headroom.

Problems Identified

1. **No outdoor coverage** for summer overflow prayer on right side of building
2. **Feedback from Sennheiser XS Wireless 1** — mobile mic crosses under ceiling speaker directly over minbar (12 ft loop), causing howl. Not a fixed-gooseneck problem; it is a mobile-mic-into-vertical-loop problem.
3. **Wireless system is entry-level** — XS Wireless 1 has zero feedback rejection, wide off-axis pickup, likely 2.4 GHz dropouts in WiFi-dense environment

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Solution

Outdoor Coverage

- **2x JBL CSS-H15** (15W, 70V, weatherproof horns). Math: a single horn at 80 ft yields approximately 76 dB SPL, marginal vs 55-65 dB ambient. Two horns spaced along the right wall give approximately 82-85 dB across the full overflow area plus redundancy.
- **Spacing:** Horn #1 at approximately 20 ft from front corner, Horn #2 at approximately 60 ft from front corner, both aimed slightly outward and 15-30 degrees downward
- **Tap setting:** 15W each (outdoor needs more power than indoor ceiling)
- **Channel:** AMP 1 (mirrors main prayer hall / khutbah audio)

Mounting Method

- **Method:** Lag screws through aluminum overlay into original wood plank siding behind
- **Hardware:** 1/4" x 2-1/2" stainless steel lag screws + neoprene bonded washers + clear outdoor silicone
- **Process:** 1/8" pilot through aluminum, feel break-through, hit wood resistance, upsize to 3/16", drive lag screws through horn U-bracket
- **Why this works:** Aluminum is non-structural skin. Original 1x8 wood planks behind have more pullout strength than modern OSB. Standard practice on aluminum-clad commercial retrofits.

Feedback Fix

- **Constraint:** All 4 ceiling speakers must remain at current tap settings. Men's zone coverage is non-negotiable — disabling the speaker above the minbar would cut coverage by 50%.
- **Free fix (EQ):** Yamaha MG10XU channel EQ — cut 250 Hz (-3 to -6 dB), cut 2.5 kHz (-3 to -6 dB), HPF 80 Hz on. Proper gain structure audit on install day.
- **Primary hardware fix:** Replace Sennheiser XS Wireless 1 with **Sennheiser EW-D 835-S** (digital UHF, e835 cardioid capsule, auto-scan, rack-mountable). e835

specifically designed for high-SPL live environments with aggressive feedback rejection. This is the main feedback solution.

- **Phase 2 (recommended if feedback persists after mic swap):** dbx AFS2 feedback eliminator inserted between Yamaha MG10XU output and JBL CSA 280Z input. Because disabling the overhead speaker is not an option, the AFS2 has a higher likelihood of being needed. Install-day decision: if feedback persists after EQ + new mic walk-test (all 4 ceiling speakers live), add the AFS2 same day rather than waiting.

Cable Routing

- **Path:** Rack through attic, drop down through aluminum soffit, directly into horn j-box
- **Topology:** Daisy-chain — single cable from rack to Horn #1, continue to Horn #2
- **Total length:** Approximately 125 ft of 16/2 (75 ft to Horn #1 + 40 ft between horns + 10 ft slack)
- **Cable spec:** 16/2 AWG, CL3 + direct-burial/UV rated (Liberty 16-2C-EXSP or Belden 5100UE equivalent)
- **Soffit penetration:** 1/2" hole, sealed with silicone, 6" away from horn bracket

Install Sequence

1. Rack Assembly

a. Assemble and mount new 12U rack to left of mihrab

b. Transfer existing gear (Tascam MZ-123BT, JBL CSA 280Z, Yamaha MG10XU, wireless receivers) from current shelf into rack

c. Dress cables, verify all existing connections operational before proceeding

2. Attic Session

a. Trace which 2 ceiling speakers are on AMP 1 vs AMP 2 (mute one channel, walk room, mark)

b. Pull 16/2 cable from rack through attic, drop through right-side soffit at Horn #1 location, continue along eave to Horn #2 drop

3. Exterior Session

a. Drill 1/8" pilot through aluminum at Horn #1 fascia mount point, confirm wood resistance behind

b. Upsize to 3/16", mount horn U-bracket with 1/4" x 2.5" SS lag screws + neoprene washers, silicone-seal

c. Repeat for Horn #2

d. Drill 1/2" cable entry through soffit 6" from each bracket, seal

e. Set both horn taps to 15W, terminate +/- observing polarity, weatherproof terminations

4. Rack Session

a. Connect new daisy-chain cable to AMP 1 output at 5-pin Euroblock (parallel with existing pair)

b. Install Sennheiser EW-D 835-S receiver in rack, run auto-scan/auto-pair

c. Reconfigure Yamaha MG10XU channel for new mic, set HPF 80 Hz, EQ cuts at 250 Hz and 2.5 kHz

d. Decommission XS Wireless 1

5. Tuning + Handoff

a. Soundcheck with imam, walk overflow area, verify intelligibility at far edge

b. Walk-test for feedback with all 4 ceiling speakers live + new EW-D 835-S mic. If feedback persists after EQ + new mic, install dbx AFS2 same day (Phase 1.5)

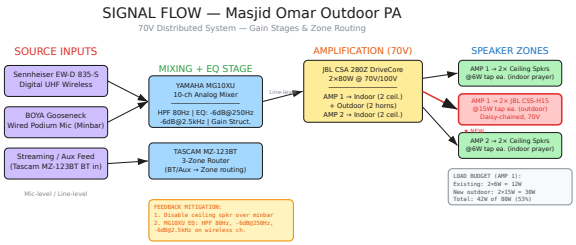
c. Gain structure audit on MG10XU

d. Hand off to masjid contact, document settings

Technical Schematics

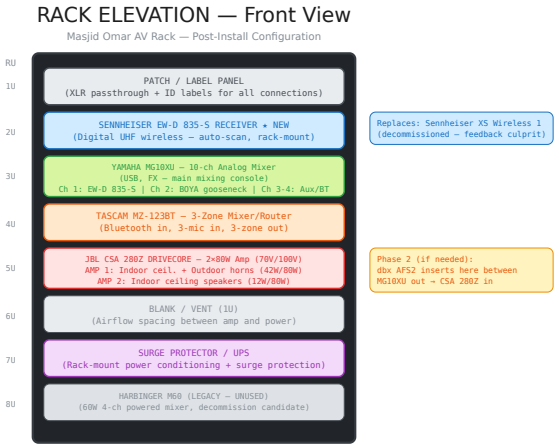
Click any schematic to view full size.

Signal Flow



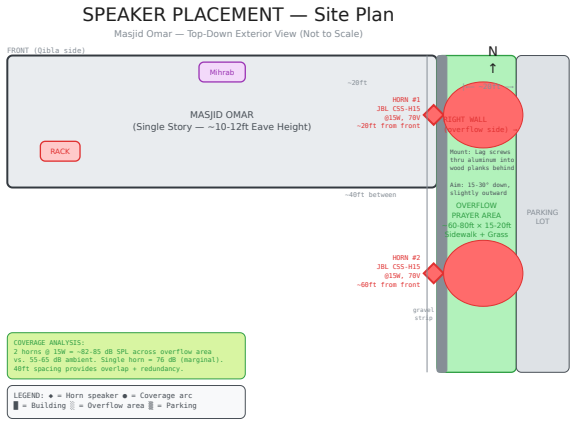
Source inputs through Yamaha MG10XU mixing/EQ stage, into JBL CSA 280Z 70V amplifier, out to indoor ceiling speakers and outdoor JBL CSS-H15 horn zone.

Rack Elevation



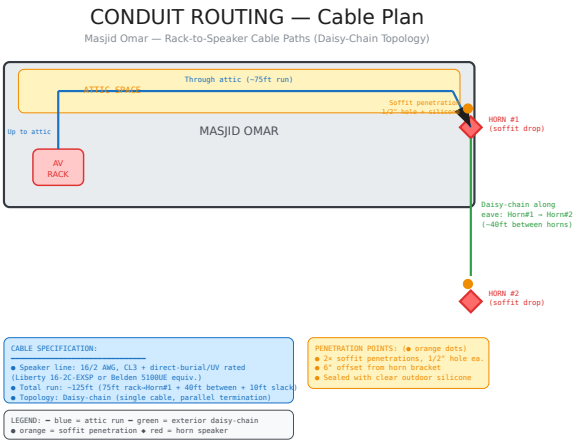
1U-by-1U front view of the AV rack post-install: patch panel, EW-D receiver, MG10XU mixer, Tascam router, CSA 280Z amp, vent spacer, surge/UPS.

Speaker Placement



Top-down site plan with Horn #1 and Horn #2 positions, coverage arcs, overflow prayer area, mounting points, north arrow, and rough scale.

Conduit Routing



Cable path from rack through attic to soffit penetrations, daisy-chain along eave. Cable spec, run lengths, penetration points marked.

Open Questions (Install-Day Verifications)

1. **AMP 1 vs AMP 2 routing** — which physical channel pair carries which 2 ceiling speakers? (Mute test in attic)
2. **Exact overflow area length** — measured 60-80 ft from photos, needs tape-measure confirmation. If less than 40 ft, one horn may suffice.
3. **Overflow attendance count** — typical headcount drives whether 2 horns is right or if more are needed
4. **Wood substrate confirmation per mount point** — drill test pilot at each of the 2 mount locations before committing lag screws
5. **Cable entry point through soffit** — confirm clear drop path from attic at each horn location (no obstructions)
6. **Imam preference** — handheld EW-D 835-S confirmed, or does khatib want headset (ME3) instead?
