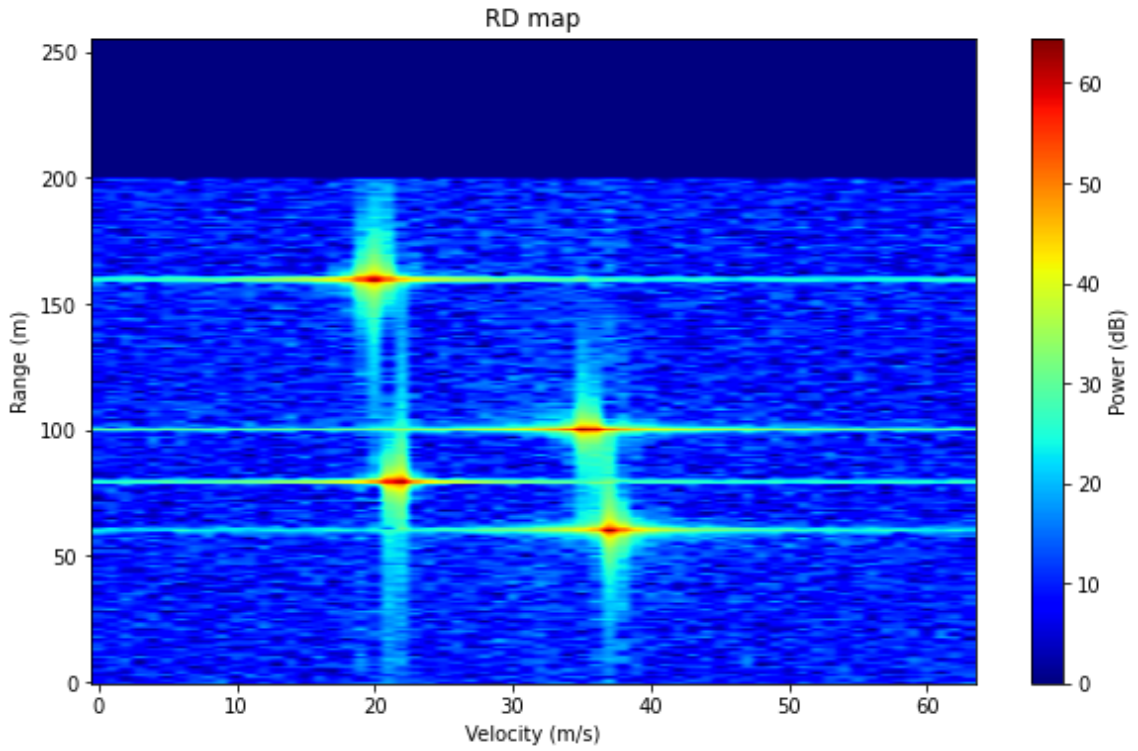
In [3]:
```
import numpy as np
import matplotlib.pyplot as plt
from pynq import Overlay, allocate
import time

overlay = Overlay("./bae/fmcw_radar_design.bit")

dma = overlay.axi_dma_0
range_ip = overlay.range_fft_0
doppler_ip = overlay.doppler_fft_0
rd_map_ip = overlay.rd_map_0

range_ip.register_map.num_chirps = 64

range_ip.write(0x00, 0x81)
doppler_ip.write(0x00, 0x81)
rd_map_ip.write(0x00, 0x81)

N = 256
L = 64
TOTAL_SAMPLES = N * L

in_buffer = allocate(shape=(TOTAL_SAMPLES,), dtype=np.uint32)
out_buffer = allocate(shape=(TOTAL_SAMPLES,), dtype=np.uint32)

raw_data = np.fromfile('./bae/lfm_pulse_bs_raw.bin', dtype=np.int16)

real_part = raw_data[0::2].astype(np.uint32) & 0xFFFF
imag_part = raw_data[1::2].astype(np.uint32) & 0xFFFF

packed_data = real_part | (imag_part << 16)

np.copyto(in_buffer, packed_data)

dma.recvchannel.transfer(out_buffer)
dma.sendchannel.transfer(in_buffer)

while not dma.sendchannel.idle:
    pass

while True:
    status = dma.recvchannel._mmio.read(0x04)
    if (status & 0x1000) == 0x1000:
        break
    time.sleep(0.001)

out_buffer.invalidate()

out_data = np.array(out_buffer, dtype=np.uint32)

rd_matrix = out_data.reshape((N, L))

plt.figure(figsize=(10, 6))
plt.imshow(10 * np.log10(rd_matrix + 1), aspect='auto', origin='lowe
plt.colorbar(label='Power (dB)')
plt.title('RD map')
plt.xlabel('Velocity (m/s)')
plt.ylabel('Range (m)')
```

```
plt.show()

in_buffer.freebuffer()
out_buffer.freebuffer()
```



In [35]:
```
out_buffer.invalidate()
print("First 10 data:", out_buffer[0:10])
print("Last 10 data:", out_buffer[-10:])

print("Range FFT:", hex(range_ip.read(0x00)))
print("Doppler FFT:", hex(doppler_ip.read(0x00)))
print("RD Map:", hex(rd_map_ip.read(0x00)))

print("DMA Send:", hex(dma.sendchannel._mmio.read(0x04)))
print("DMA Recv:", hex(dma.recvchannel._mmio.read(0x04)))
```

```
수신된 앞부분 데이터 10개: [ 5  9 13  5  5  4 13 17 25 50]
수신된 뒷부분 데이터 10개: [ 4  2 10 36  0 25 13  5  4  5]
=== HLS IP Status ===
Range FFT   : 0x81
Doppler FFT : 0x81
RD Map      : 0x81

=== DMA Status ===
DMA Send (TX) : 0x11009
DMA Recv (RX) : 0x11009
```