

MICROWAVE COMMUNICATIONS From the Micro-ray to the Moon

Shortening the wavelengths, increasing the power, and reducing the noise of wireless communications characterized the development of 20th century microwave technology.



Earliest Microwave Relay

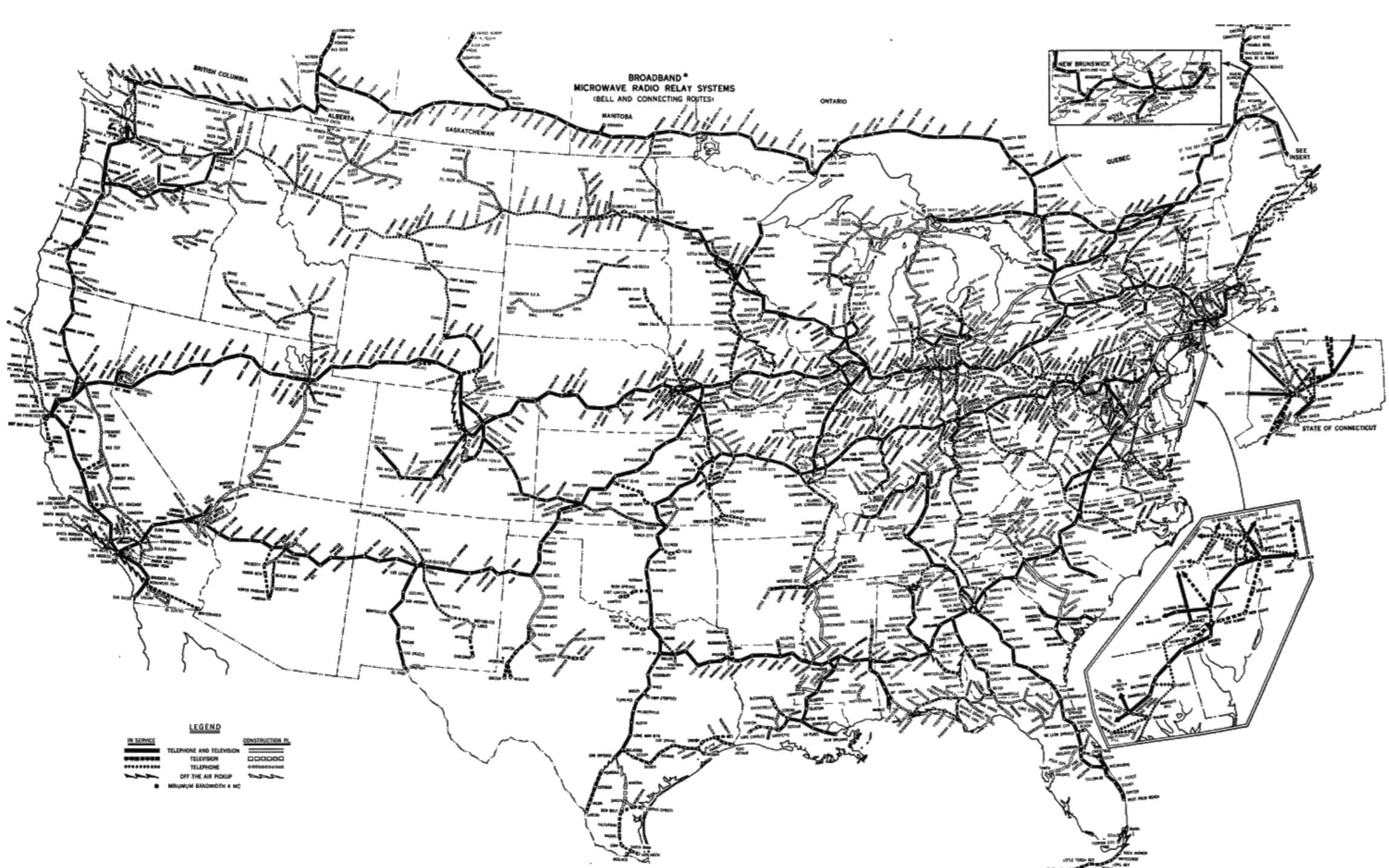
In 1931, French and British engineers demonstrated a 40km, 1.7GHz (17cm), "micro-ray" link across the English Channel for the International Telegraph & Telephone Corporation (IT&T). Three years later, the two countries' air ministries commissioned a half-watt, commercial, microwave link between St. Inglevert, France and Lympne, England. The three-meter paraboloid antenna provided 28dB of gain, and the hemispherical reflector at the focal point added another 5dB.

A cigarette card from 1938 commemorating the "micro-ray" link across the English Channel.

Courtesy Alexander B. Magoun

Networking Nations, Wirelessly

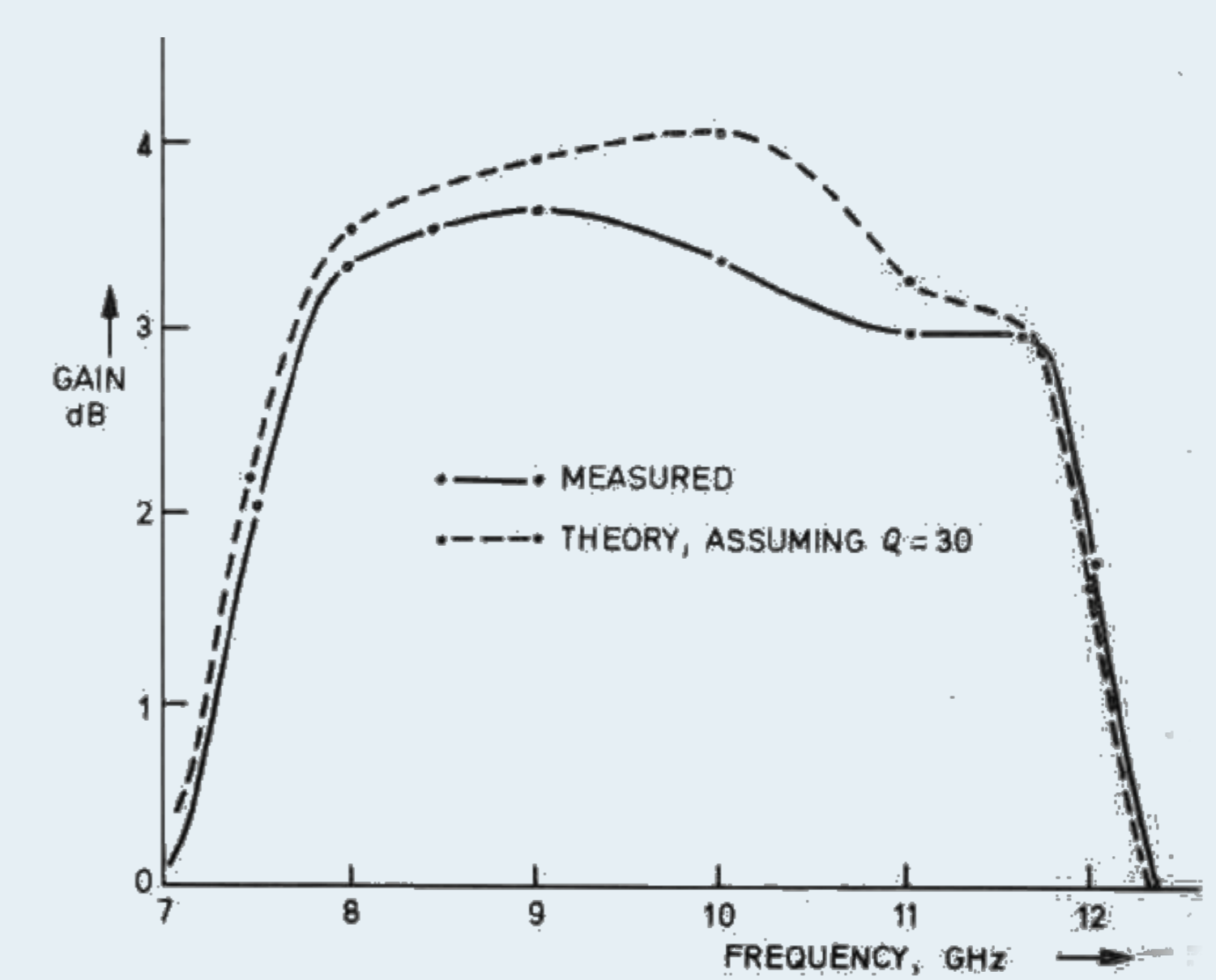
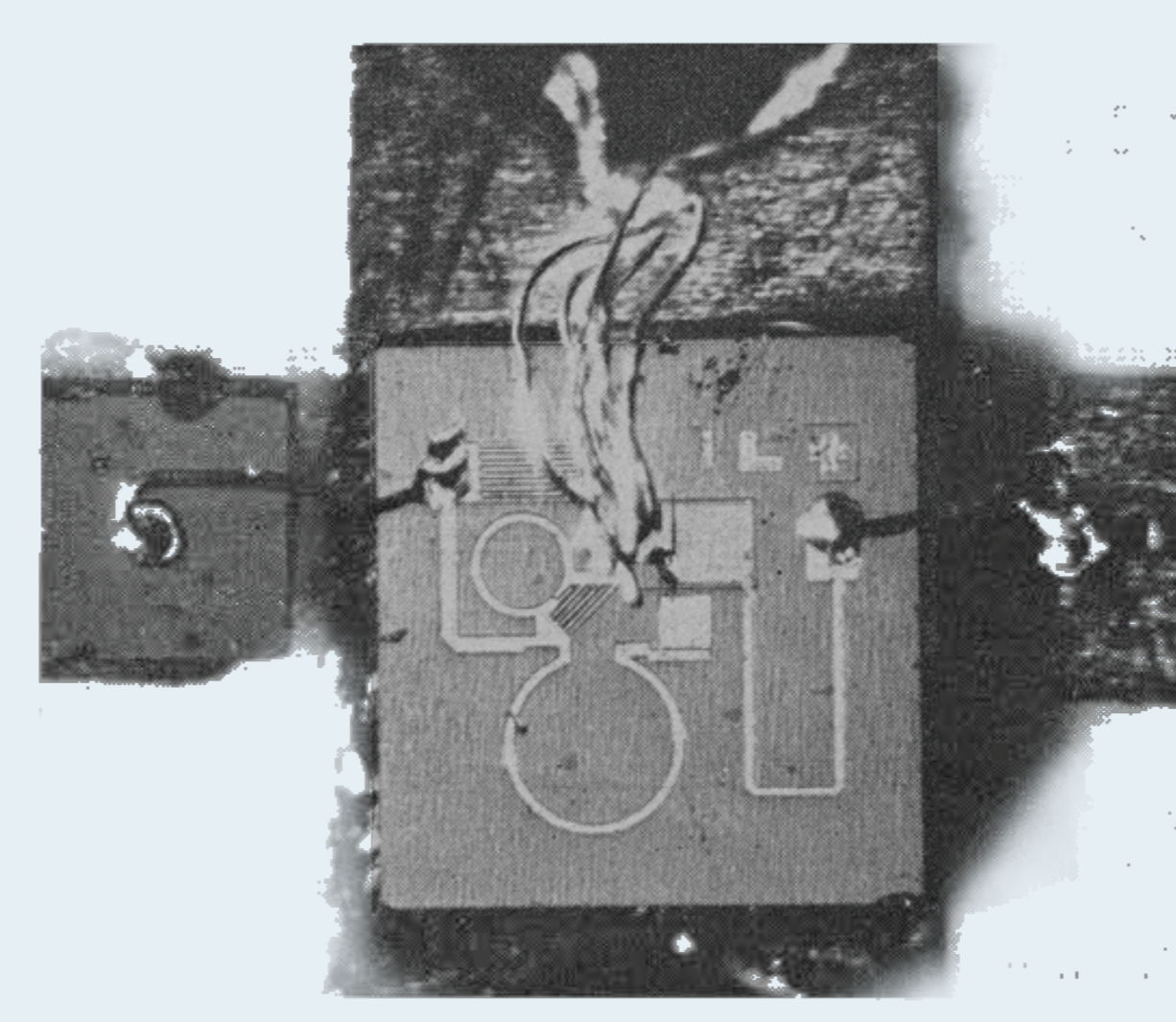
Between the 1930s and 1960s, wireless telecommunications across countries and continents became a reality. Wartime demands for radar and radio accelerated microwave research. In particular, Rudolph Kompfner's travelling wave tube dramatically enhanced signal amplification, which boosted commercialization of high-capacity microwave channels after World War II. The unprecedented volume of television programs, telephone calls, and data transmitted at the speed of light reshaped global communications and connectivity.



AT&T's North American microwave radio relay network in 1960.
AT&T Archives

Miniaturizing Microwave Amplifiers

In 1975, Ray Pengelly and James Turner introduced a monolithic microwave integrated circuit. MMICs improved military communications and enabled generations of mobile telephones. Working with teams at Plessey Company's Applied Research and Central Research Laboratories in the United Kingdom, they designed a single-stage amplifier with 1-micron transistor gates using Compact's eponymous CAD program and Rubylith masking film, fabricated on 2cm gallium arsenide wafer substrates.



Pengelly and Turner's GaAs MMIC and its gain response at X-band (8–12GHz, or 2.5–3.75cm). *The Radio and Electronic Engineer* 46, no. 10 (1976)

To the Moon and Back

During the last three Apollo moon missions, U.S. astronauts communicated from their Lunar Roving Vehicles (LRVs) with NASA Mission Control 390,000km away. The LRV's remote-controlled television system sent color video of the extra-vehicular expeditions. On Earth, three 26-meter dish antennas transmitted and received voice, TV, data, and control signals over the Unified S-Band developed by MIT Lincoln Laboratories.

Apollo 17 Lunar Roving Vehicle on the moon's surface, 1972. NASA

