G Line for the Gigahertz Men

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Ask your friends at the local club what G-line or G-string is and you'll probably get a bemused grin followed by a blank stare. Yet G-line (named after its 'inventor' Gobau) is a remarkable form of RF feeder which uses a single wire for transmission. What's more, it offers very low loss at UHF, comparable with the best hardline feeder. For all this, G-line has never found much favour and this article is an attempt to clear away some of the mystery surrounding Gobau's brainchild.

Finding information on G-line is not an easy task. My first encounter with it was in the October 1965 issue of *Practical Television*, which contained a description of the amateur TV station G6CTS/T located at Norwood Technical College, south London. This station was conceived back in 1947 by the Engineering Group of the Royal Television Society as an experimental station for UHF TV. A few years later it went on the air (vision frequncy was 427 MHz — those were the days of a 70cm band 30MHz wide!), and provided test transmissions with vision and sound for the London area. Two students at the college were involved with a research project relating to the transmission characteristics of surface wave feeders. This surface wave feeder was G-line, and photographs accompanying the article showed the G-line feeding the 70cm aerials and some strange looking cones. No further details were given, and it took me a while to track down more information.

An article by K6LK in the June 1974 issue of QST (the USA equivalent of *Radcom*) and some notes in microwave textbooks subsequently supplied the missing data, and fact turned out to be stranger than fiction. A bare metal wire may act as a waveguide for propagating electromagnetic waves, with losses smaller than most grades of coaxial cable. Virtually no radiation occurs from the wire and well-nigh all the energy is carried in a circular field close to the wire. Cone shaped launching and receiving devices are used to match the G-line to conventional coaxial feeder, with the result that G-line can be used for long runs, reserving the use of coax for the more complex connections at the transceiver and aerial ends.

No doubt this sounds like science fiction to some readers and while it is not, it must be admitted that there are some snags which restrict the utility of G-line. The line must be kept fairly straight, otherwise radiation will be lost at bends. G-line must be kept clear of metallic objects and standing waves are a serious problem. Nonetheless, workers who persevered have had success with G-line and after I have disposed of the theory I'll give some practical dimensions and details. Gobau, who popularised G-line, showed that for a bare copper wire of 2mm diameter stretched in air and excited at 3000MHz the attenuation was a mere 0.023dB per metre, and the extent of the field was such that 75 per cent of the transmitted energy was conveyed within a circle 36cm in diameter around the wire. A demonstration system is shown in **Fig. 1.** The inner conductor of the coax is joined to the G-line while the outer conductor is soldered to the launching horn. The angle of flare must be kept small to keep undesired transmission modes to a minimum. Calculated results are given in **Fig. 2** and in experiments the measured total loss has compared well with the calculated values.

George Hatherell, K6LK, made his experiments at 1296MHz with a number of types of wire. An acceptable compromise was with a 100 ft length of 14 SWG wire, which gave the following results:

Enamel coated wire . . . . loss 3.87dB
Ditto sleeved with Teflon loss 2,53dB
Plastic insulated household
wire (white) . . . . . loss 3.62dB
Ditto (black) . . . . . loss 3.87dB

Transmitted power was 10 watts. While these results were encouraging, subsequent 'souping up' of the system brought the total loss of the G-line and launchers and receivers to well under 2dB. His article gives all the constructional details of the launching and collecting horns and his method of suspending the G-line from tightly stretched monofilament fishing line. ●

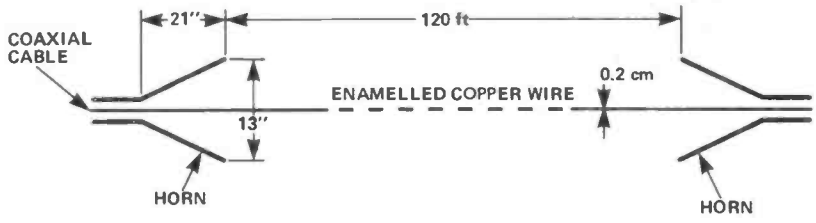

Fig. 1 Experimental surface-wave transmission system

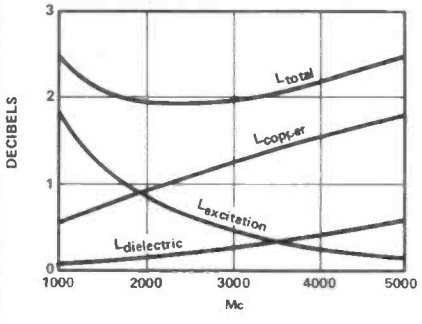

Fig. 2 Transmission losses for the 120-foot surface-wave guide shown in Fig. 1

REFERENCES

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