OFFICE OF TELECOMMUNICATIONS POLICY
WASHINGTON

February 10, 1975

Tom:

I have enclosed some material on the use of microwave to distribute video signals. We have had trouble getting the exact reference to the Microwave Systems News article but at least you will have the information itself.

Let me know if I can be of any further help.

Dale

DALE HATFIELD

U.S. DEPARTMENT OF COMMERCE
Office of Telecommunications
POLICY SUPPORT DIVISION
Boulder, Colorado 80302

DATE: February 3, 1975

TO: Dale N. Hatfield

FROM: Jim Hart Jim

SUBJECT: Video Microwave Transmitters and Transmission Systems

REFERENCE: Our Telephone Conversation of February 3, 1975.

A. Good books and articles covering this topic are:

1. The Economics of Microwave in CATV Systems, Microwave Systems News - approximately 1970. (I have a copy but it doesn't show the date.)

2. Engineering Considerations for Microwave Communications Systems, Lenkurt Electric Company, San Carlos, California.

B. I would strongly suggest contacting the following equipment suppliers for technical and cost information on "less" expensive type microwave equipment:

1. International Microwave Corporation, Cos Cob, Connecticut.

2. Microwave Associates, Burlington, Massachusetts.

C. Other Sources:

1. DRI Broadband Report - Appendix C. (OTP)

2. Theta-Com, Phoenix, Arizona, (Multichannel video microwave transmission).

3. I.T.T. Handbook, 6th Edition -- lists frequencies available.

D. For industrial operation:

1. IMC supplies 12 GHz systems for around $6,000 complete.

2. At 12 GHz over flat terrain repeaters must be placed at approximately 15 miles for reliability. In the 6 GHz band, 25 mile spacing is usually satisfactory. See reference (A-2) for more information.

CONFIRMATION COPY - Original sent by FAX 2-3-75

U.S. DEPARTMENT OF COMMERCE
Office of Telecommunications
POLICY SUPPORT DIVISION
Boulder, Colorado 80302

DATE: February 5, 1975

TO: Dale N. Hatfield

FROM: Jim Hart Jim

SUBJECT: Transmittal of Requested Microwave Equipment Information

Enclosed are:

(1) The MSN article "The Economics of Microwave in CATV Systems." The costs should be updated since the article is several years old.

(2) IMC's catalog information.

(3) Microwave Associates MA-I7C catalog information.

(4) Farinon's (high quality) 12 GHz microwave equipment brochure.

Let me know if I may be of further aid.

SYSTEMS/

The Economics of Microwave in CATV Systems

The CATV Industry's annual NCTA meetings were held last month in Washington, D.C. with much discussion over the potential role that microwave will play in the Local Distribution Services (LDS) programming by CATV system operators. Until as recently as last year, microwave was seen as an expensive, but high-quality method of distributing CATV signals to subscribers. But the impending FCC decision on the top 100 urban TV markets could change all this.

Microwave head-end equipment used in various LDS applications appears to offer significant growth potential for use in the Community Antenna Relay Service (CARS)-band from 12.7 to 12.95 GHz. But, due to the restrictions imposed by the FCC on the importation of "distant" signals into large markets, use of expensive new systems has been very limited. However, most analysts uniformly agree that CATV in urban America is inevitable because no federal, state or local agency should be allowed to regulate the right of increased channel choice to the public. So, says Wall Street, if distant signals are freed or not cable companies and their microwave suppliers are assured growth in this field.

Short Haul Microwave As An Answer

The use of short-haul, FM microwave links in urban areas has been in various phases of development for some 6 years. TV signals are obtained on a line-of-sight path to a receiving antenna, where they are then downconverted into normal, wired CATV distribution systems. The obvious advantages of microwave in rural areas is its utility in reaching areas considered prohibitively expensive for the installation of "trunk" cable. In urban areas where it might be both expensive and difficult to dig up city streets to lay cable, microwave offers CATV system operators a very good potential return on investment. Cable operators can increase subscriber penetration with homes that would normally have been inaccessible by normal cable techniques. One additional plus for the microwave approach in LDS is the picture improvements.

Microwave CATV Economics

Conventional microwave TV transmission in CARS-band has used mostly FM techniques to date. The FM transmission of TV signals is done in the same way as telephone and telemetry data is transmitted by microwave. A conventional system requires an investment of about $12,000 per channel by the operator. A combining network is usually required to multiplex all transmitters into one antenna and direct the channels into the proper receivers.

Recently, however, equipment costs have plummeted. As late as last December, a CATV operator who wanted to transmit 12 channels from a "head-end" 10 miles out to reach a concentration of potential subscribers could buy equipments from $60,000 to $70,000, or just $5,000 per channel. The alternative cable method which would include lossy line amplifiers would be cost competitive on the initial installation but annual maintenance costs would be much greater than the microwave system's.

AM Microwave Transmission

Recently, AM transmission has begun to gain in popularity because it eliminates the need for modulation equipment using only up and down converters.

A typical AM system uses up-converters to translate the TV channel upward in frequency without altering the modulation already on the carrier and then down converts at the receiver by mixing with transmitter LO.

Proponents of this method of eliminating the modulators and demodulators offers modest savings over the FM approach plus the additional advantage of less components in the system. This, say the AM people, also reduces the number of signal degradation that can adversely effect picture quality.

AM transmitter cost is higher than an FM system's but the elimination of the modulators and demodulators and the fact that only one receiver is required have lowered the estimated cost to 35% of the five channel FM system. AM system also seems to offer cost advantages to operators in both small and large markets. A typical small market operation is shown schematically below.

Figure 1

Three desired TV channels cannot be picked up off the air closer than 100 miles from the service area due to the geographic arrangement, e.g., a mountain range blocks the signals. Although this problem may be solved with cable links between the mountain top and the community, as in the past, the microwave link offers a better, and more manageable alternative. Below is a cost comparison between FM, AM and pure cable.

Cable:

Cable Construction & Equipment — 5 mi. @ $6,000/mi. =	$30,000
Yearly maintenance & upkeep— 10% of construction or $3,000 x 5 years =	$15,000
	$45,000

FM Microwave — 3 channels:

Demodulator	— $1,000 ea. x 3 =	$ 3,000
Transmitter	— 4,000 ea. x 3	12,000
Receiver	— 4,000 ea. x 3	12,000
Modulator	— 1,000 ea. x 3	3,000
Antenna	— 2,000	2,000
Multiplexer	— 2,000	2,000
		$34,000
Yearly Maintenance & Upkeep— 5% of construction or $1,750 x 5		8,500
		$42,500

AM Microwave — 3 channels:

Transmitter	— $4,500 ea. x 3 =	$13,500
Reference Sc.	— 1,000	1,000
Power Divider	— 300	300
Antenna	— 2,000	2,000
Multiplexer	— 1,500	1,500
Receiver	— 3,500	3,500
		$21,800
Yearly Maintenance & Upkeep— 5% of construction or $1,080 x 5		5,400
		$27,200

Based on these representative costs for an AM system, it appears to be a sound alternative to FM or cable from a raw cost standpoint. To expand this approach, assume that two communities were isolated from the three broadcast transmitters, but were separated by a lateral distance of five miles as shown below in figure 2:

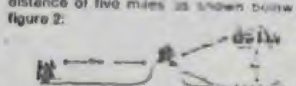


Figure 2

Now make the following cost additions:

Cable:

Construction & Equipment — 10 miles @ $6,000/mi.	$60,000
Yearly maintenance & upkeep— $6,000 x 5 years —	[illegible]
	[illegible]

FM Microwave:

Demodulator	— $1,000 ea. x 3	$3,000
Transmitter	— 4,000 ea. x 3	12,000
Receiver	— 4,000 ea. x 6	24,000
Modulator	— 1,000 ea. x 6	6,000
Antenna	— 3,000	3,000
Multiplexer	— 3,000	3,000
		[illegible]
Yearly Maintenance & Upkeep 5% of construction or [illegible] x 5		[illegible]
		[illegible]

AM Microwave

Transmitter	$4,[illegible] ea. x 3	$13,[illegible]
Refer. Source –	1,000 ea. x	1,000
Power Divider –	300 ea.	300
Antenna –	3,000 ea.	3,000
Multiplexer –	1,500 ea.	1,500
Receiver –	3,500 ea. x 2	7,000
		$[illegible]

Yearly maintenance & upkeep –
5% of construction yr. $1,315 x 5 $[illegible]
$[illegible]

Due to the fact that only one inexpensive receiver is required for the new site, the AM system shows some economic advantages as the number of receiving points grow.

From this it is not difficult to expand the above two path concept to a multiple path system in a large city. Assume that cable is connected to a distribution hub (as shown in figure 3)

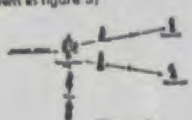


Figure 3

which in conventional applications would split the incoming signals and distribution by cable. Due to existing structures, high construction costs and a multitude of city and utility company rules and regulations, the cost of cable construction in large cities approaches $30,000 per mile. Due to the shorter distances required the transmitter output power could be lowered with two signals per transmitter possible. A 20 channel system could then be built with ten transmitters with a resultant system cost as shown below:

Transmitter	$4,500 ea. x 10 =	$45,000
Reference Source	1,000 ea. x 2	2,000
Power Divider	300 ea. x 2	600
Antenna	2,000 ea.	2,000
Multiplexer	3,000 ea.	3,000
Receiver	3,500 ea. x 3	10,500
		$63,100

Six miles of cable construction at $30,000 per mile would cost some $180,000! FM microwave transmission for 20 channels is not feasible because of FCC channel assignments for FM requiring a minimum of 25 MHz band width per channel. *This allows only ten channels across the CARS band.* In addition, ten FM channels would cost in excess of $100,000.

An FCC type approval has been granted to Theta-Com (the Hughes-Tele-PrompTer joint venture) for such an AM system. The all important type acceptance is further referenced in the FCC rules and regulations governing CAR Stations.

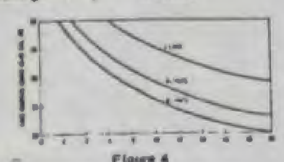


Figure 4
Typical AM Link Performance

The Theta-Com system guarantees path margins greater than 45 dB as illustrated in figure 4 for ten-foot antennas. The illustration also shows how the performance varies with the number of links used in the network. For instance, concentrating 4 outputs on one link can produce a 6 dB increase in fade margin. On the other hand, for a 3 dB fade decrease, the transmit output of the system can be sent to eight different locations.

Figure 5 shows the cross-modulation distortion of an AM microwave link that is compared with cable. Here, three different configurations which span 15 miles are treated. The first has a span of 5 miles with the remainder being cable. The second has 10 miles of link and remainder cable and the third is 15 miles etc. Thus, intermodulation products are lower with the microwave link. Any further deterioration in the cross modulation is due to line amplifiers. This illustration also conclusively shows that it is possible to bypass large sections of "trunk" and still provide higher quality signals at the point where they are used than would be possible by using a "trunk" system. The resultant

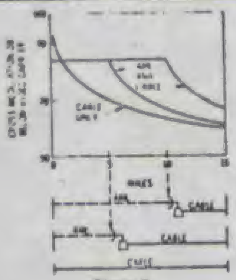


Figure 5
Typical Link versus Cable Cross-Modulation

increases in picture quality are also desired by CATV system operators.

Fading due to unfavorable atmospheric conditions is always a concern with air-linked systems.

An AM microwave system . . .

Conversion of normal VHF TV to microwave frequencies is illustrated in figure 8. A single conversion is required to shift the VHF signals at the headend to microwave frequencies. The output of the summing network then directs the microwave signals at 12 GHz to a number of networks and then to receivers throughout the antenna system. Each receiver requires a single shift in frequency back to its original VHF condition and makes use of a frequency control circuit which keeps the received signal from varying from the transmitted signal.

The system is composed of modules capable of putting out up to four channels. The outputs of the modules are then filtered and combined through magic tee coupling to provide four outputs. Those four can be further divided into eight if desired. A typical configuration for an AM microwave transmitter consists of 14 television channels and the standard FM broadcast band plus one channel for pilot frequency tone networks, then directs the microwave signals at 12 GHz to a number of receivers throughout the antenna system. Each receiver requires a single shift conversion back to its original VHF condition and makes use of a frequency control circuit which keeps the received signal from varying from the transmitted signal.

The Theta-Com output multiplexing network is shown in figure 9. The system is composed of modules capable of putting out up to four channels. The outputs of the modules are then filtered and combined through magic tee coupling to provide four outputs. Those four can be further divided into eight outputs if desired. A typical configuration for an AM microwave type transmitter consists of 14 television channels, one pilot tone for frequency control, and the standard FM broadcast band.

CATV Link Literature Available:

FCC Rules and Regulations Part 74 governing CARS-band. Check Information Retrieval No. 202.

Theta Com: AML (AM Link) system for use in urban, sub-urban and rural areas. Check Information Retrieval No. 203. FCC type accepted.

Microwave Associates: Mfers of both FM and AM microwave links in CARS band with type accepted equipments. Check Information Retrieval No. 204.

Laser Link: FM microwave links "Air Link" system with FCC type acceptance. Check Information Retrieval No. 205.

Varian Micro Link: Manufacturers of both AM and FM microwave links with FCC Type acceptance. Check Information Retrieval No. 206.

Scientific Atlanta: Manufacturers of "Busi-Link" CATV microwave link system with FCC type acceptance. Check Information Retrieval No. 207.

COMMUNICATIONS CARRIERS, INC
a subsidiary of International Microwave Corporation
33 RIVER ROAD / GREENWICH / CONN 06830 / USA / 203-661-7655 / TWX 710-579-2925

Dear Sir:

In response to your request for information on our ICM-12 Microwave Link as advertised in Microwave Systems News, I have enclosed our current literature on our system. The ICM-12 is designed for use by non-technical personnel to provide a simple communications link for many different applications.

The Intra-city microwave link can operate over a five mile path providing one-way communications of video, audio, data or tone. The system is all solid state. It requires no monitoring or control and it is fully guaranteed for two years. The ICM-12 installs in minutes and does not require any special personnel (such as electricians) to wire and install.

The ICM-12 costs $3800 complete. This price includes a pair of antennas, a receiver, a transmitter, a receiver terminal and a transmitter terminal plus all necessary interconnecting cables. Everything you will need is supplied. FCC licensing is simple to obtain in the uncluttered business communications band and no license is needed to operate the system.

The ICM-12 is one of a family of short haul microwave links. Other units are available for the mobile communications (Model ICM-10), common carrier (ICM-11), and TV-CATV (Model ICM-13) applications. A higher power link covering all the above models is capable of up to 20 mile transmission. Options are also available for audio, data, telephone and multiple video transmission.

I hope that you find the enclosed literature useful and informative. If you have a specific use in mind or wish to be kept informed on this and our future products, please fill out and return the enclosed card. For even faster results, call (203) 661-7655. Again, thank you for your interest in Communication Carriers, Incorporated.

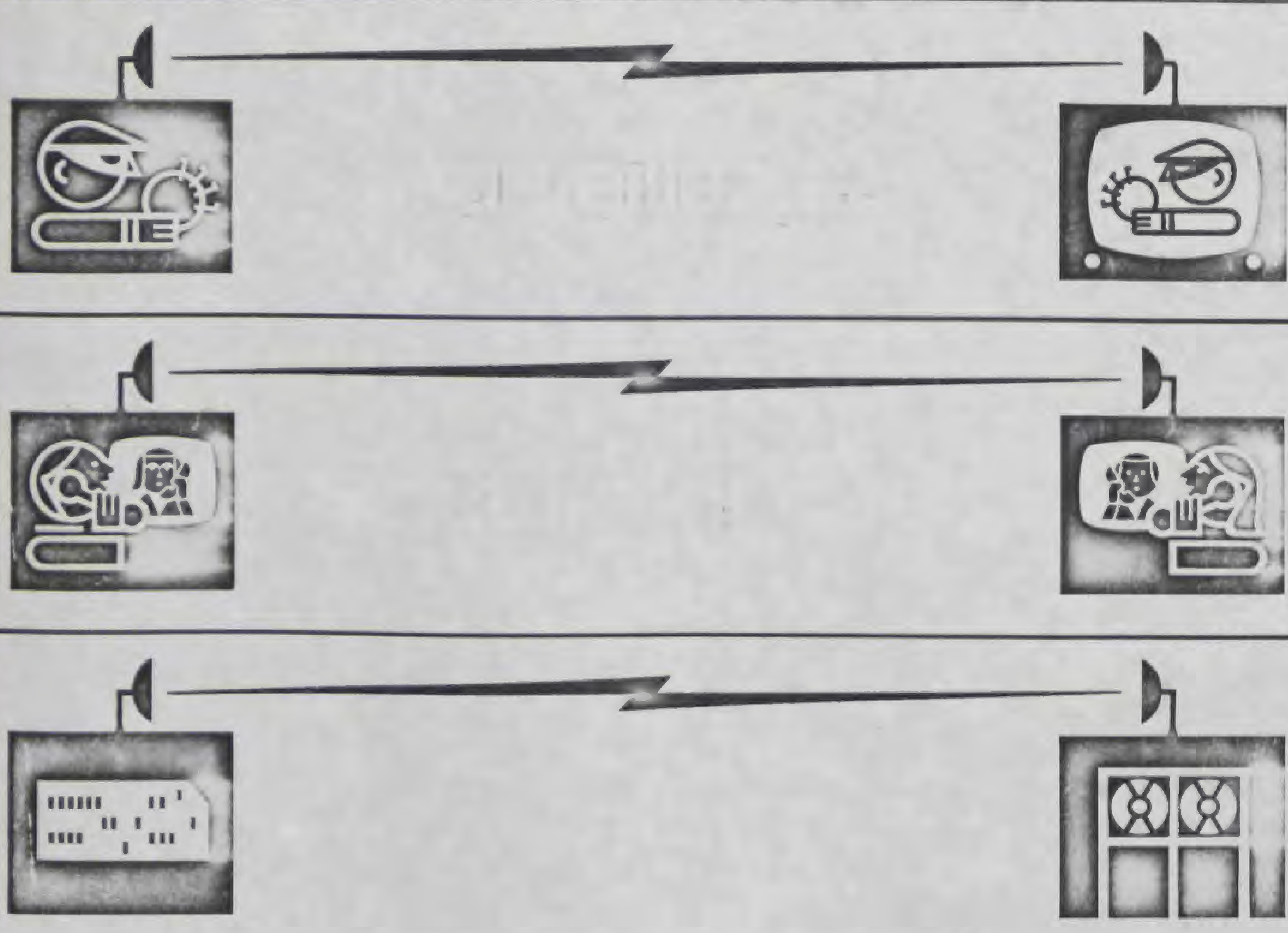
Very truly yours,

Mark R. Rosenzweig

MRR/gbh

Enclosure

INTRA-CITY MICROWAVE LINKS FROM IMC



your own wireless
"private line"
for sight, sound
or data transmission
...simple, versatile
dependable, low cost

IMC INTERNATIONAL MICROWAVE CORPORATION

IMC's Intra-City Microwave Link, ICM-12, represents a major development in the technology and economics of wideband signal transmission for TV, data, and time-division multiplex. ICM-12 beats coax-cable costs for distances beyond ¼ mile, can be put into operation without public-utility red tape, and in many cases will have paid for itself within one year of operation.

- ICM-12 is the lowest cost Microwave Communication system on the market.
- ICM-12 is a complete communications system including antennas, which needs only to be plugged into a 110 Volt outlet.
- ICM-12 operates from standard TV cameras, consoles, receivers and data facilities.
- ICM-12 uses the uncrowded 12.2-12.7-GHz microwave band, with quick and easy FCC assignments.
- ICM-12 installation and maintenance procedures have been so simplified that they are easily handled by non-technical personnel.

The applications for such a system are numerous: they include,

- **TV surveillance**
- **traffic control**
- **law enforcement**
- **education**
- **industrial**
- **picture-phone**
- **CATV**
- **datacom**
- **TDM communications (such as T-1).**

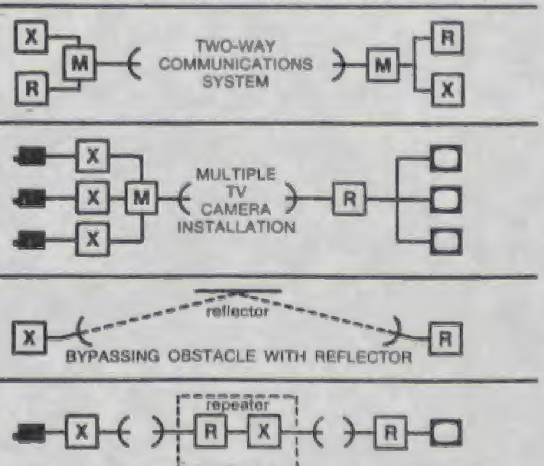
The ICM-12 system utilizes a new super-long-life microwave solid-state technology* which assures many years of trouble-free operation (in fact, IMC fully guarantees all parts of the ICM-12 system for a minimum of 1 year). This new technology has also resulted in extensive system simplification, size reduction, and absolutely safe operation even in the hands of totally inexperienced personnel (the highest internal voltage is 12 volts and the transmitter power is 1/1000 of US human-safety standards).**

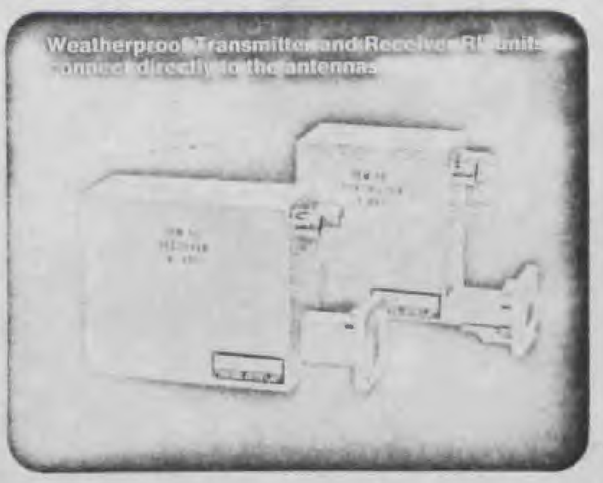
system planning

The selection of system hardware depends on the answers to the following

- Is it to be a one- or two-way system?
- How many transmitters will be used to feed a single receiver installation?
- Where are the actual locations of the transmitters and receivers?
- Is there a line-of-sight path between sites?

POSSIBLE SYSTEM CONFIGURATIONS

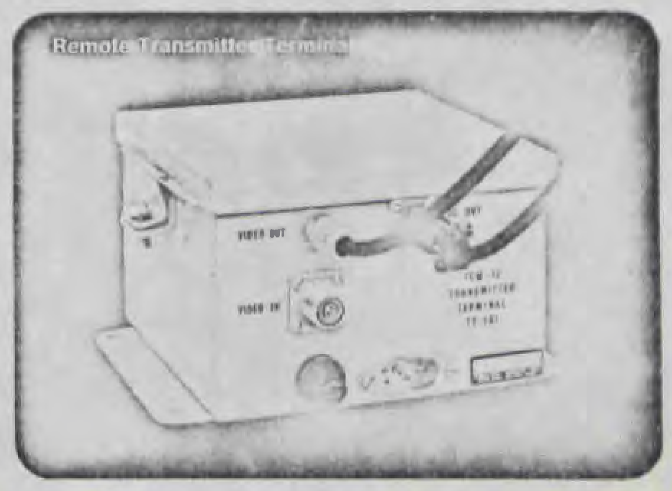



Weatherproof Transmitter and Receiver RF units connect directly to the antennas

X ICM-12 Transmitter
R ICM-12 Receiver
M Multiplexer Available as Option
TV Camera
TV Console

Obtaining a line-of-sight (LOS) path can be the most critical aspect of system planning. Line-of-sight paths should have 20-foot clearance from reflecting planes such as rooftops, sides of buildings, etc., so as to prevent double paths which can cause increases in path loss. Where there is no direct LOS path, the signal can be bounced off a reflecting metal plane much like a billiard shot, or a repeater can be used to circumvent the obstacle. Rooftop installation for the antenna is desirable and, in some cases, a mast may be required.

Heavy rainfall can also increase path loss. At single-hop distances greater than 4 miles, rain is a factor to be considered in system design. For hops shorter than 4 miles, rain can be ignored.



Remote Transmitter Terminal

*Gunn-Diode Oscillator
**The 110-Volt input line is thoroughly isolated.*

installation

Every one-way installation requires one transmitter and one receiver. Both the transmitter and receiver consist of two compact RF cases. The RF sections of the transmitter and receiver are mounted directly on their antennas in sealed weatherproof cases. The power supply is in a second box, and is designed for indoor installation. The two interconnecting lines are a 12-Volt DC line and a 75-Ohm video line. Neither of these two lines requires conduit or electrically-licensed installation, and they can be run for over 100 feet with no special attention required. The indoor power-supply boxes can be plugged into any standard 110-Volt power line much like a home radio. When power is applied, the system is on the air directly in the FCC-approved channel. The system inputs and outputs are compatible with all standard TV cameras, consoles and TV receivers.

The antenna installation requires line-of-sight alignment between transmitter and receiver antennas. Instructions for carrying out this procedure are given in the instruction manual. A simple test set is available, if desired, to check system operation during installation and for periodic routine tests.

maintenance

Once installed, ICM-12 normally requires no further adjustment and, although operating difficulties are extremely unlikely, maintenance procedures have been so simplified that any trouble can be quickly traced to a specific unit. Spare units can be kept on hand by the user, or loan replacements are available from the factory within 48 hours to keep you on the air while the defective unit is being factory repaired.

obtaining fcc authorization

FCC authorization for operation in the 12.2-12.7-GHz range is one of the easiest authorizations to obtain because of the uncrowded conditions in this frequency band.

In order to obtain authorization, FCC Form 402 must be filled out and filed with a $30 fee. Authorization should be obtained within two months of filing. FCC-licensed personnel are not required to operate ICM-12 equipment, but a second-class license is needed to oversee installation and also to perform yearly frequency checks. Where such personnel are not available, International Microwave Corporation can assist you in obtaining such help, as well as in preparing your FCC application.

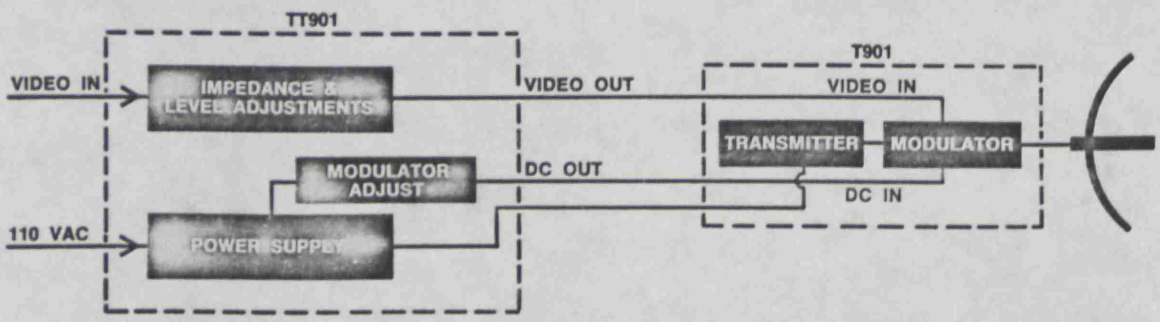
ICM-12 specifications

RF FREQUENCY	12.2-12.7 GHz
VIDEO	
Bandwidth	6 MHz
Input	1.4V Peak-to-Peak @ 75 Ohms
Output	1.4V Peak-to-Peak @ 75 Ohms
MODULATION	Double-Sideband AM
DISTANCE PER HOP (maximum)	5 Miles
AGC FADE MARGIN (maximum)	40 dB
OPERATING TEMPERATURE	−30°F to +110°F
POWER	110 VAC @ 0.1 Amp. or ±12 VDC @ 0.25 Amp

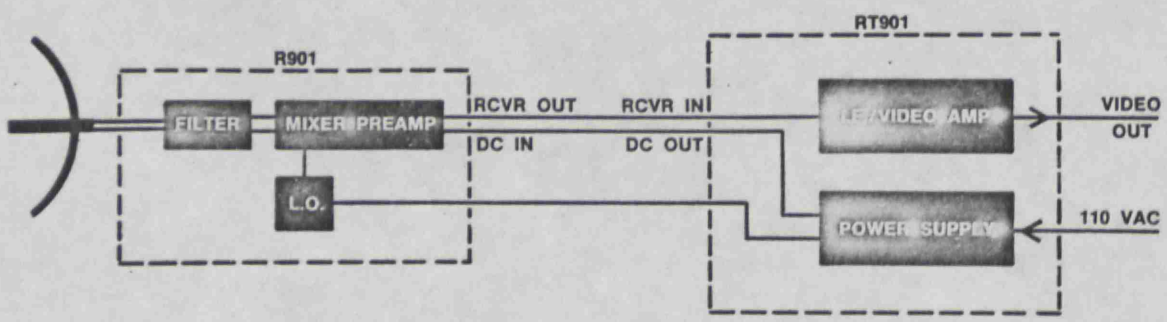
dimensions

TERMINALS	
Transmitter	6″ X 6″ X 4″
Receiver	8″ X 10″ X 4″
RF	
Transmitter	3″ X 3½″ X 1¾″
Receiver	4″ X 3½″ X 1¾″
ANTENNA Dish Diameter	2 Feet

ICM-12 TRANSMITTER



ICM-12 RECEIVER



IMC INTERNATIONAL MICROWAVE CORPORATION 33 RIVER ROAD / COS COB / CONN / 06807 / USA / 203-661-8924 / TWX 710-579-2925

MICROWAVE LINKS FROM INTERNATIONAL MICROWAVE

MODEL ICM-12
FREQUENCY RANGE 12.2 – 12.7 GHz

INTRODUCTION

This unit is designed for use in the business service band for private communications applications. The standard system is a video-only system with an audio sub carrier option. The ICM-12 is adjustment free, all solid state and fully guaranteed for two years.

ICM-12 SYSTEM PERFORMANCE

1. Range (with 2′ Parabolic Antennas)	5 Miles
(with 4′ Parabolic Antennas)	10 Miles
2. Frequency Response	30 Hz to 6 MHz
3. Input Impedance	75 Ohms
4. Input Level	1.4 Peak to Peak Video
5. Output Level	1.4 Peak to Peak Video
6. P – P Signal/RMS Noise	40 dB (unweighted) Min.
7. Differential Gain (3.58 MHz) (10 to 90% APL)	1 dB
8. Differential Phase (3.58 MHz) (10 to 90% APL)	0.5°
9. Square Wave Tilt	1%

OPTIONS

- Audio Sub Carrier
- Intercom Sub Carrier
- R.F. Multiplexer

TRANSMITTER SYSTEM–ELECTRICAL

1. Frequency Band	12,200–12,700 MHz
2. Frequency Stability	± 0.025%
3. Type of Modulation	A.M.
4. F.C.C. Emission Designation	12000A9 w/o Audio 13300A9 w/ Audio
5. R.F. Power Output	10 mW
6. Input Voltage	115 ± 15%V AC, 50-60 Hz
7. Temperature Range	–30 to + 60°C

TRANSMITTER SYSTEM–MECHANICAL

1. Transmitter Terminal	
a. Dimensions	6″ x 6″ x 4″
b. Weight	Approx. 7.0 lbs.
2. Transmitter	
a. Dimensions	4″ x 3.6″ x 1.75″
b. Weight	Approx. 1.2 lbs.

TRANSMITTER SYSTEM–CONNECTORS

1. Video Input	Type UHF Female
2. RF Output	WR75 Cover Flange
3. Power Input	AC3G Switchcraft

RECEIVER SYSTEM–ELECTRICAL

1. Frequency Band	12,200–12,700 MHz
2. Noise Figure	9 dB
3. Image Rejection	75 dB
4. Frequency Stability	± 0.025%
5. Intermediate Frequency	120 MHz
6. Input Voltage	115 ± 15%V AC, 50-60 Hz
7. Temperature Range	–30 to + 60°C

RECEIVER SYSTEM–MECHANICAL

1. Receiver Terminal	
a. Dimensions	10″ x 8″ x 4″
b. Weight	Approx. 10.6 lbs.
2. Receiver	
a. Dimensions	4″ x 3.6″ x 1.75″
b. Weight	Approx. 1.5 lbs.

RECEIVER SYSTEM–CONNECTORS

1. Video Output	Type UHF Female
2. RF Input	WR75 Choke Flange
3. Power Input	AC3G Switchcraft

IMC INTERNATIONAL MICROWAVE CORPORATION
33 RIVER ROAD / COS COB / CONN / 06807 / USA
PHONE 203-661-5924 / TWX 710-579-2925

IMC

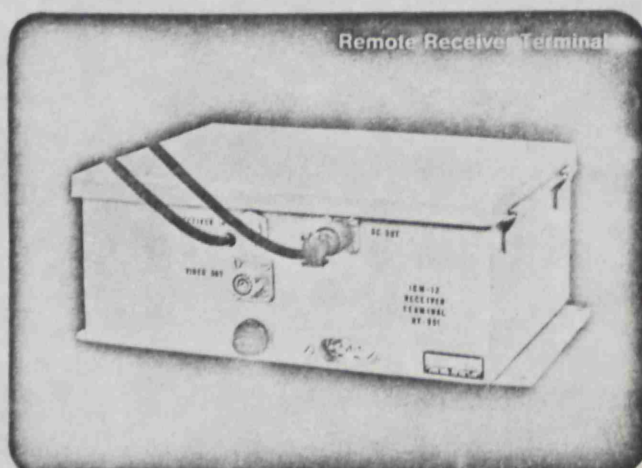
reflector

antenna alignment

antenna feed

mounting clamps

power and video lines



Remote Receiver Terminal

Selling on the Come: The practice of selling a television series by way of syndication sales while the series is still in its "on-network" exhibition, the syndication agreement to be effective when the series goes "off-network."

Barter Deal: A television production-exhibition arrangement under which some organization, usually a national advertiser, guarantees to underwrite the cost of a production in exchange for the right to a certain portion of the commercial advertising time available during the telecast, with the telecasting station retaining the righ to sell the remainder of the advertising.

John Rawls
A Theory of Justice
1971

~~Th~~ Re: Friedman letter:

1. His point about military dictatorships offering more possibilities for return to free society because of existence of separate "private sphere of life" is good. Communist totalitarianism centralizes public and private sector institutions into one. The "govt" or the "state" is everything -- one big bureaucracy -- stable & self-perpetuating bec there is no ~~[illegible]~~ competing influence.

2. ~~The [illegible] main~~ A major reason for American intellectuals' double standard re Communist & military totalitarianism is that they are more like the Communist party ideologues than the military. The military usually isn't ideological on social issues & lacks intellectuals' commitment to make his concept of society "work" by perpetuating ~~it [illegible]~~ the totalitarianism endlessly into all sectors of business, educ, & soc.

But contrast Hitler.

Chap 2 Notes

(1) quote (in Mayer book?) of someone saying TV wouldn't amount to any good bec half greek & half latin.

(2)

(3)

(4)

3 done
4/60 Mr Rubin.

production, there was little opportunity for correction of numerous component reliability and maintenance problems. . . .

- Avionics component reliability specifications based on bench tests appear to have little relation to the subsequent reliability of the component in an operational environment.
- Data now being routinely collected during both initial and operational test phases are being used to some extent to estimate future operating costs of the system. These same data could be used to estimate operational availability. . . .

Conclusions and recommendations based on the findings are that:

- Existing data systems should be improved where necessary and utilized to obtain a better understanding of system cost and operational availability.
- More realistic specifications and procedures should be devised for avionics components, peculiar ground support equipment, and associated software prior to Initial Operational Test and Evaluation.
- Many of the components that cause important support cost and operational availability problems were detected early enough in the test phase to consider corrective action before committing the system to full-scale production. Such actions would undoubtedly delay the apparent Initial Operational Capability date. However . . . [it] seems likely that a somewhat extended development and test phase . . . would result in a truly operational force at a date no later than the present procedure and with a considerably improved operational availability relative to its support cost.

J. R. Nelson, P. Konoske Dey, M. R. Fiorello, J. R. Gebman, G. K. Smith, and A. Sweetland, A Weapon-System Life-Cycle Overview: The A-7D Experience, *Rand Report R-1452-PR, October 1974.*

CONCENTRATION OF MASS MEDIA OWNERSHIP

Those who control the mass media wield enormous political and economic influence; and in the United States, that control rests almost entirely in private hands. The fundamental tenet of public policy toward the mass media is contained in the First Amendment to the U.S. Constitution: "Congress shall make no law . . . abridging the freedom of speech, or of the press. . . ." For more than a century, this Amendment was taken to imply that there could be no government restrictions on or regulation of media ownership.

But the framers of the First Amendment were thinking of the partisan penny press and handbills distributed on street corners as the free marketplace of ideas they considered essential to democratic government. They could not anticipate radio and television broadcasting, by which news and opinion reach millions of people at once. Nor could they foresee the technological and economic trends that have favored consolidation of print and electronic media outlets into chains and groups owned by large corporations.

Consequently, while the words of the First Amendment remain simple and direct, their interpretation under more complex technical, economic, and social conditions is no longer straightforward. It has even become necessary to ask whose rights the First Amendment is supposed to protect—those of media owners, of working journalists who produce news and opinion, or of individual citizens who receive information from the media.

Congressional actions and court decisions in this century have permitted some government intervention in media ownership through antitrust litigation, special legislation for "failing" newspapers, and direct regulation of the electronic media by the Federal Communications Commission.

These interventions are based on the fundamental objective of preserving and enlarging the marketplace of ideas and information available to the citizenry. . . . Ensuring, to use Judge Hand's words . . . "the widest possible dissemination of information from diverse and antagonistic sources" is the basic objective underlying media ownership policies. . . .

In April 1973, under National Science Foundation sponsorship, The Rand Corporation began a study to assess the research literature and other writings dealing with the ownership and control of radio, television, cable communications, and newspapers.

Issues of media ownership concentration are very much on the public mind. How concentrated is ownership in the newspaper, broadcasting, and cable fields? Should newspapers own television stations in the communities they serve? Do the television networks and other corporations own too many stations? Do media monopolies present one-sided versions of the news? Even if monopoly is not demonstrably harmful at present, should media ownership be diversified on general principles, as a safeguard? Under the First Amendment, what are the appropriate and permissible roles of the federal government in regulating media ownership?

These are crucial issues, with obvious political and economic implications for government, media owners, and the public at large. The stakes are high for everyone, and feelings run high when the issues are discussed. Rhetoric, and sometimes polemics, dominate much of the literature on media ownership. . . .

In this highly charged atmosphere, Rand considered it important to sift the literature systematically, and as dispassionately as possible, with two goals in mind: first, to determine what factual evidence there is on the effects of media ownership and its relevance to present government policies; and second, to suggest what additional data and analysis are needed to strengthen the basis for future policymaking.

This report represents the results of the assessment.

Walter S. Baer, Henry Geller, Joseph A. Grundfest, and Karen B. Possner, Concentration of Mass Media Ownership: Assessing the State of Current Knowledge, *Rand Report R-1584-NSF, September 1974.*

IMPROVING THE EFFICIENCY OF PUBLIC INSTITUTIONS

Public institutions are created within government to serve societal goals and are endowed with public funds. These institutions are often considered to be inefficient, partly because some citizens cannot see their benefits, only the costs, but largely because they are not subject to the tests of the free market as are competitive profit-making organizations. . . .

Some economists recommend moving certain government functions to private firms where market price signals can help ensure efficiency. . . . While there may be virtue in such a recommendation, some bureaucratic functions, such as defense, will very likely remain in the public sector. . . .

Since we have public-sector organizations, the problem for the policy analyst is to find ways to move these organizations toward the efficiency of profit-making firms. . . .

Our thesis is that behavioral forces within public-sector organizations contribute to resource allocation inefficiencies and that finding ways to reduce these forces can improve efficiency.

We investigate this hypothesis in the context of a large Department of Defense organization, the Strategic Air Command (SAC). . . . The investigation focuses on the B-52 flying organizations of the . . . Command. . . . Annual expenditures for SAC flying organizations is approximately $2 billion. . . . Therefore, relatively small improvements in resource allocation efficiency could produce striking amounts of absolute dollars either saved or turned to increased performance. . . .

SAC's basic goal for manned aircraft is to maintain combat-ready aircrews and aircraft as a credible nuclear deterrent. SAC operates decentralized bombardment wings, each of which conducts a flying program to maintain proficiency of aircrews, qualify new crew members, exercise aircraft systems, and preserve maintenance skills. Additionally, some of the aircrew and aircraft resources are continuously assigned to ground alert to serve as quick-reaction strategic forces.