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SMS/GOES WEFAX USERS GUIDE

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SUMMARY

The purpose of this document is to provide both the WEFAX user and the APT user the basic equipments necessary to convert present equipment to the new SMS WEFAX frequency. This conversion is simple, and as in all communication systems, can be accomplished by innumerable approaches. The approach used for this document assumed commercial purchase of components and integration by the user into his system. This conversion requires no modification to existing equipment and is simply an RF conversion from S-band to the present VHF frequencies.

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SMS Project

SMS/GOES WEFAX USERS GUIDE

The SMS/GOES spacecraft will transmit at a frequency of 1690.1MHz. This document describes a technique for conversion from this S-band frequency to the present VHF frequency. In order that the user may make his own system tradeoffs, detailed link analysis is provided. These tradeoffs are necessarily limited to system noise temperature and antenna size.

Four items will be required for this conversion: 1) S-band antenna, 2) Preamplifier, 3) local oscillator, 4) mixer converter. Since the latter two are standard and do not present a range of selections that are available for the antenna, they will be presented first.

The local oscillator and mixer described in this transmittal are commercially available and are presented as a class of devices, not the only approach.

The local oscillator tested is a Greenray Industries Inc. Model EY 118BD with a 5mw output at S-band. The salient specifications are:

Frequency	1554.5MHz
RF Power	5 mw
Input Voltage	12 VDC
Frequency Stability	±.00075% for 0-59°C
Spurious Outputs	Non-Harmonic -60db Min Harmonic -26db Min
Warm-up Time	15 min.
Cost	$750.00 in units of 1

The mixer converter is a Relcom model MIG. It is a wideband, low noise, double balanced mixer. The salient specifications are:

Noise Figure	7.5db max
Isolation	40 db
Cost	$200 in units of 1

A wide selection of preamplifiers is available with noise figures ranging from less than 3db for an uncooled parametric device to less than 8db for an inexpensive transistor amplifier. A typical S-band preamplifier would be the Aertech Model 4658N (type N connectors) transistor amplifier with the following salient characteristics.

Noise figure	6/0db
Frequency range	1 to 2GHz
VSWR	2.5 to 1
1db gain compression	+10dbm
Voltage	+20V DC
Cost	$538 in units of 1

The antenna must be selected as a function of station location and system margin desired. Figure 1 provides the elevation and azimuth angles as a function of station location. Figure 2 is a plot of antenna size as a function of elevation angle.

The link analysis and system margin is predicated on a system noise figure of 6db(temperature of 860 degrees kelvin). The detailed link budget is given in Table 1.

The cost to convert to the SMS frequency is given for 1 each purchase and will definitely be reduced for quantity buys. As an example, the mixer price is $144 in lots of 10 to 24 and $170 in lots of 5 to 9.

Antenna	$ 825 (10 foot)	$510 (8 foot)
Preamp	538	538
Mixer	200	200
LO	750	750
TOTAL	$2,313	$1,998

These antenna prices are quotations from a number of manufacturers (Andrew Prodelin, Mark, etc.).

REFERENCES

1. Car Eslinger and Sumin Tchen. "A Ground Station for the Nimbus Weather Satellite Automatic Picture Transmission System." NASA/GSFC X320-67-511, October 1967

2. Charles H. Vermillion. "Weather Satellite Picture Receiving Stations." SP-5080 1969

Tables -

Figures -

SMS - SYNCRHONOUS METEOROLOGICAL SATELLITE

GOES - GEOSTATIONARY OPERATIONAL ENVIRONMENTAL SATELLITE

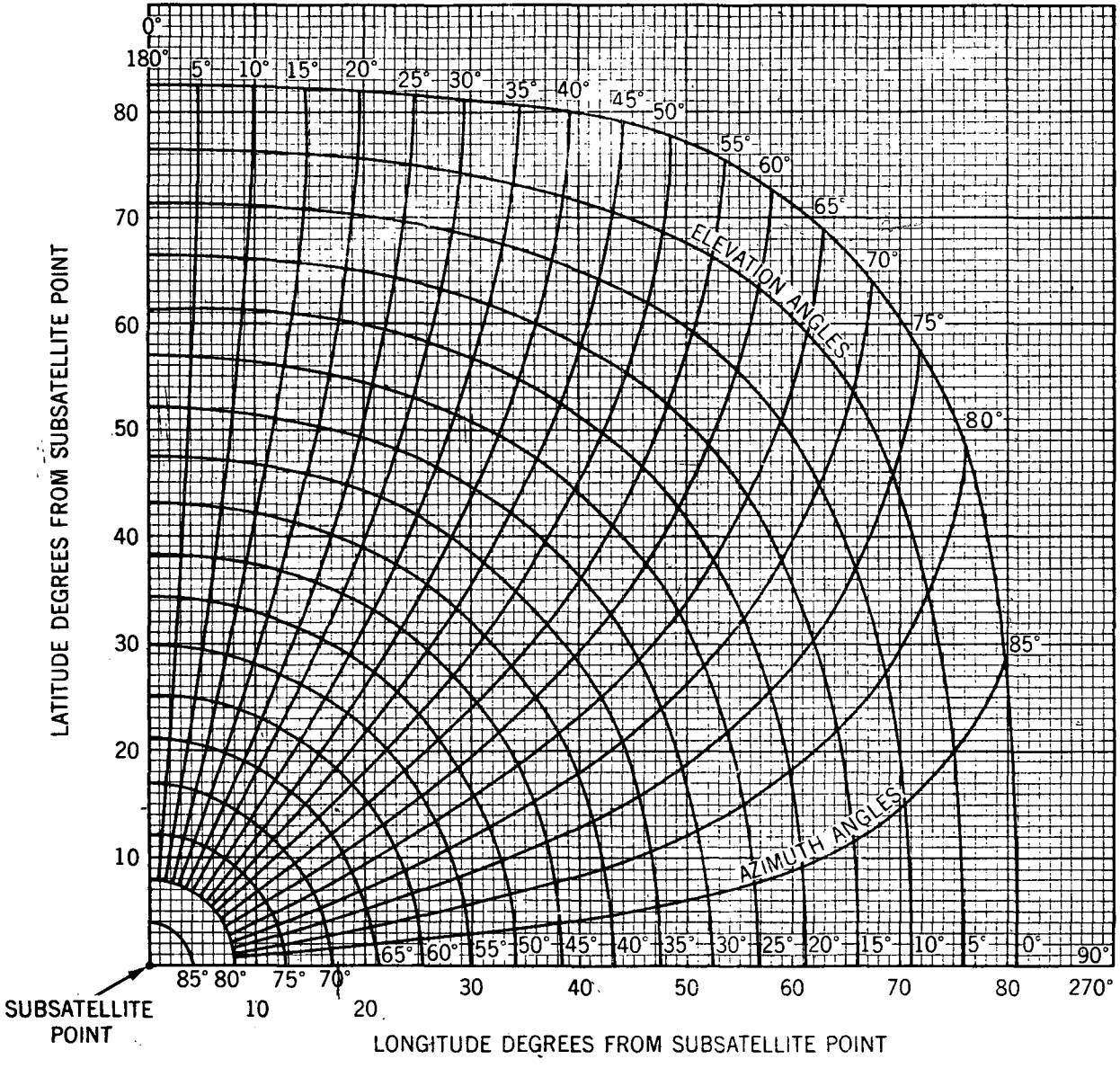
WEFAX - WEATHER FACSIMILE

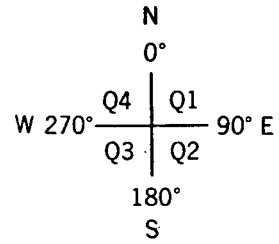
APT - AUTOMATIC PICTURE TAKE

TABLE I

S-BAND WEFAX LINK NEAR EARTH EDGE

SPACECRAFT TRANSMITTER POWER	+42.2	dBm
ANTENNA FEED LOSS	- 3.3	dB
ANTENNA GAIN (ON AXIS)	+17.3	dB
SPACECRAFT EIRP	+56.2	dBm
OFF-BEAM LOSS	- 2.2	dB
PATH LOSS	-189.3	dB
POLARIZATION LOSS	- 0.2	dB
RECEIVE ANTENNA GAIN (10')	+32.1	dB
POINTING LOSS	- 0.5	dB
RECEIVE LOSSES	- 2.0	dB
RECEIVED SIGNAL LEVEL	-106.2	dBm
RECEIVER NOISE DENSITY (860°K)	-169.3	dBm/Hz
RECEIVED CARRIER/NOISE DENSITY	+63.1	dB.Hz
REQUIRED CARRIER/NOISE DENSITY	+57.0	dB.Hz
MARGIN	+6.1dB	





AZIMUTH ANGLE CONVERSION
(Q1 ANGLES ARE SHOWN ON CHART)

Q1	Q2	Q3	Q4
0	180	180	0
5	175	185	355
10	170	190	350
15	165	195	345
20	160	200	340
25	155	205	335
30	150	210	330
35	145	215	325
40	140	220	320
45	135	225	315
50	130	230	310
55	125	235	305
60	120	240	300
65	115	245	295
70	110	250	290
75	105	255	285
80	100	260	280
85	95	265	275
90	90	270	270

Figure 1. Longitude Degrees from Subsatellite Point

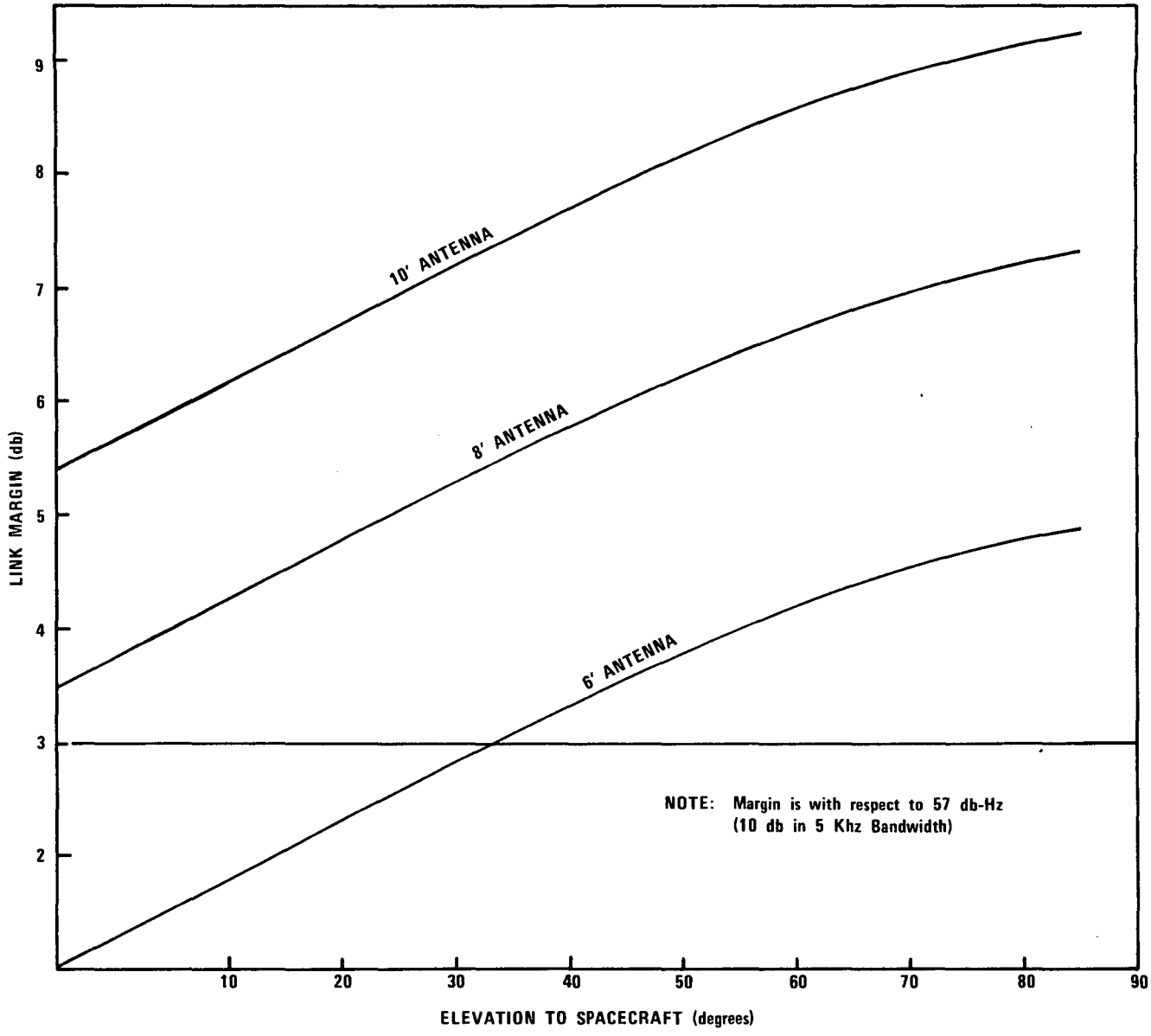


Figure 2. WEFAX Link Margin as a Function of Spacecraft Elevation from Ground Station