5. With the transmitter energized, use the spectrum analyzer and plotter to produce a plot of the spurious emissions appearing at the transmitter antenna terminal over the range from 1 GHz to the tenth harmonic of the transmitter operating frequency. Record transmitter operating frequency, power output reference level (Step 5), and spectrum analyzer resolution/video bandwidth on the emissions plot.
6. With the transmitter energized, use the Rohde & Schwarz EMI Receiver and record a data file of the spurious emissions appearing at the transmitter antenna terminal over the range from 894 to 896 MHz. Record transmitter operating frequency, power output reference level (Step 5), and spectrum analyzer resolution/video bandwidth on the emissions plot.
7. With the transmitter energized, use the Rohde & Schwarz EMI Receiver and record a data file of the spurious emissions appearing at the transmitter antenna terminal in the band $f_0 \pm$ 11.2 kHz. Record transmitter operating frequency, power output reference level (Step 5), and resolution/video bandwidth on the emissions plot.
8. Via the MMT, program the transmitter to operate at an RF output power level 3 dB below the maximum power output level and repeat Steps 4 through 7.
9. Via the MMT, program the transmitter to operate at an RF output power level 13 dB below the maximum power output level and repeat Steps 4 through 7.
10. Via the MMT, program the transmitter to operate at the minimum RF output power level and repeat Steps 4 through 7.
11. Via the MMT, program the transmitter to operate at maximum RF power output at 895.994100 MHz (P2, Blk 5) and repeat Steps 4 through 10.
12. List all test equipment used in these measurements. Include the manufacturer's name and model number, a description of the equipment, and the date that the equipment was last calibrated.

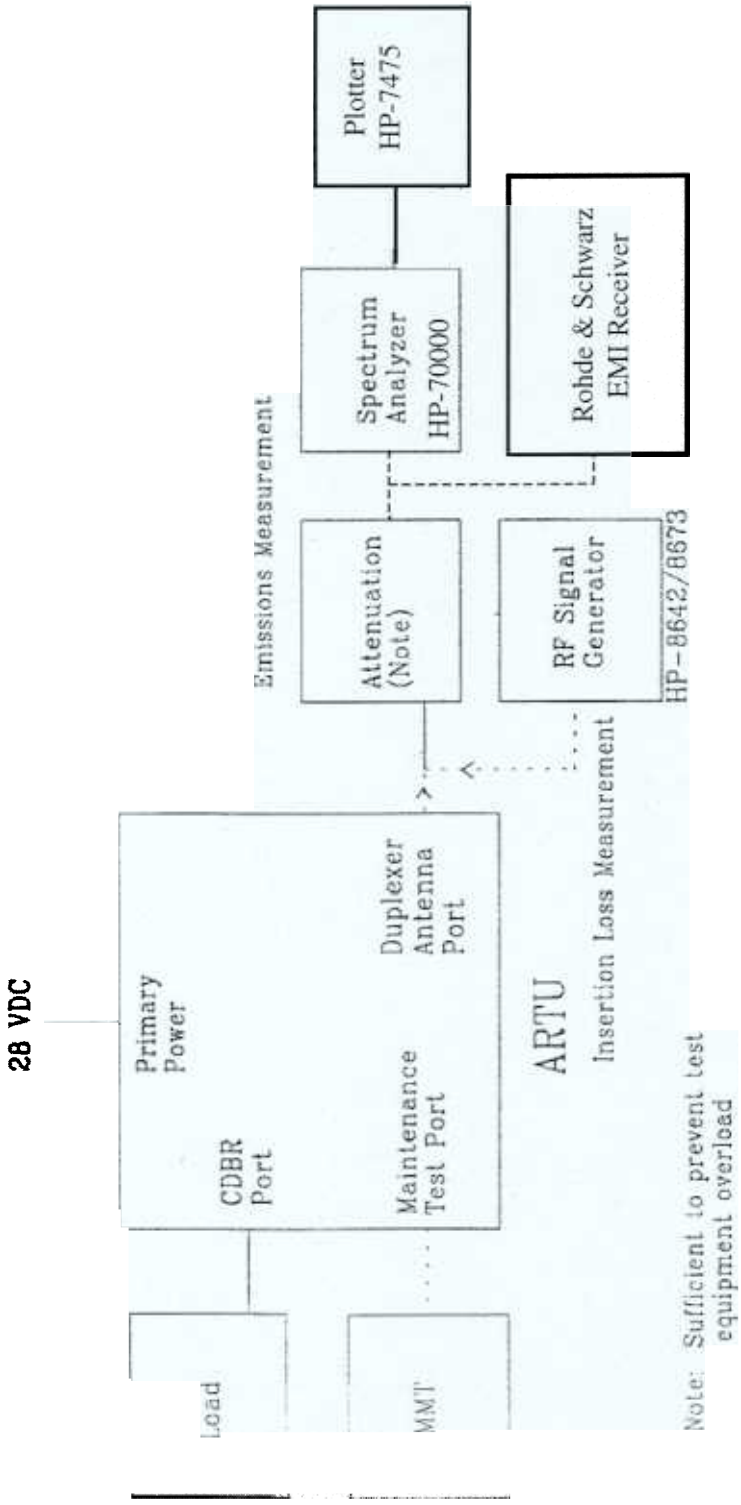

Figure 2.3-2 Antenna Terminal Emissions Measurement Setup (Control Channel)

2.4 Field Strength of Spurious Radiation [2.1053]

Measurements of the field strength of spurious emissions shall be performed in accordance with the requirements of FCC Part, §2.1053.

Requirement - The power of any spurious emission in each of the adjacent channels must be at least 30 dB below the peak envelope power of the main emission. The power of any emission in any of the channels other than the one being used and the adjacent channels must be at least 50 dB below the peak envelope power of the main emission {FCC Part 2, §22.861 and Memorandum Opinion and Order (July 11, 1991)}.

Test Site - The Raytheon open field test site is situated on flat grassy farmland in an area relatively free from RF interference. The test site is free of aboveground metallic structures for a distance greater than 75 m. A ground plane is installed at the site. The ground plane consists of 120, 14 AWG copper-wire radials. The radials are uniformly spaced and have a length of 125 ft. The site is equipped with a remotely controlled turntable and 25 ft (7.6 m) antenna mast. The turntable and mast are separated by a distance of 3 meters. Canvas and wood-frame tents are located at the test and measurement positions to provide inclement weather protection for personnel and equipment.

2.4.1 Measurements

Test data shall indicate the relative radiated power of each spurious emission with reference to the power output of the transmitter under test, assuming all emissions are radiated by a half-wave dipole antenna. Antenna factors for all the antennas used in these measurements appear in Figures 2.4-3 through 2.4-6. The frequency spectrum, which shall be investigated, extends from 30 MHz to ten times the transmitter operating frequency (f_o).

Radiated emissions data will be marked with the limits given in §22.861. Limits for emissions at frequencies outside of the air-to-ground band are not specified in §22.861. Consequently, the limit column of the test data sheet will not be filled in when out-of-band emissions measurements are made. All out-of-band emissions not attenuated more than 63 + 10log(P) dB (where P is the average transmitter power output) shall be recorded.

A measurement system bandwidth of 300 Hz shall be employed for measurements over the range from 894 to 896 MHz. A measurement system bandwidth of 30 kHz shall be employed at all other measurement frequencies from 30 MHz to ten times the transmitter operating frequency (f_o).

Measurements will be made with the ARTU transmitter operating at maximum power output at two frequencies in the 894 - 896 MHz operating frequency range of the transmitter. Channel/Block assignments and corresponding operating frequencies are listed in Table 2.4-1.

Table 2.4–1 Channel Assignments & Measurement Frequencies

Channel/Block Assignments	Frequency (MHz)
Ch. 17/Blk 10	894.101500
Ch. 17/Blk 1	895.901500

During testing the transmitter will be operated into a non-radiating, 50-ohm load and will be modulated by a pseudo-random data stream. The pseudo-random data stream will contain pilot symbols and represents the maximum data rate and the full range of symbol amplitudes encountered during normal operation of the transmitter.

Radiated emissions tests will be made in a shielded test enclosure prior to performing any testing at the open area test site. This data will identify frequencies where EUT radiated emissions exist and will help the tester to differentiate EUT emissions from open area site ambient emissions. The shielded enclosure test data will be used only to facilitate measurements at the open area test site.

All open area radiated emissions tests shall be performed with measurement antenna located in the far-field of the transmitter under test. Table 2.4-2 lists the measurement antennas, the antenna frequency range, and the antenna polarization(s) to be used in each frequency range.

Table 2.4–2 Measurement Antenna, Frequency Range, and Polarization

Antenna	Frequency Range	Polarization
Compliance Design B 100	30 - 175 MHz	Vertical & Horizontal
Compliance Design B 200	175 - 400 MHz	Vertical & Horizontal
Compliance Design B 300	400 - 1000 MHz	Vertical & Horizontal
EMCO 3102	1 - 12.6 GHz	Circular

The insertion loss of the cables and attenuators between the measurement antenna and the spectrum analyzer will vary with frequency. To account for these effects, loss measurements will be performed prior to the start of testing. The resulting data will be used, as described in the measurement procedure below, to compute the relative attenuation of EUT emissions.

During open site testing, care shall be used to ensure that the spectrum analyzer and LNA (Low Noise Amplifier - used at frequencies below 1 GHz) are not overloaded by strong signals in the test site's ambient electromagnetic environment. When emissions measurements are made, the spectrum analyzers shall be operated in the "MAX HOLD" mode until no further change in the emissions spectrum of the ARTU is noted. (A minimum of ten sweeps shall be taken.)

2.4.2 Spurious Radiation Measurement Procedure

Prepare the test setup shown in Figure 2.4-1. All RF connections shall be made using 50ohm coaxial cables.

2. Measure and record the insertion loss of the cables and attenuators used in the signal path between the measurement antennas and the spectrum analyzer or LNA.
3. Power the ARTU from a 28 VDC power source.
4. Via the MMT, program the transmitter to operate at the maximum power output level at 894.101500 MHz (Ch. 17, Blk 10).
5. Energize the transmitter and measure the power output level. Record the power level in the spaces provided on a test data sheet of the type shown in Figure 2.4-2, accounting for all losses in the measurement path.
6. Calculate the reference field strength using the formula

$$E_{ref} = 20 \cdot \log\{[120 \cdot PI \cdot P_t \cdot G_t / 4 \cdot PI \cdot d^2]^{1/2} / 10^{-6}\}$$

$$= 10.\log[Pt] + 107.4$$

where,

Eref = Field Strength in dBuV/m
PI = 3.14159
Pt = Transmitter Power Output in Watts
Gt = 1.64 = Dipole Antenna Gain (numeric)
d = 3 m = Separation Distance

7. Record the value calculated in Step 6 in the space provided on the test data sheet.
8. Install the Compliance Design B 300 antenna and orient it to measure the horizontal component of the radiated field.
9. Set the spectrum analyzer center frequency, span, and resolution/video bandwidth to the transmitter operating frequency, 18 kHz, and 300 Hz, respectively.
10. Energize the transmitter and monitor the spectrum analyzer display. Use the data obtained during shielded enclosure testing as a guide to locating EUT emission frequencies. At each EUT emission frequency:
    a. Rotate the turntable and raise and lower the measurement antenna (from 1 to 4 m) to maximize the amplitude of the EUT emission.
    b. Inject a CW signal, having the same frequency as the EUT emission, into the spectrum analyzer or LNA (as appropriate) input port. Adjust the amplitude control of the calibrated signal substitution source to produce a response having the same amplitude as the EUT emission. Record the frequency and signal substitution level (E_{sub}, in dBuV) in the spaces provided on the test data sheet.

c. Record the spectrum analyzer resolution/video bandwidth in the space provided on the test data sheet.

d. Record the corresponding cable/attenuator loss (C/A, in dB) and Antenna Factor (AF, in dB/m) in the spaces provided on the test data sheet.

e. Calculate the relative attenuation (ATTEN, in dB) of the EUT emission (EUT emission level with respect to the reference level recorded in Step 7) using the formula:

$$ATTEN = E_{ref} - (E_{sub} + C/A + AF)$$

f. Record the relative attenuation in the space provided on he test data sheet.

11. Set the spectrum analyzer start frequency, stop frequency, and resolution/video bandwidth to 894 MHz, 896 MHz and 300 Hz, respectively, and repeat Step 10.

12. Set the spectrum analyzer bandwidth to 30 kHz. With the Compliance Design B 100, B 200 or B 300 antenna (as appropriate) horizontally polarized, repeat Step 10 to measure EUT emissions in the range from 30 MHz to 1 GHz.

13. Repeat Steps 9 through 12 with the measurement antennas vertically polarized.

14. Install the EMCO 3102 antenna and repeat Step 10 to measure EUT emissions in the range from 1 GHz to the tenth harmonic of the transmitter operating frequency.

15. Via the MMT, program the transmitter to operate at the maximum power output level at 895.901500 MHz (Ch. 17, Blk 1) and repeat Steps 5 through 14

16. List all test equipment used in these measurements. Include the manufacturer's name and model number, a description of the equipment, and calibration dates.

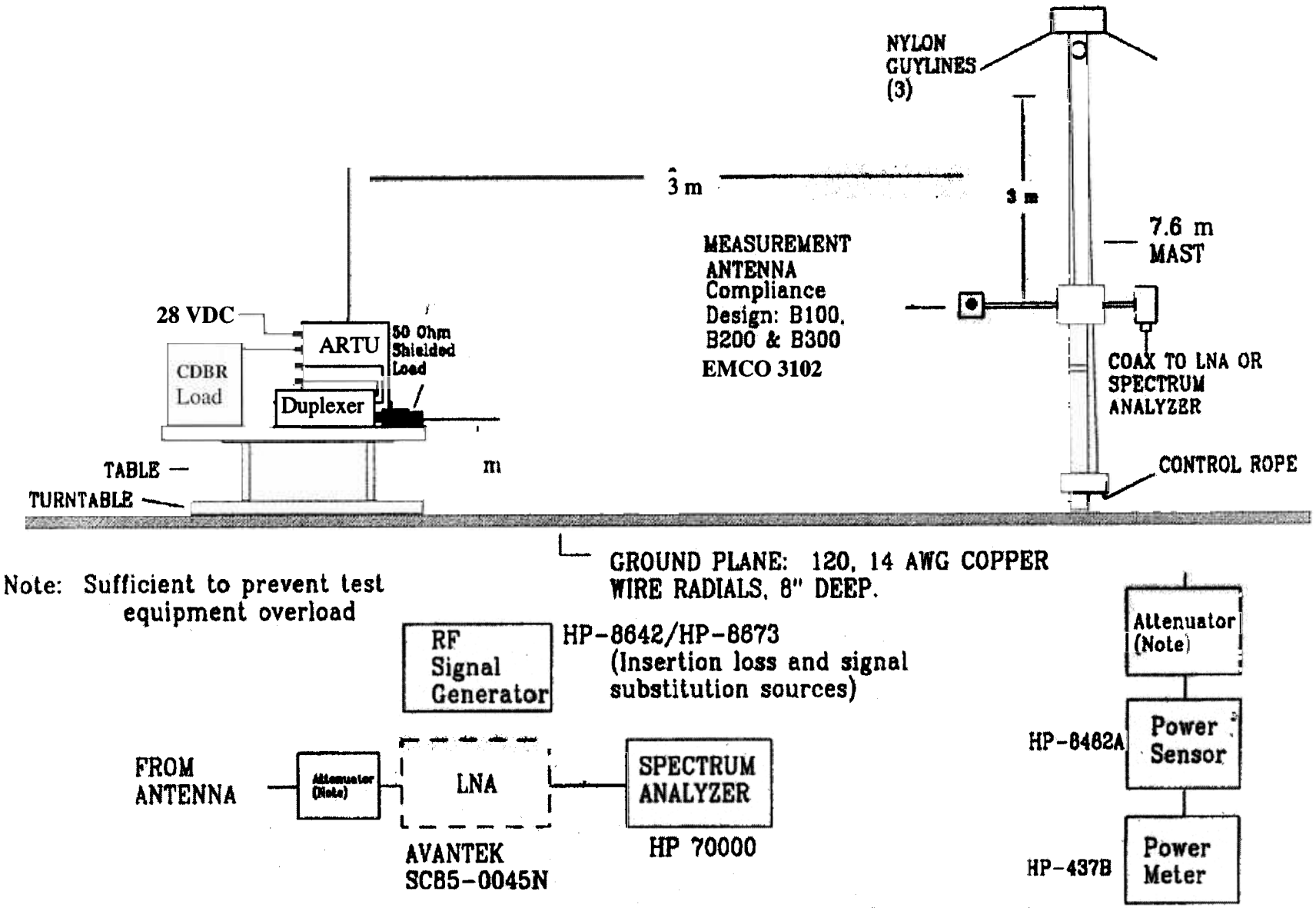

Figure 2.4-1. Radiated Spurious Emissions Measurement Setup