BACKUP AID RADIATED EMISSIONS

AND

METHOD OF TEST

3-29-00

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Equipment Used

MANUFACTURE	MODEL/TYPE	DATE CALIBRATED
Hewlett Packard	83630A Synthesizer	6-99
Hewlett Packard	6632A Power Supply	6-99
Hewlett Packard	6624A Power Supply	12-99
Hewlett Packard	8991A Peak Power Analyzer	2-00
Hewlett Packard	84813A Peak Power Sensor	2-00
Hewlett Packard	438A Power Meter	12-99
Hewlett Packard	8485D Power Sensor	7-99
Hewlett Packard	8563E Spectrum Analyzer	6-99
Hewlett Packard	8510C Network Analyzer	12-99
Narda	639 Standard Gain Horn	17.6dBi @ 17Ghz
Narda	4609 WG to Coax Adapter	-0.3dB insertion loss
CTT	AFM/180-3530 Amplifier	35.7dB gain @ 17Ghz
CDI	3 ft Semi Flex Coax	-2.7 dB insertion loss @ 17Ghz

Equipment Characterization

The HP8510C Network Analyzer was used to characterize the CDI 3ft. Semi Flex Coax Cable and the CTT Amplifier. *Both the coax and amp were swept from 5-25Ghz, together and separate. At 17Ghz the amplifier has a gain of 35.7dB and the cable has an insertion loss of –2.7dB, an additional –0.3dB will be used for insertion loss of the WG to Coax Adapter.*

The HP83630A Synthesizer and 438A power meter were used to verify the amplitude measurements of the HP8563E Spectrum Analyzer. *A known signal amplitude at various frequencies were set using the power meter and verfied on the Spectrum Analyzer to within 0.5dB. (well within calibration limits)*

The HP8991A Peak Power Analyzer was connected to the amplifier to measure the SNR. *With the amplifier OFF the noise floor of the Peak Power Analyzer measured –34.4dBm. The amplifier ON condition raised the noise floor to –32.4dBm.*

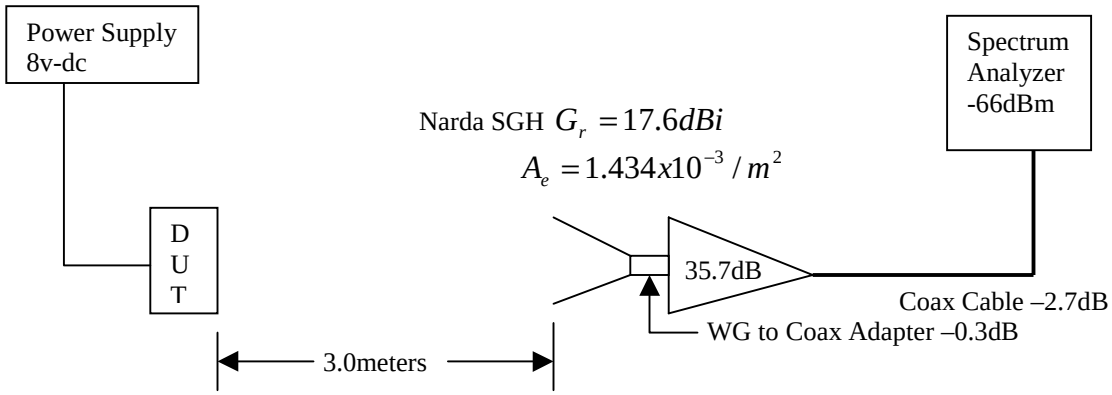
Therefore: -32.4dBm= .57μW Shall be reduced from the signal + noise measurement.

Effective Aperture of Narda 639 Standard Gain Horn

Gain @ 17Ghz = 17.6dbi

$$A_e = \frac{G_r \lambda^2}{4\pi} = \frac{10^{1.76}(.0177)^2}{4\pi} = 1.434x10^{-3}/m^2$$

Spectrum Analyzer Measurement SN-9105



Spectrum Analyzer settings

Reference Level –30dBm	5dB/div	Atten 0dB	Center Freq. 16.950Ghz
Span 1.0Ghz	RBW 1.0Mhz	VBW 10Khz	SWP 250ms

Trace was set to MAX HOLD then the DUT went through several slow rotations in all directions to capture all possible signal at 3 meters away. Marker PEAK SEARCH was then pushed to find maximum. MKR display read 16.805Ghz –66.08dBm.

$$P_r = -66.0dBm + (-35.7dB) + 0.3dB + 2.7dB = -98.7dBm$$

$$\omega_{rad} = \frac{p_r}{A_e} = \frac{-98.7dBm}{1.434x10^{-3} / m^2} = \frac{10^{-9.87}\, dBm}{1.434x10^{-3} / m^2} = 94.1pW / m$$

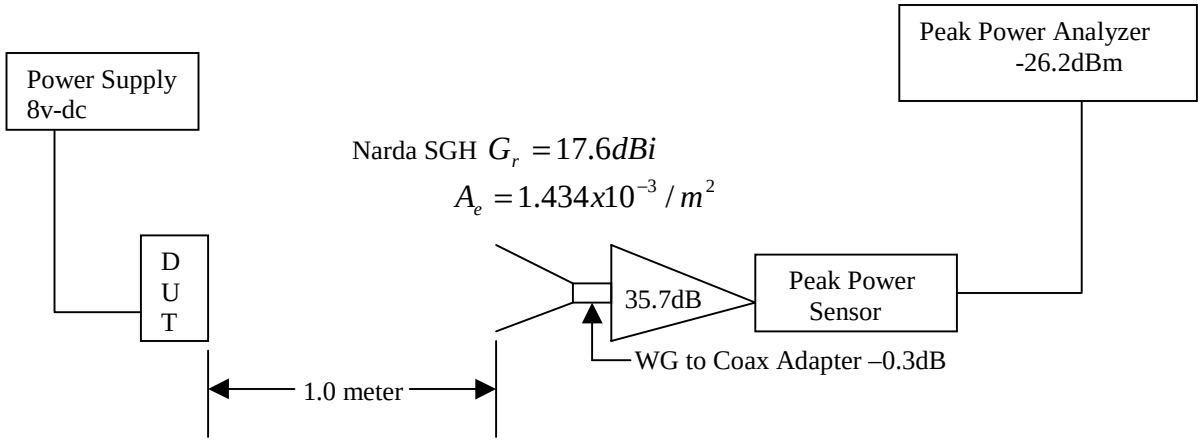
$$E\big|_{3m} = \sqrt{\eta\omega_{rad}} = \sqrt{120\pi\left(94.1x10^{-12}\right)} = 188\mu V / m$$

$$188\mu V / m = 20\log 188 = 45.5dB\mu V / m$$

RESULT: The radiated emissions are 8.5dB below the limit of 54dBµV/m.

Peak Power Analyzer Measurement SN-9105

To measure Total Instantaneous power



Peak Power Analyzer settings

Reference Level –20dBm Scale 2dB/div Time Base 50µsec/div
Bandwidth Low Carrier Freq. 17Ghz

DUT was 1.0 meter from SGH and rotated to achieve a peak signal on the Peak Power Analyzer display. The displayed data read –26.16dBm includes noise from the amplifier.

Under Equipment Characterization the noise from the amplifier was calculated to be 0.57µW. Therefore: The corrected displayed reading should be –26.16dBm = 2.42µW –0.57µW = l.85µW = **-27.3dBm.**

$$P_r = -27.3dBm + (-35.7dB) + 0.3dB = -62.7dBm$$

$$\omega_{rad} = \frac{P_r}{A_e} = \frac{-62.7dBm}{1.434x10^{-3} / m^2} = \frac{10^{-6.27}\, dbm}{1.434x10^{-3} / m^2} = 374nW / m$$

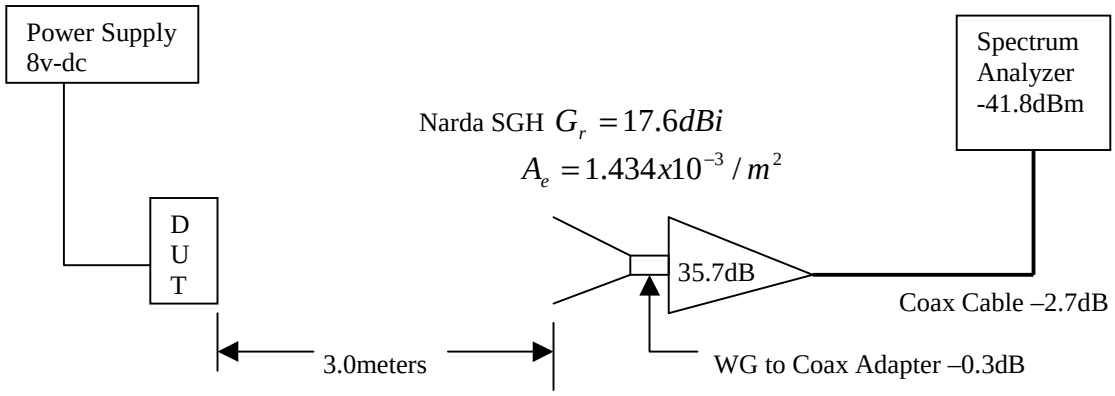
$$E\big|_{1m} = \sqrt{\eta\omega_{rad}} = \sqrt{120\pi\left(374x10^{-9}\right)} = 11874\mu V / m$$

$$E\big|_{3m} = \frac{11874}{3} = 3958\mu V / m = 20\log 3958 = 71.9dB\mu V / m$$

RESULT: The radiated Total Instantaneous emissions are 2.1dB below the Limit of 74dBuV/m.

Demodulated BUA Radar SN-2002

Demodulation was accomplished by cutting traces to pins 54 & 55 of the ASIC, and changing resistors R35 & R36 (which bias the modulator) from 20 ohm to 210 ohm 1/8w. R36 was tied to ground and R35 had 5v applied. Normally only 1v is applied but no longer available which in turn required a resistor change.



Spectrum Analyzer settings

Reference Level –30dBm 5dB/div Atten 0dB Center Freq. 16.9823Ghz
Span 100Mhz RBW 1.0Mhz VBW 10Khz SWP 50ms
Trace was set to MAX HOLD then the DUT went through several slow rotations in all directions to capture all possible signal at 3 meters away. Marker PEAK SEARCH was then pushed to find maximum. MKR display read 16.825Ghz –41.83dBm.

$$P_r = -41.8dBm + (-35.7dB) + 0.3dB + 2.7dB = -74.5dbm$$

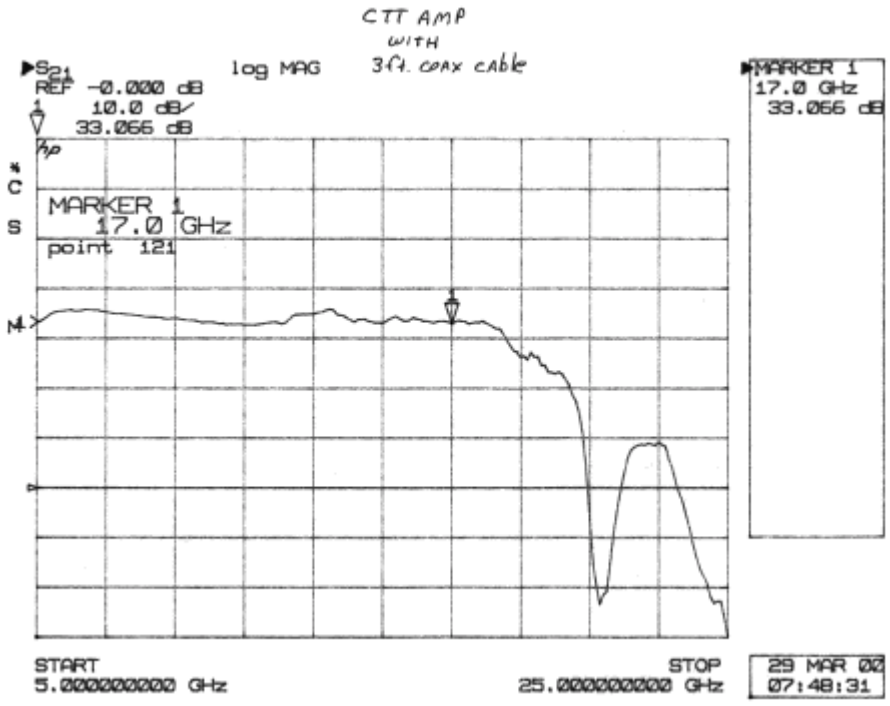
$$\omega_{rad} = \frac{P_r}{A_e} = \frac{-74.5dBm}{1.434x10^{-3} / m^2} = \frac{10^{-7.45}\,dBm}{1.434x10^{-3} / m^2} = 24.7nW / m$$

$$E\big|_{3m} = \sqrt{\eta\omega_{rad}} = \sqrt{120\pi\left(24.7x10^{-9}\right)} = 3052\mu V / m$$

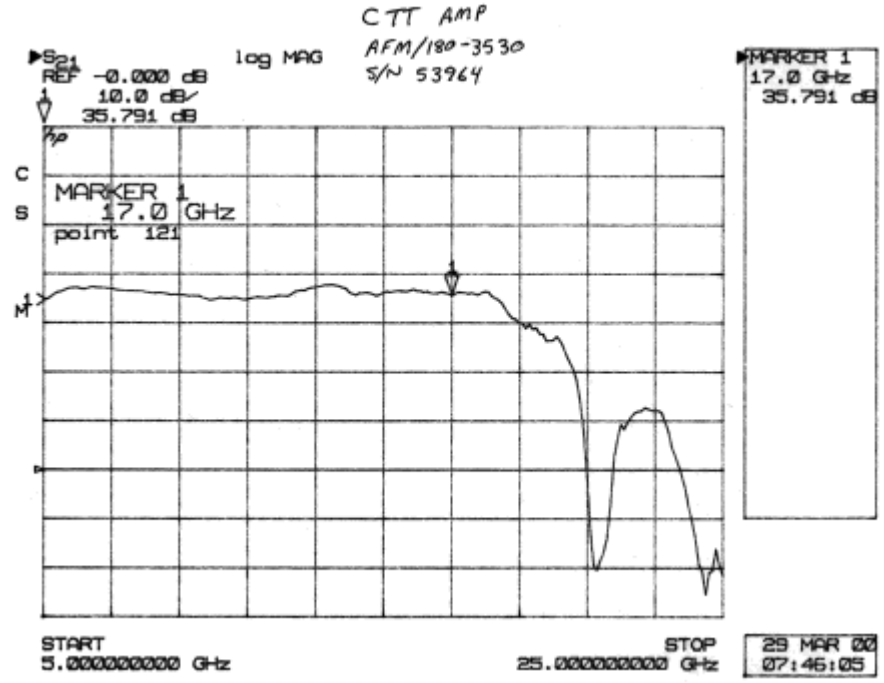
$$3052\mu V / m = 20\log 3052 = 69.7dB\mu V / m$$

RESULT: The radiated emissions of the demodulated radar are 4.3dB below the limit of 74dBuV/m

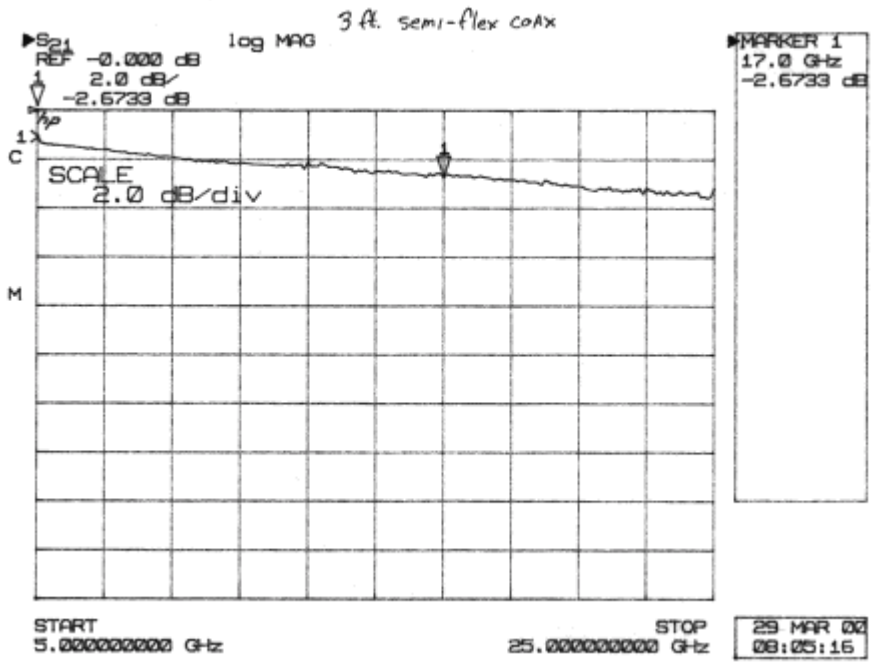
CTT AMPLIFIER WITH 3Ft. COAX



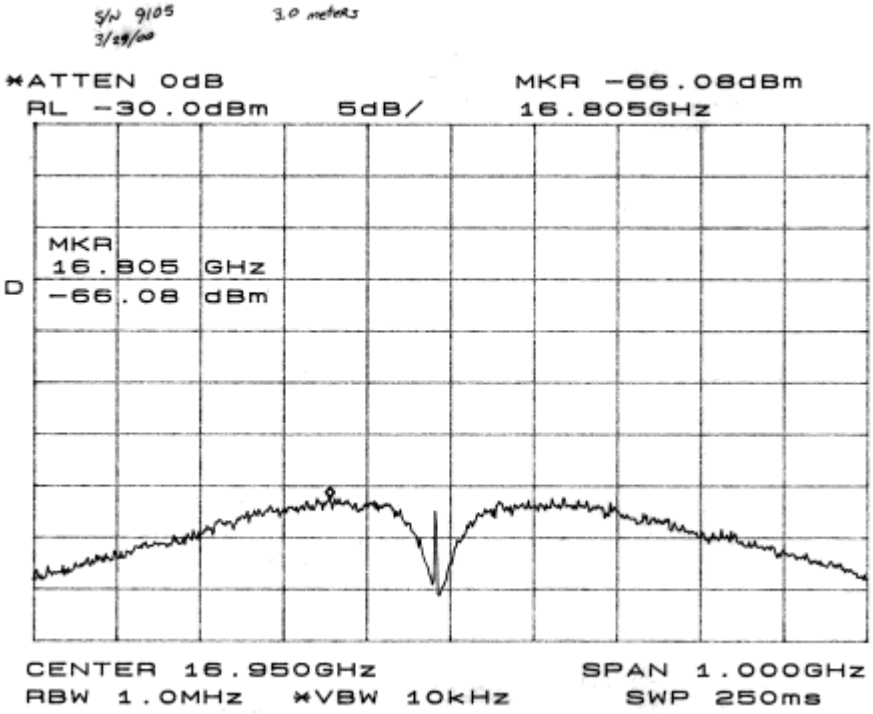
CTT AMPLIFIER MODEL # AFM/180-3530



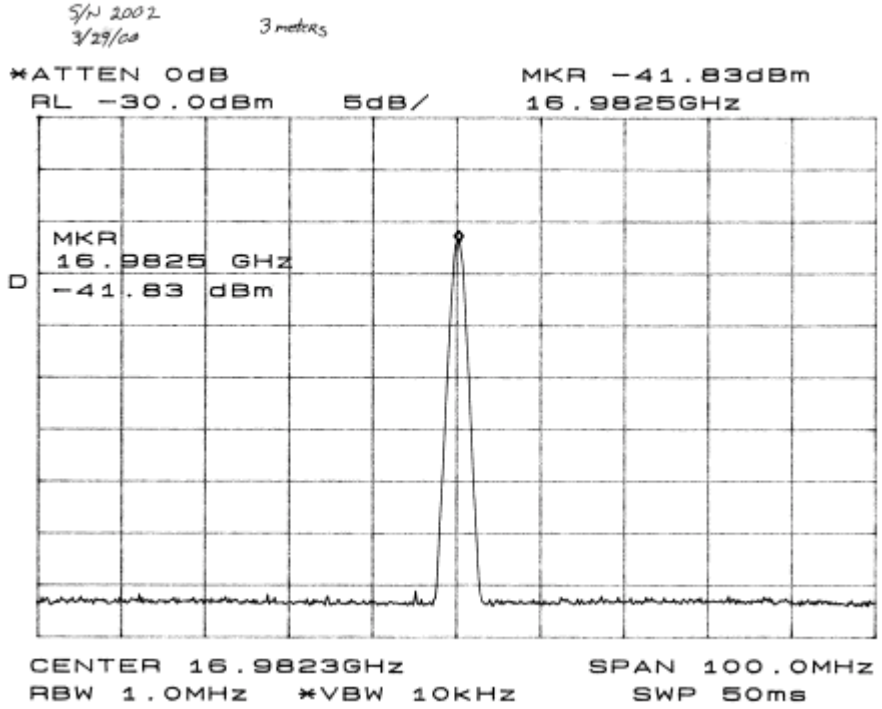
CDI 3ft. SEMI-FLEX COAX CABLE



MODULATED BUA RADAR 3 meter MEASURMENT SN-9105



DEMODULATED RADAR 3meter MEASURMENT SN-2002



MODULATED BUA 1 meter MEASURMENT SN-9105
TOTAL INSTANTANEOUS POWER