

Supplemental Information

T R A N S M I T T A L



To: Frank Coperich

Fax: (301) 344-2050

From: M. Brett Wilson

Date: September 27, 1994

Pages: Lead + 11

Subject: Pending Application for Type Acceptance, FCC ID
AJKPN822-0329 - dB down conversions

Frank:

I have enclosed the latest fix to our field strength demonstration problems. Each of the attached graphs from the original Exhibit I now note dB down. Please let me know if this is what you wanted. My phone number is (703) 412-6635.

Thank you,

Brett Wilson

M. Brett Wilson

Rockwell International

Suite 1200

'45 Jefferson Davis Highway

Arlington, VA 22202

Telephone: 703/412-6635

Fax: 703/412-6868

Comnet: 747-6635/6868

3.5 Field Strength of Spurious Radiation (2.993)

The DME and test equipment were connected as shown in the Figure 3-39. Data was taken with the DME tracking channels 1X and 126X. The unit was scanned using a linearly polarized antenna in the horizontally polarized position. Broad band emissions were recorded from 150 KHZ to 1215 MHz and are included in Figures 3-40 through 3-42. Figures 3-43 and 3-44 are broad band plots centered on the DME's transmit frequency at channels 1X and 126X. Narrow band emissions were recorded from 150 KHZ to 12 GHz and are included in Figures 3-45 through 3-50. Figures 3-51 and 3-52 are narrow band plots centered on the DME's transmit frequency at channels 1X and 126X

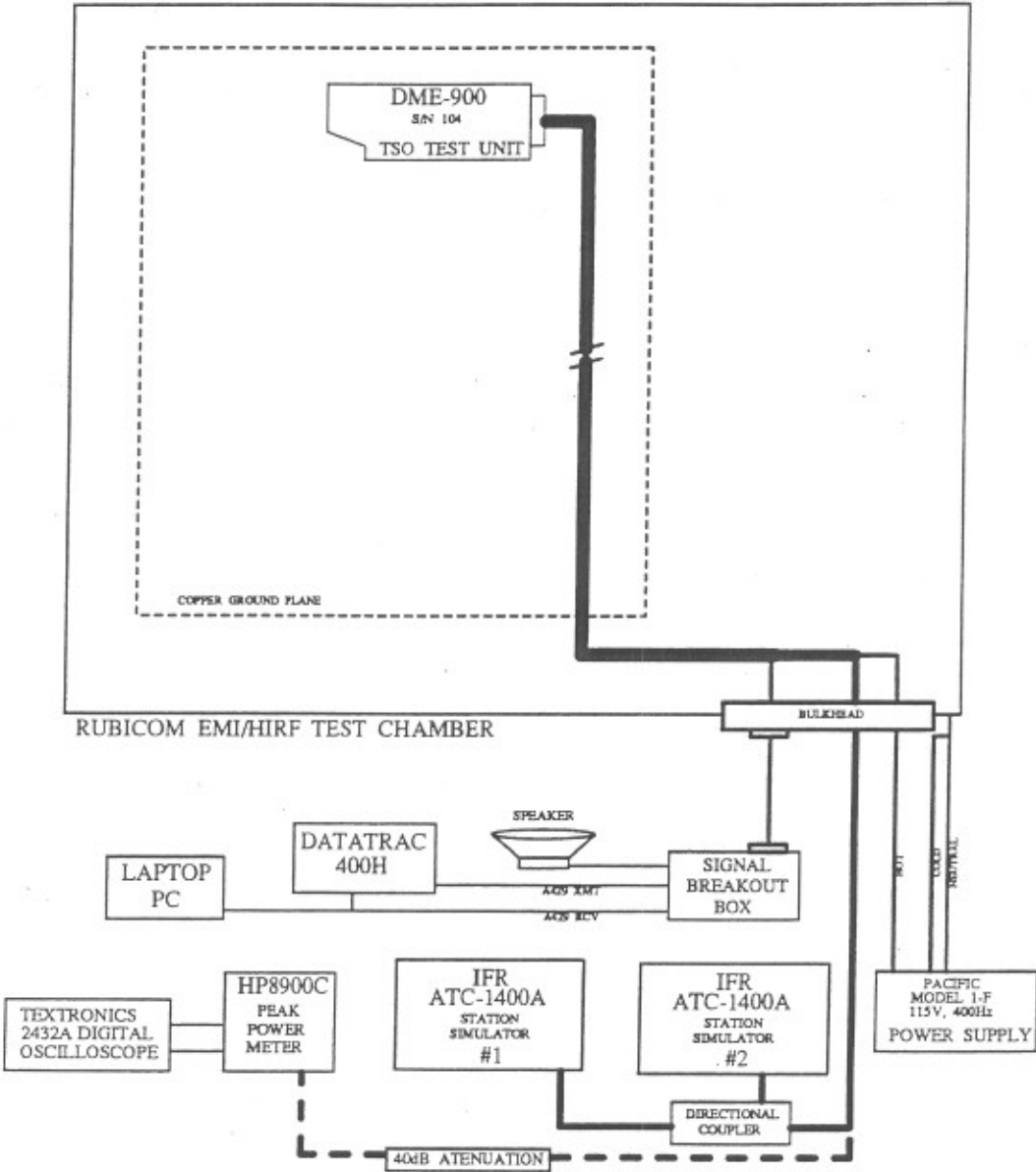


Figure 3-39 Radiated Emissions Equipment Set-up

To calculate the radiated power of the transmitter the Friis Transmission Formula (from Kraus Antennas Equ. 3-39) is used to calculate the power density P:

$$P = \frac{W_t}{4\pi r^2}$$

Where:

$$r = 1 \text{ Meter}$$

$$W_t = 28.4 \text{ dBW (from Exhibit E, page 21 section 3.1.1)}$$

W_t in Watts is calculated:

$$W_t = 10^{\frac{(28.4)}{10}} = 691.8 \text{ Watts}$$

$$P = \frac{691.8}{4\pi} = 55 \text{ W/Meter}^2$$

Factoring in the antenna gain for a 1/2 wave dipole:

$$P_t = D_t P$$

Where the directivity D_t is given by Kraus Table 3-1 as 1.64:

$$P_t = 1.64 * 55 = 90.3 \text{ W/Meter}^2$$

Converting Watts/Meter² to Volts/Meter using 120 π ohms as the impedance of free space:

$$P_t = 20 \log(120\pi * 90.28)^{1/2} = 45.3 \text{ dBV/Meter}$$

In dB μ V/Meter:

$$P_t = (20 \log 10^6) + 45.3 = 165 \text{ dB}\mu \text{ V/Meter}$$

In Figures 3-40 through 3-56 following, the reference line at the top of the graph is shown with respect to the transmitter as radiated with a 1/2 wave dipole and is the number given in dB within parenthesis. The maximum emission is also shown relative to the transmitter and is given in dB of to the right of the chart.

REF 110 dB μ V/m/MHz (-55dB) ATT 0 dB A_write*m B_view
10dB/

RBW
10 kHz
VBW
1 MHz
SWP
6 s

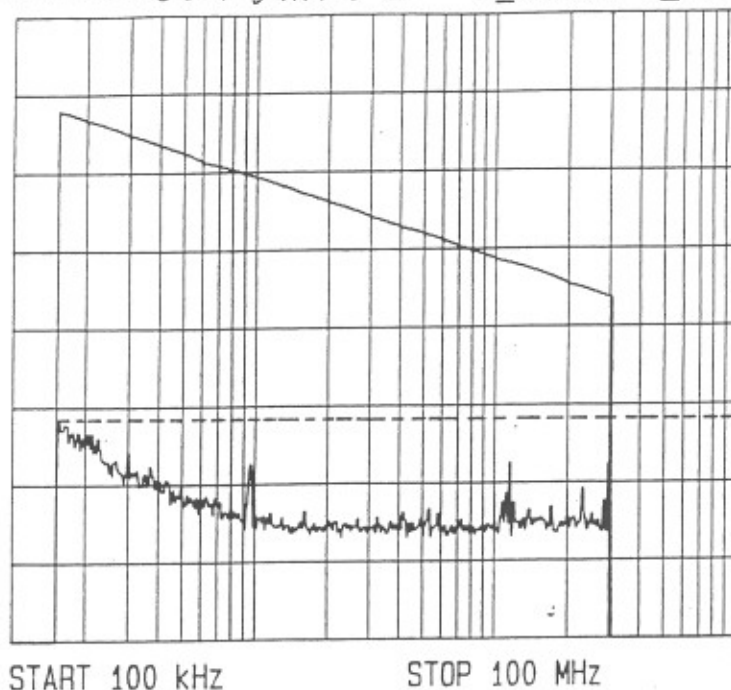


Figure 3-40 Radiated Emissions, Broad Band 150 KHz to 30 MHz

REF 110 dB μ V/m/MHz (-55dB) ATT 0 dB A_view B_view
10dB/

RBW
100 kHz
VBW
1 MHz
SWP
400 ms

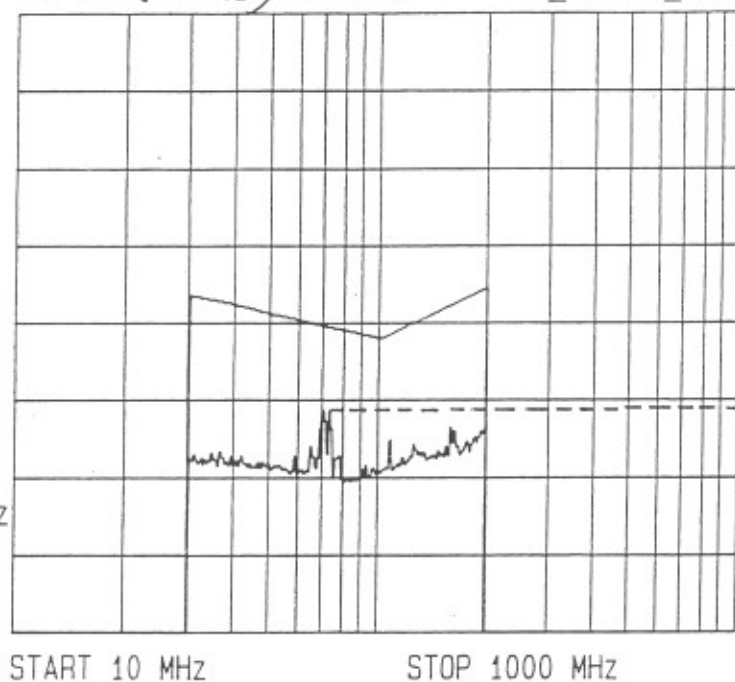


Figure 3-41 Radiated Emissions, Broad Band 30 to 200 MHz

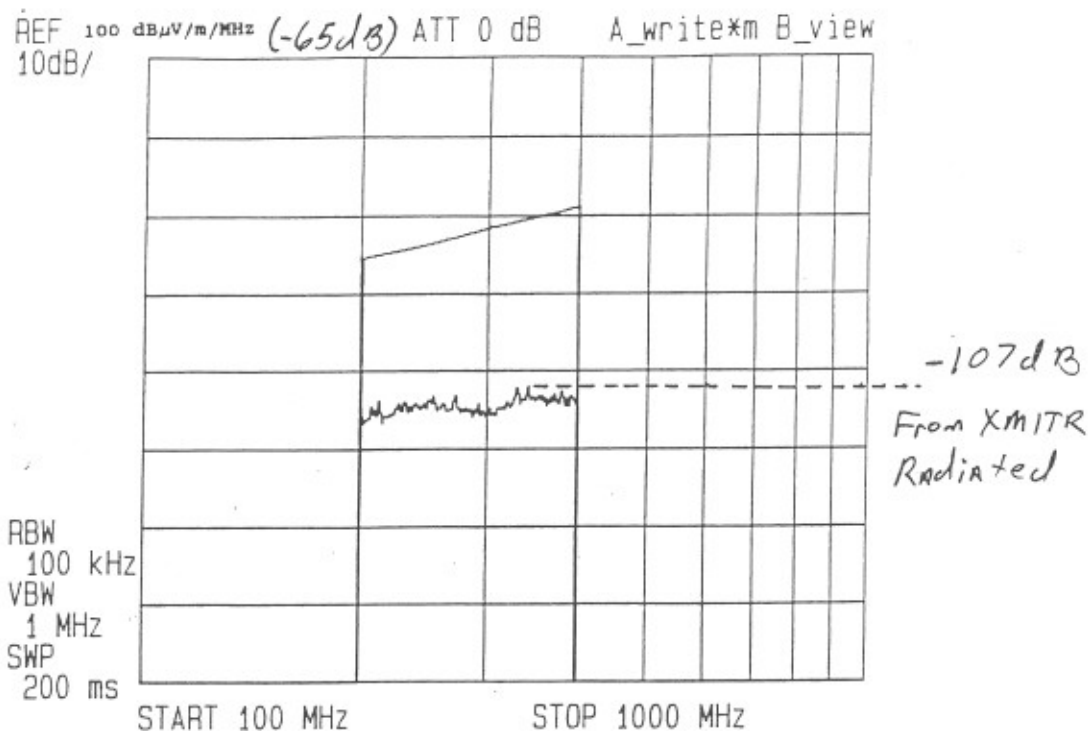


Figure 3-42 Radiated Emissions, Broad Band 200 to 400 MHz

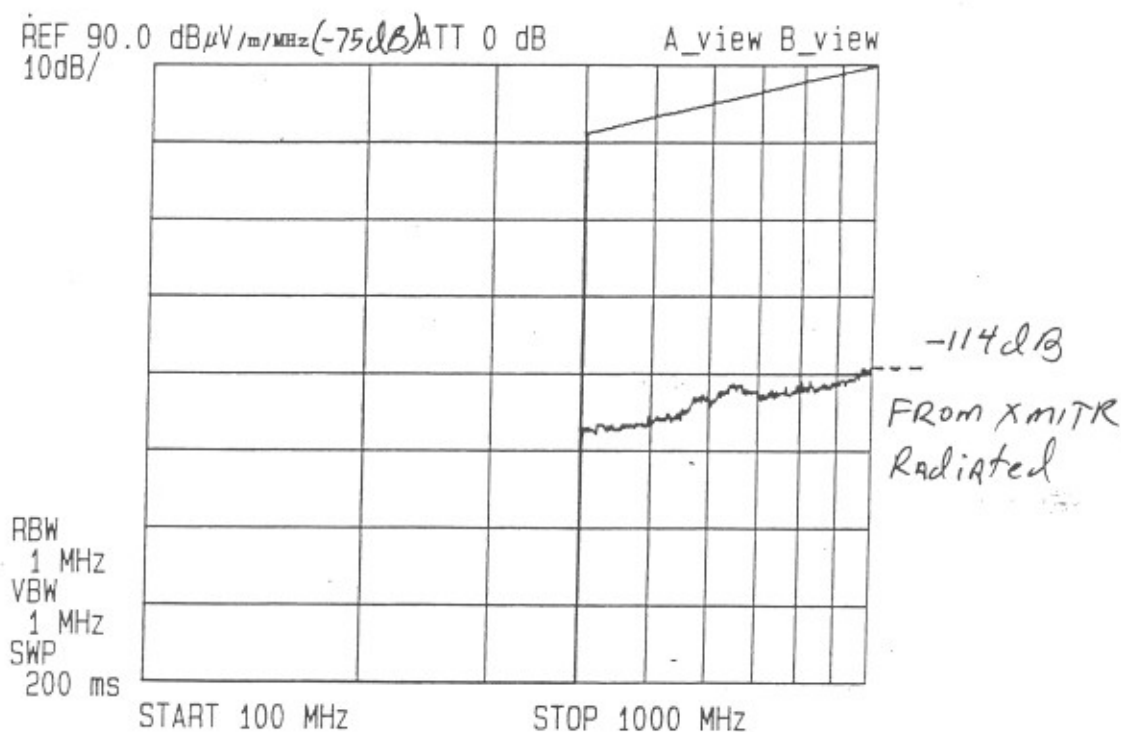


Figure 3-43 Radiated Emissions, Broad Band 400 to 1,000 MHz

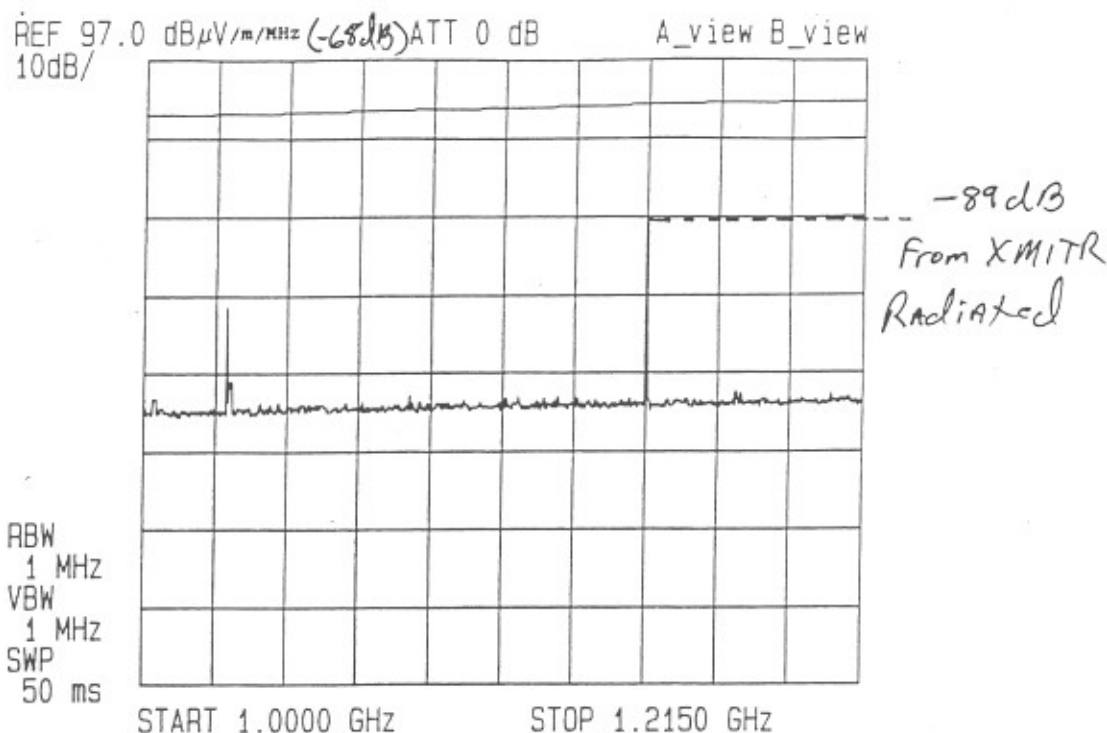


Figure 3-44 Radiated Emissions, Broad Band 1,000 to 1,215 MHz

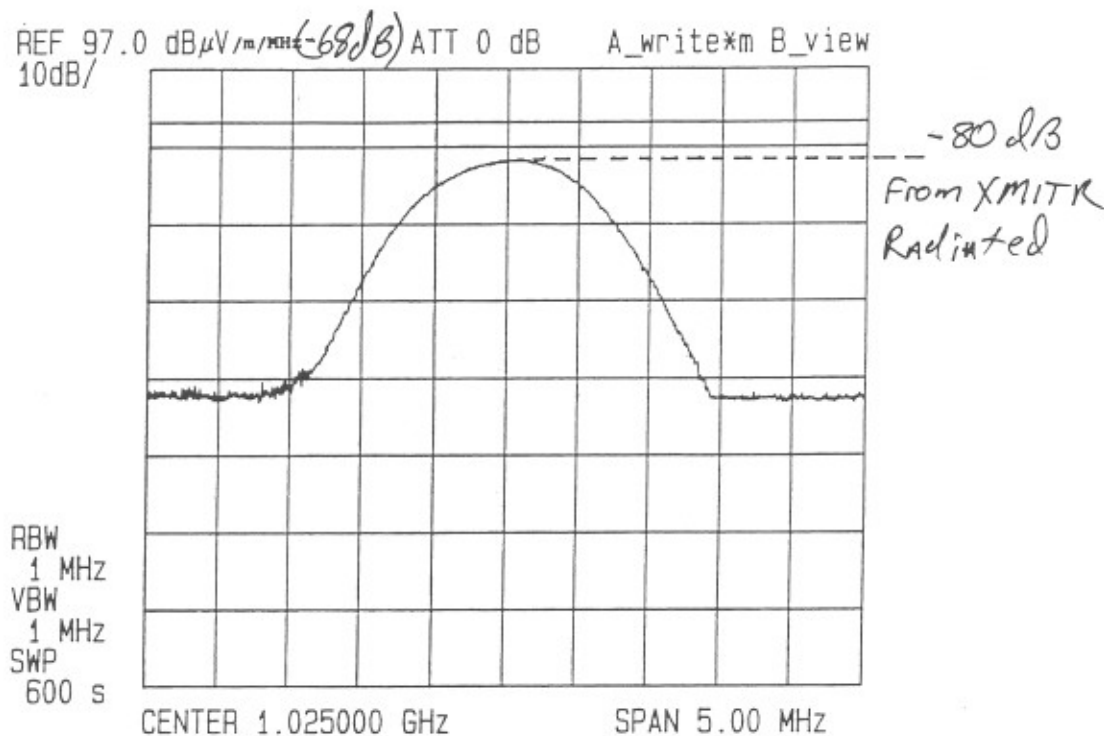


Figure 3-45 Radiated Emissions, Broad Band Centered on Channel 1X

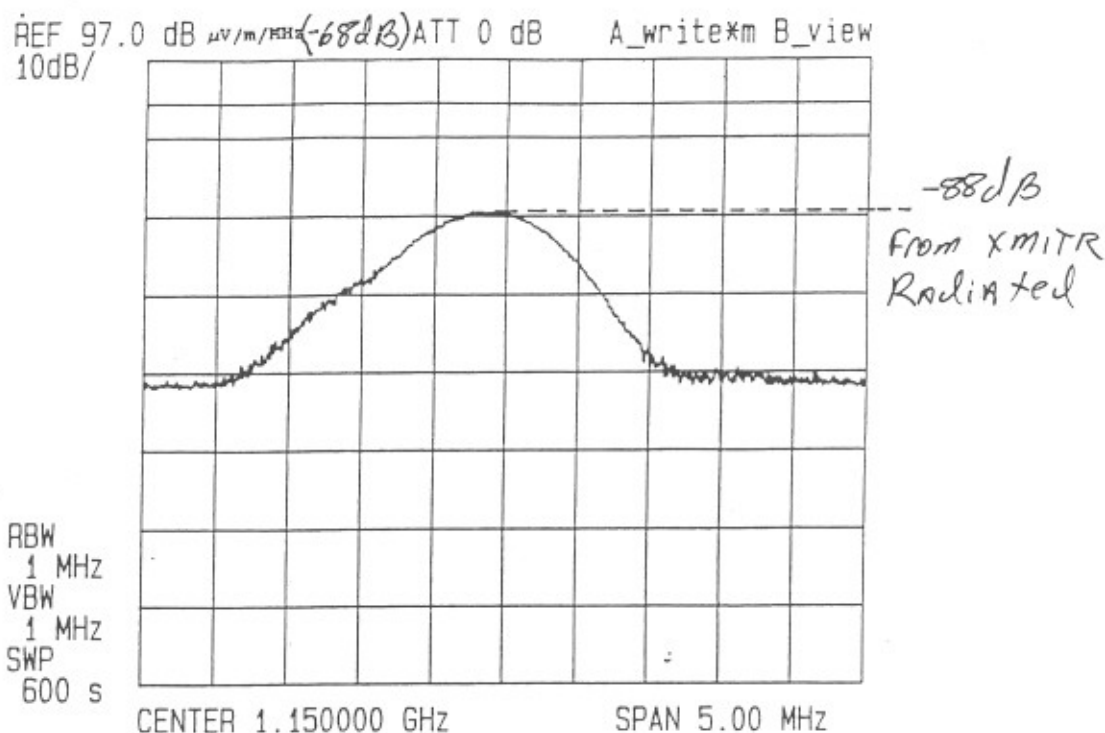


Figure 3-46 Radiated Emissions, Broad Band Centered on Channel 126X MHz

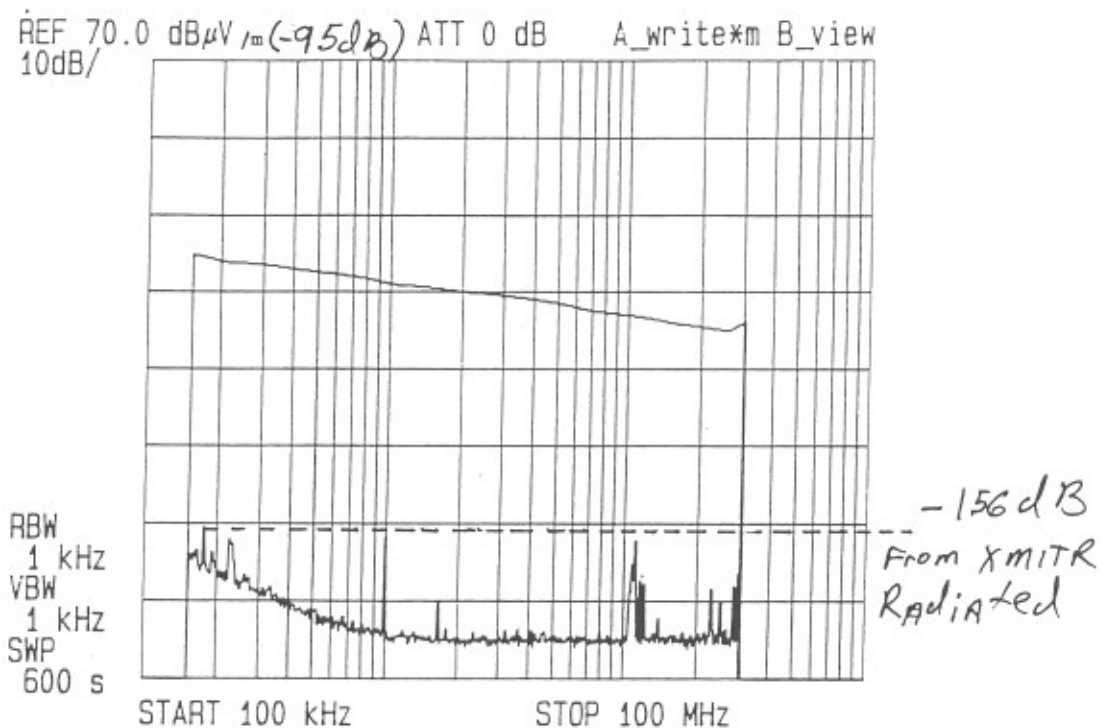


Figure 3-47 Radiated Emissions, Narrow Band 150 KHz to 30 MHz

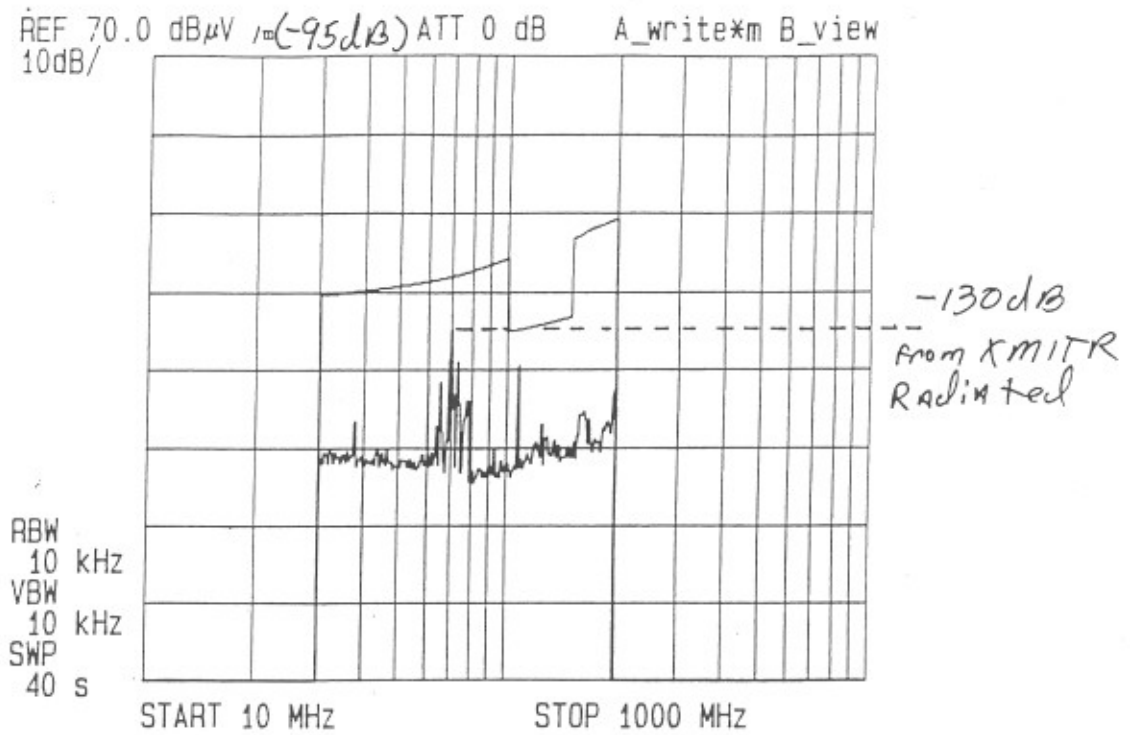


Figure 3-48 Radiated Emissions, Narrow Band 30 to 200 MHz

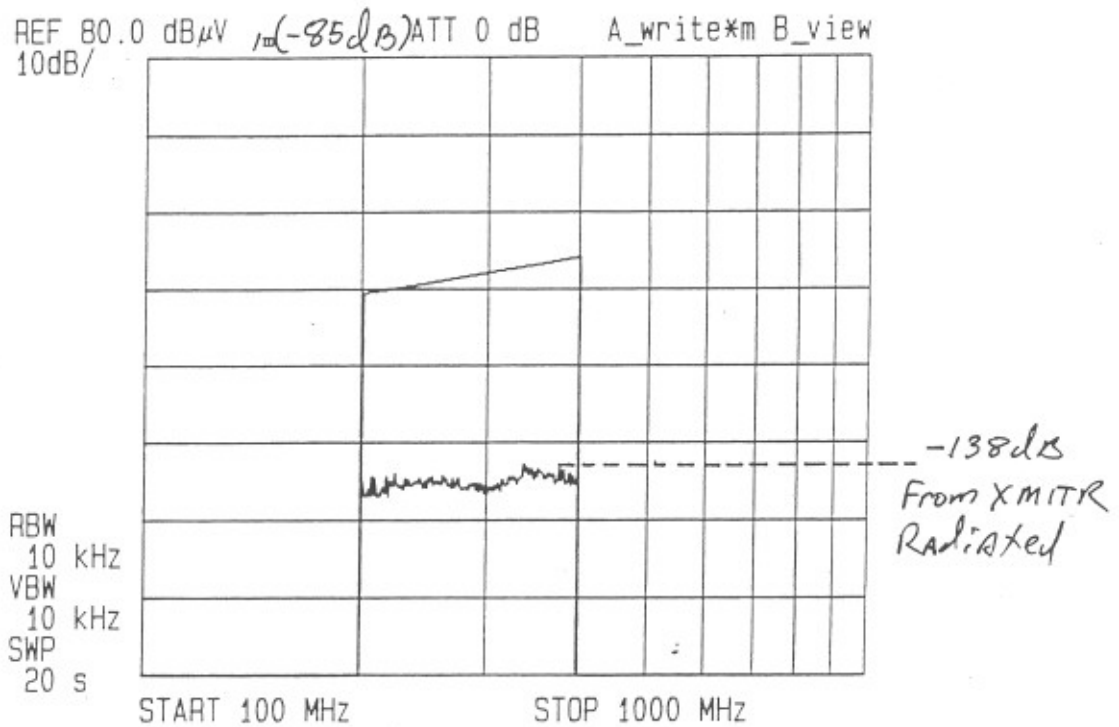


Figure 3-49 Radiated Emissions, Narrow Band 200 to 400 MHz

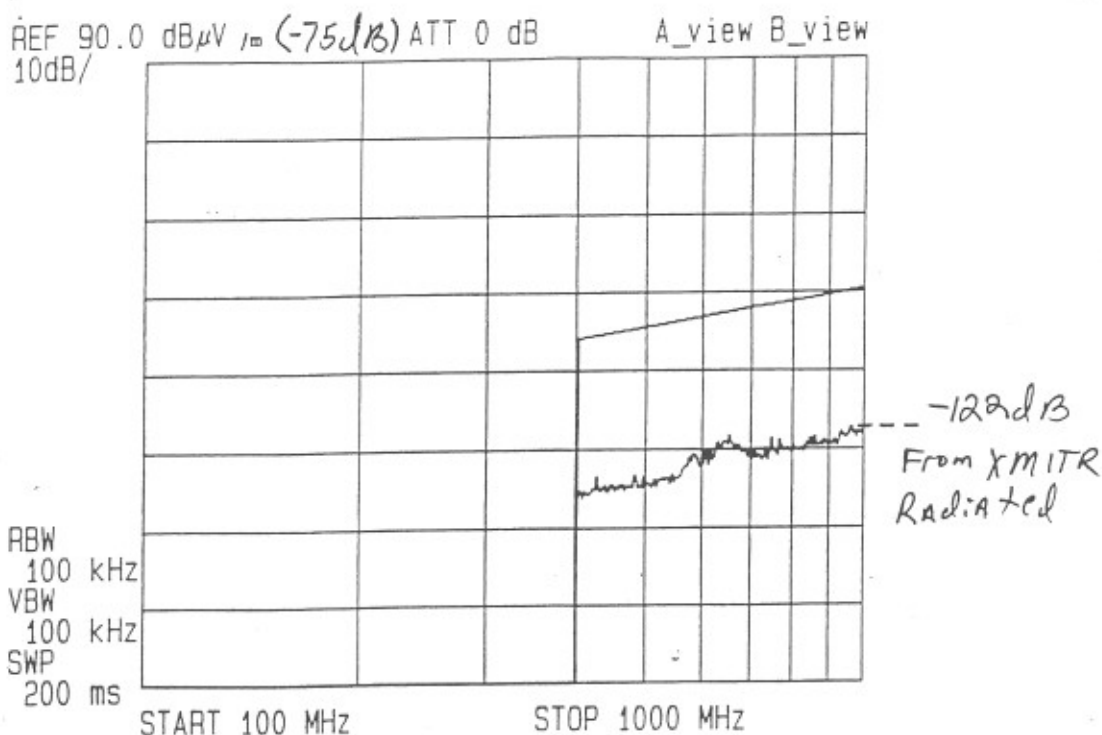


Figure 3-50 Radiated Emissions, Narrow Band 400 to 1,000 MHz

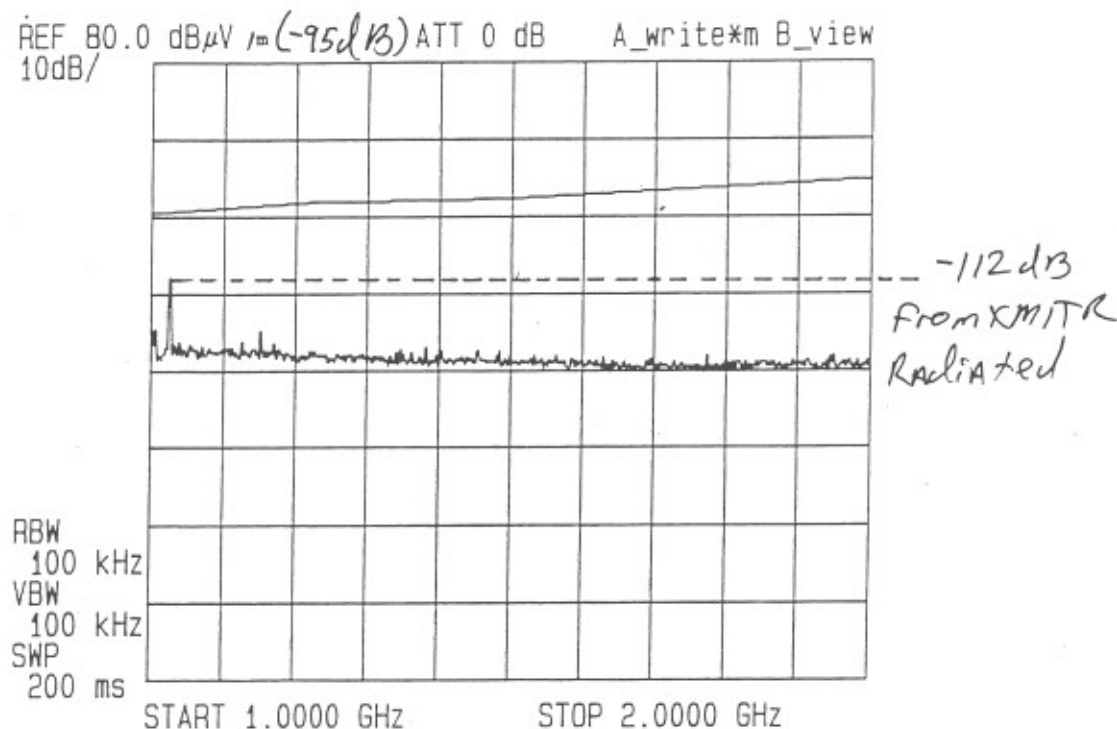


Figure 3-51 Radiated Emissions, Narrow Band 1.0 to 2.0 GHz

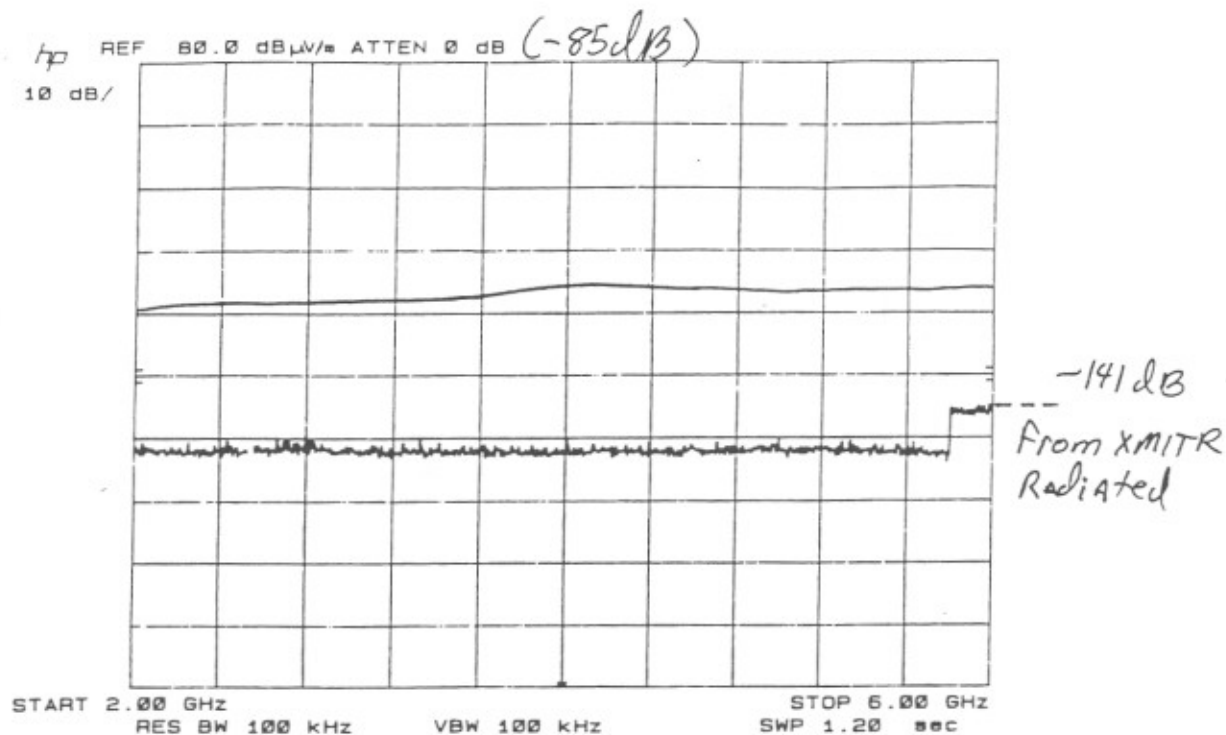


Figure 3-52 Radiated Emissions, Narrow Band 2.0 to 6.0 GHz

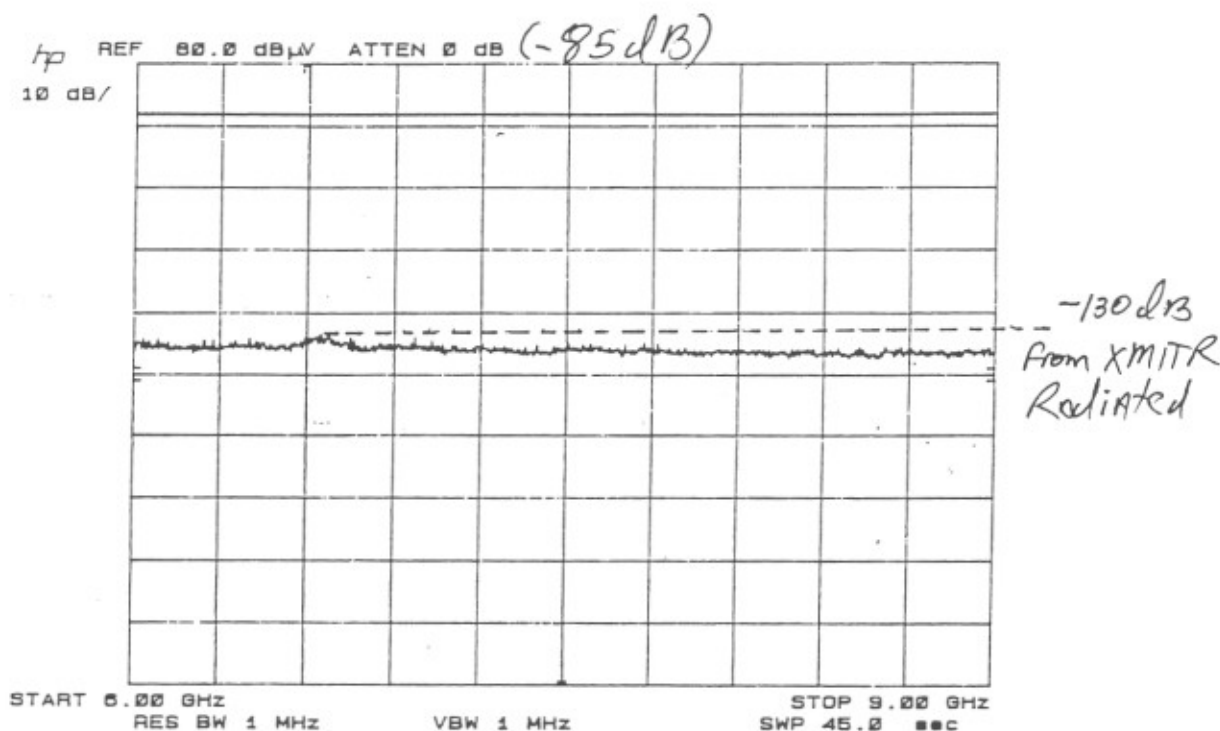


Figure 3-53 Radiated Emissions, Narrow Band 6.0 GHz to 9.0 GHz

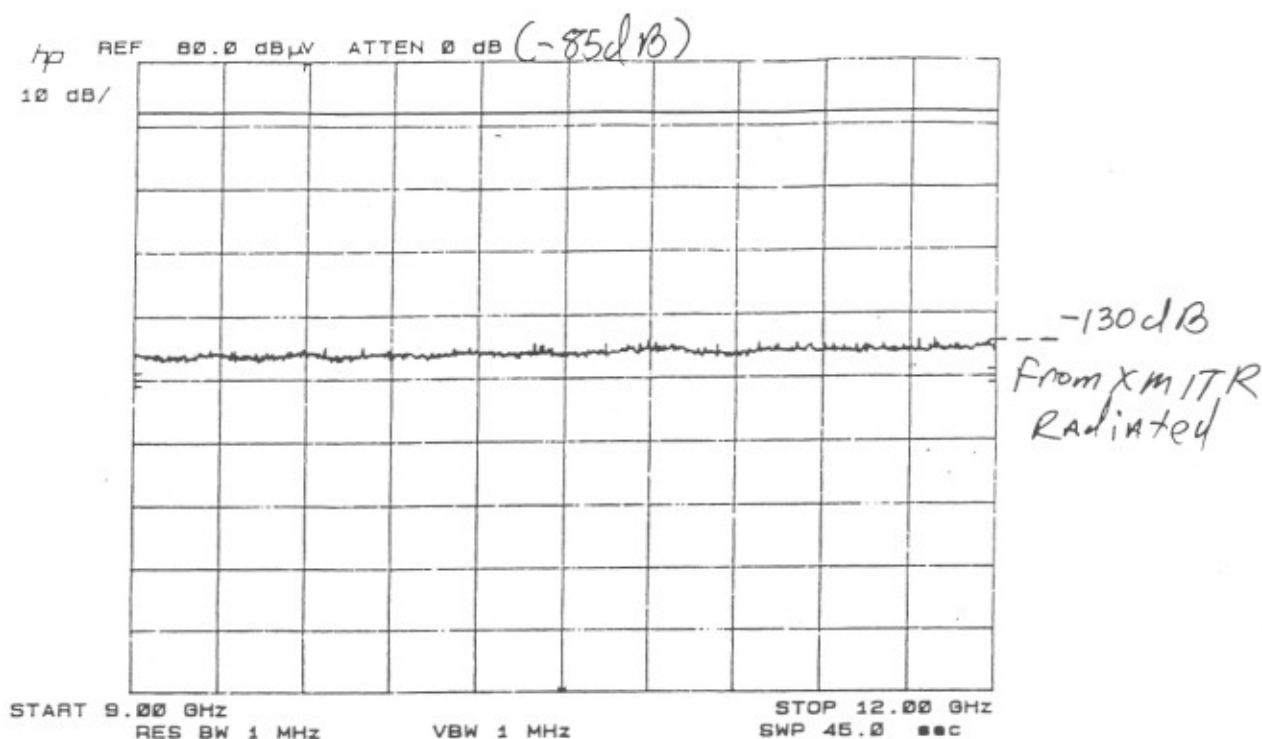


Figure 3-54 Radiated Emissions, Narrow Band 9.0 to 12.0 GHz

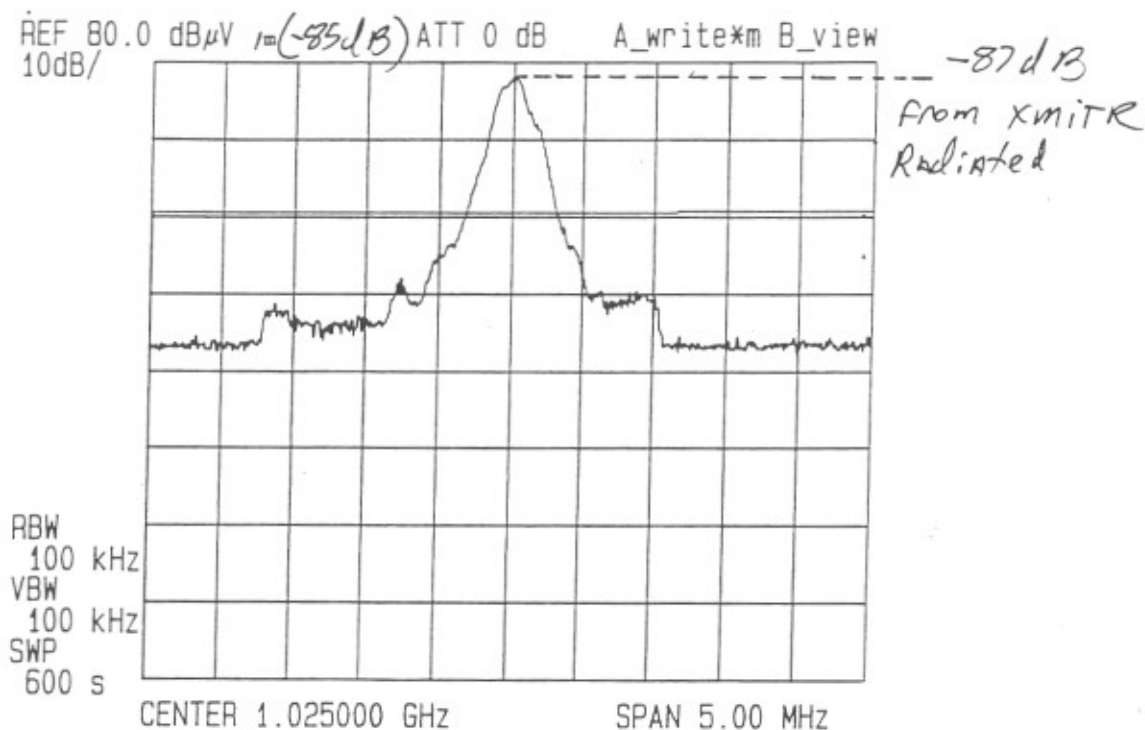
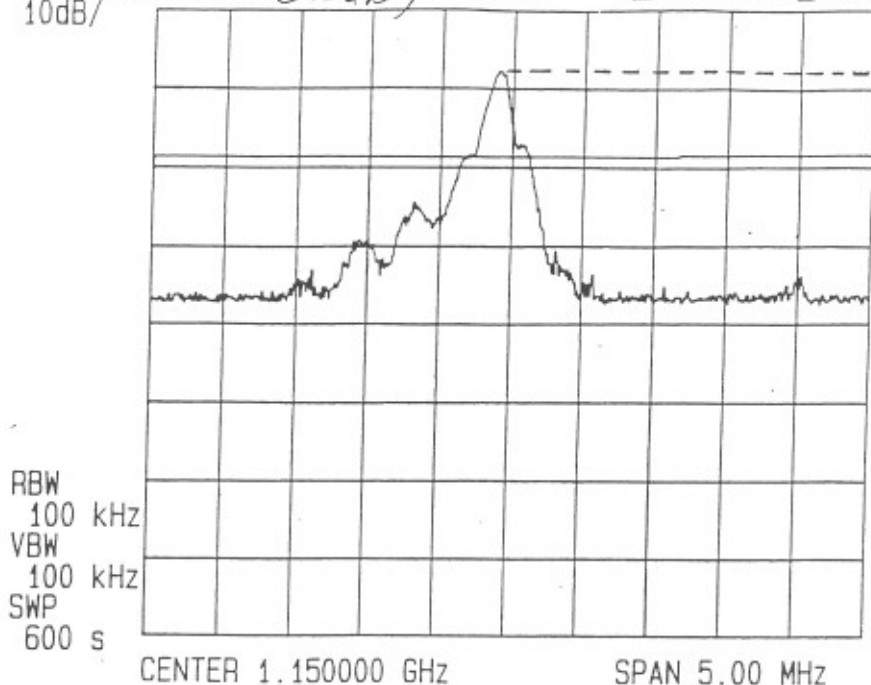


Figure 3-55 Radiated Emissions, Narrow Band Centered on Channel 1X

REF 80.0 dB μ V 1m(-85dB) ATT 0 dB A_writexm B_view

10dB/



-92 dB
From TMITR
Radiated

Figure 3-56 Radiated Emissions, Narrow Band Centered on Channel 126X

T R A N S M I T T A L



To: Frank Coperich

Fax: (301) 344-2050

From: M. Brett Wilson

Date: September 19, 1994

Pages: Lead + 5

Subject: Pending Application for Type Acceptance, FCC ID
AJKPN822-0329 - Your fax to Rubicom Systems on
9/14/94.

Frank:

Attached is an answer to your inquiry about the above application and replacement pages for page 29, Exhibit G.

We realize that our fax number was not included on the Form 731s of more than one of our recent applications. Please fax any additional request for information on Rockwell Equipment Authorization Applications to Linda Sadler at (703) 412-6811 or to me at (703) 412-6868.

Thank You,

Brett Wilson

M. Brett Wilson

Rockwell International

Suite 1200

745 Jefferson Davis Highway

Arlington, VA 22202

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Fax: 703/412-6868

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INQUIRY:

"Please convert the field strength readings for radiated spurious emissions to show dB below the desired signal so that the attenuation requirements of Section 87.139 may be demonstrated."

ANSWER:

For a field strength of 1 uV/meter, the associated power density radiated from the DME-900 is calculated as follows.

> $10 \cdot \text{LOG}(E^2/Z_0)$ in dBW /sq. meter

E = energy (volts)

Z_0 = impedance of free space ($120 \cdot \pi$ ohms)

> Substituting into the equation...

$$10 \cdot \text{LOG} \left(\frac{[1 \cdot (10)^{-6} \text{ Volts/meter}]^2}{120 \cdot \pi} \right) = -145.76 \text{ dBW per sq. meter}$$

> Thus 80 dB at field strength of 1uV per meter
converts to a power density of **-65.76 dBW per sq. meter.**

Replaced

3.3.3 Emission Limitations (87.139 (3))

Part 87, section 87.193 requires the transmitter power to be attenuated by 40 dB when the frequency is removed by 250% of the authorized bandwidth. The authorized bandwidth for the DME is calculated 800 KHz (1 MHz channel separation - 2 X 100 KHz transmitter frequency stability). The limit is then calculated to be 2.0 Mhz. A plot of the spectrum taken with the HP 8591E is shown in Figures 3-13a for channel 64X indicating the transmitter output to be attenuated by 40 dB 780 KHz removed from the assigned frequency.

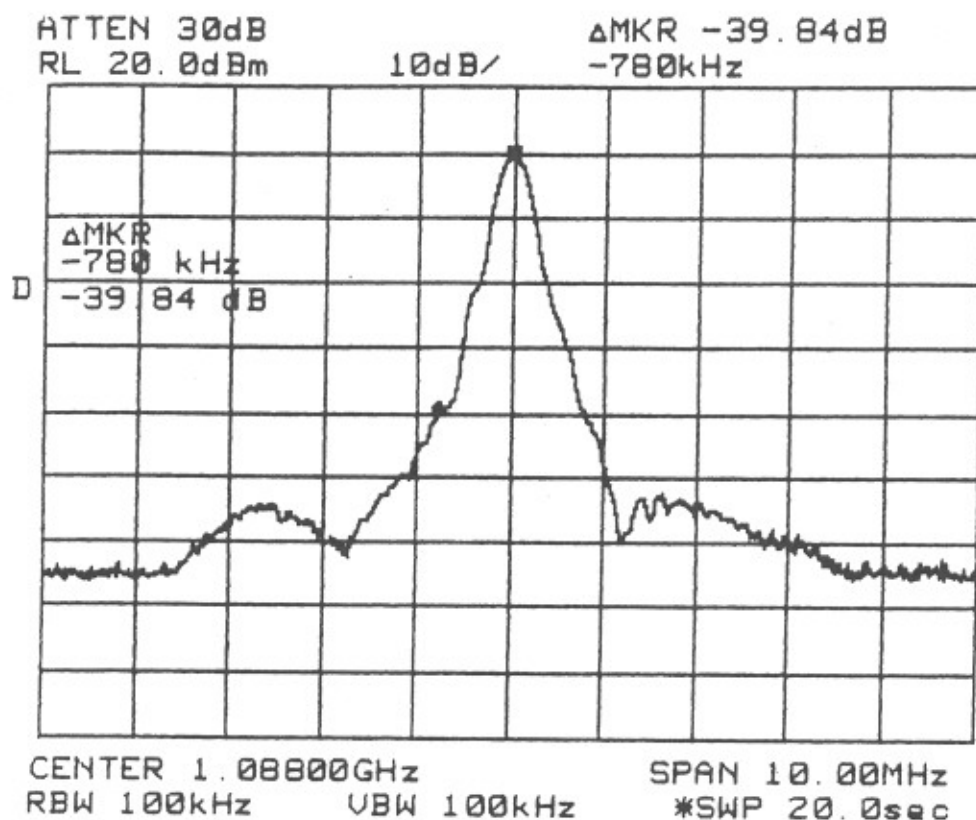


Figure 3-13a Pulse Spectrum of Channel 64X Showing Spectrum Width @ -40 dB



FAX Cover Sheet

Federal Communications Commission

Authorization & Evaluation Division

7435 Oakland Mills Road

Columbia, MD 21046

Telephone No.: (301) 725-1585

FAX No.: (301) 344-2050

Date:

Sept. 14, '94

Time:

3:30

AM ☒ PM

From:

Name:

Frank Conerich

Ext:

211

To:

Name:

ENGINEER IN CHARGE

Organization:

Rubicon Syst.

Phone Number:

() -

FAX Number:

(✓) -

This Cover Sheet is Page 1 of

2

Pages

Please direct inquiries, if any, to the

sender at the above extension.

Comments:

Reference pending type acceptance

filing for Rockwell FCC ID: ATK9URPN822-0329.

Please see attached Page.

Please convert the field strength readings for radiated spurious emissions to show dB below the desired signal so that the attenuation requirements in Section 87.139 may be demonstrated.

BRETT WILSON

INQUIRY:

"Please convert the field strength readings for radiated spurious emissions to show dB below the desired signal so that the attenuation requirements of Section 87.139 may be demonstrated."

ANSWER:

For a field strength of 1 uV/meter, the associated power density radiated from the DME-900 is calculated as follows.

> $10 \cdot \text{LOG}(E^2/Z_0)$ in dBW /sq. meter

E = energy (volts)

Z_0 = impedance of free space ($120 \cdot \pi$ ohms)

> Substituting into the equation...

$$10 \cdot \text{LOG} \left(\frac{[1 \cdot (10)^{-6} \text{ Volts/meter}]^2}{120 \cdot \pi} \right) = -145.76 \text{ dBW per sq. meter}$$

> Thus 80 dB at field strength of 1uV per meter
converts to a power density of **-65.76 dBW per sq. meter.**

3.3.3 Emission Limitations (87.139 (a))

Part 87, section 87.139 (a)(1) requires the transmitter power to be attenuated by at least 25 dB when the frequency is removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth. The authorized bandwidth for the DME is calculated to be 1 MHz as described in Exhibit D section 2.4.1. Plots of the spectrum taken with the HP 8591E are shown in Figures 3-13a for channel 64X indicating the transmitter output to be attenuated by 26.89 dB 500 KHz below the assigned frequency, and in Figures 3-13b for channel 64X indicating the transmitter output to be attenuated by 27.45 dB 500 KHz above the assigned frequency.

Part 87, section 87.139 (a)(2) requires the transmitter power to be attenuated by at least 35 dB when the frequency is removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth. Plots of the spectrum taken with the HP 8591E are shown in Figures 3-13c for channel 64X indicating the transmitter output to be attenuated by 46.94 dB 1 MHz below the assigned frequency, and in Figures 3-13d for channel 64X indicating the transmitter output to be attenuated by 49.53 dB 1 MHz above the assigned frequency.

Part 87, section 87.139 (a)(3) requires the transmitter power to be attenuated by at least 40 dB when the frequency is removed from the assigned frequency by more than 250 percent of the authorized bandwidth. Plots of the spectrum taken with the HP 8591E are shown in Figures 3-13e for channel 64X indicating the transmitter output to be attenuated by 55.76 dB 2.5 MHz below the assigned frequency, and in Figures 3-13f for channel 64X indicating the transmitter output to be attenuated by 58.50 dB 2.5 MHz above the assigned frequency.

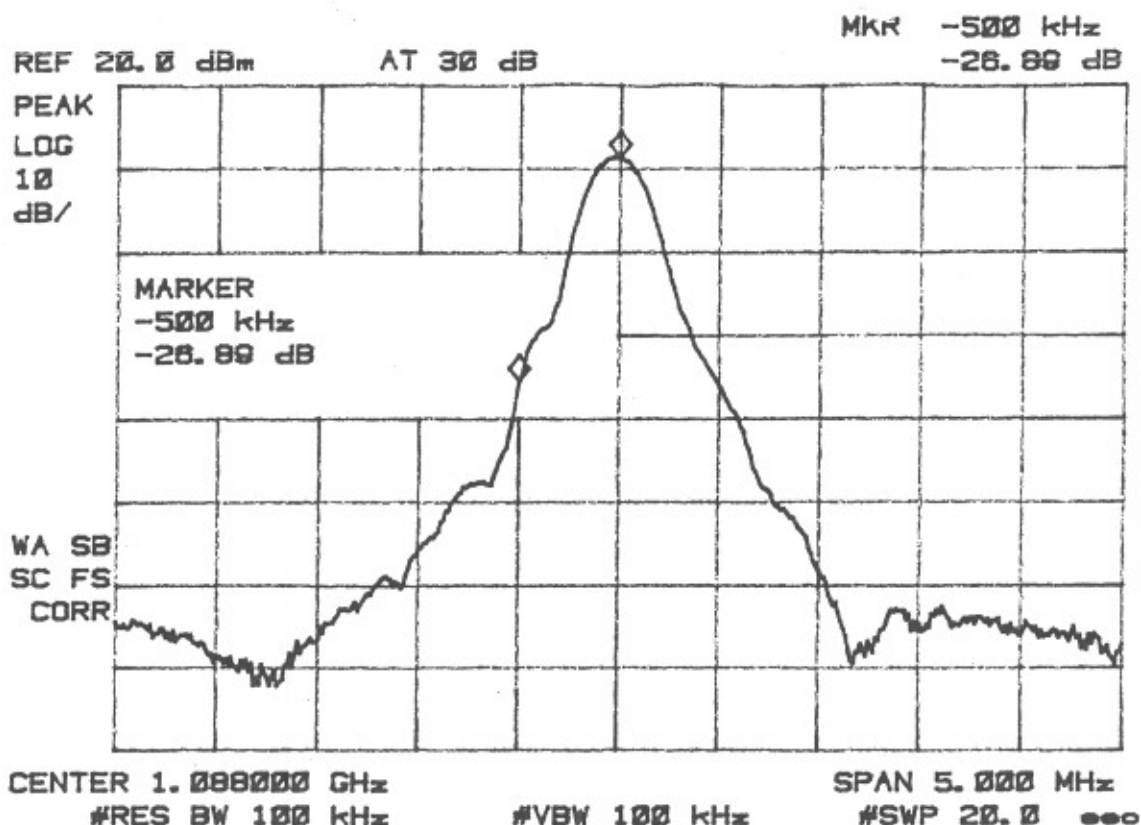


Figure 3-13a Pulse Spectrum of Channel 64X Showing Attenuation @ -50% Authorized Bandwidth

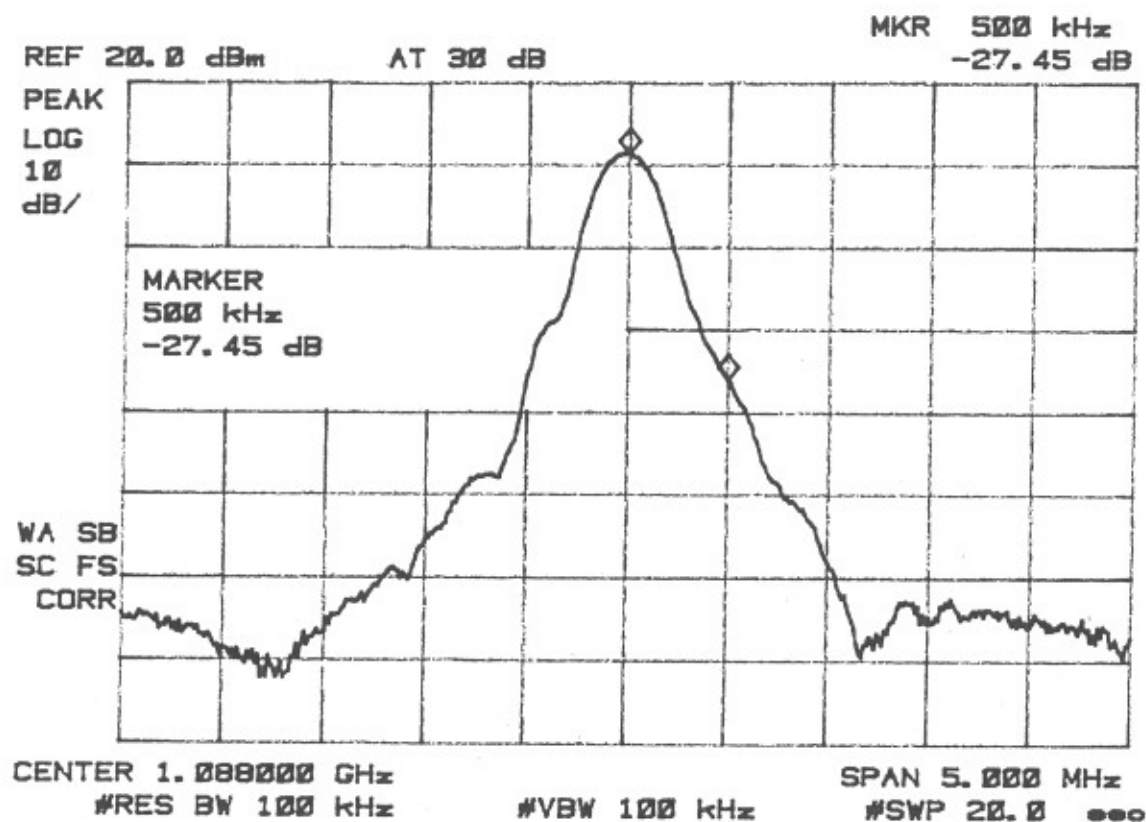


Figure 3-13b Pulse Spectrum of Channel 64X Showing Attenuation @ -50% Authorized Bandwidth

REF 20.0 dBm
AT 30 dB
MKR -1.000 MHz
-48.94 dB

PEAK
LOG
10
dB/

MARKER
-1.000 MHz
-48.94 dB

WA SB
SC FS
CORR

CENTER 1.000000 GHz
#RES BW 100 kHz

#VBW 100 kHz

SPAN 5.000 MHz
#SWP 20.0 sec

Figure 3-13c Pulse Spectrum of Channel 64X Showing Attenuation @ -100% Authorized Bandwidth

REF 20.0 dBm
AT 30 dB
MKR 1.000 MHz
-48.53 dB

PEAK
LOG
10
dB/

MARKER
1.000 MHz
-48.53 dB

WA SB
SC FS
CORR

CENTER 1.000000 GHz
#RES BW 100 kHz

#VBW 100 kHz

SPAN 5.000 MHz
#SWP 20.0 sec

Figure 3-13d Pulse Spectrum of Channel 64X Showing Attenuation @ +100% Authorized Bandwidth

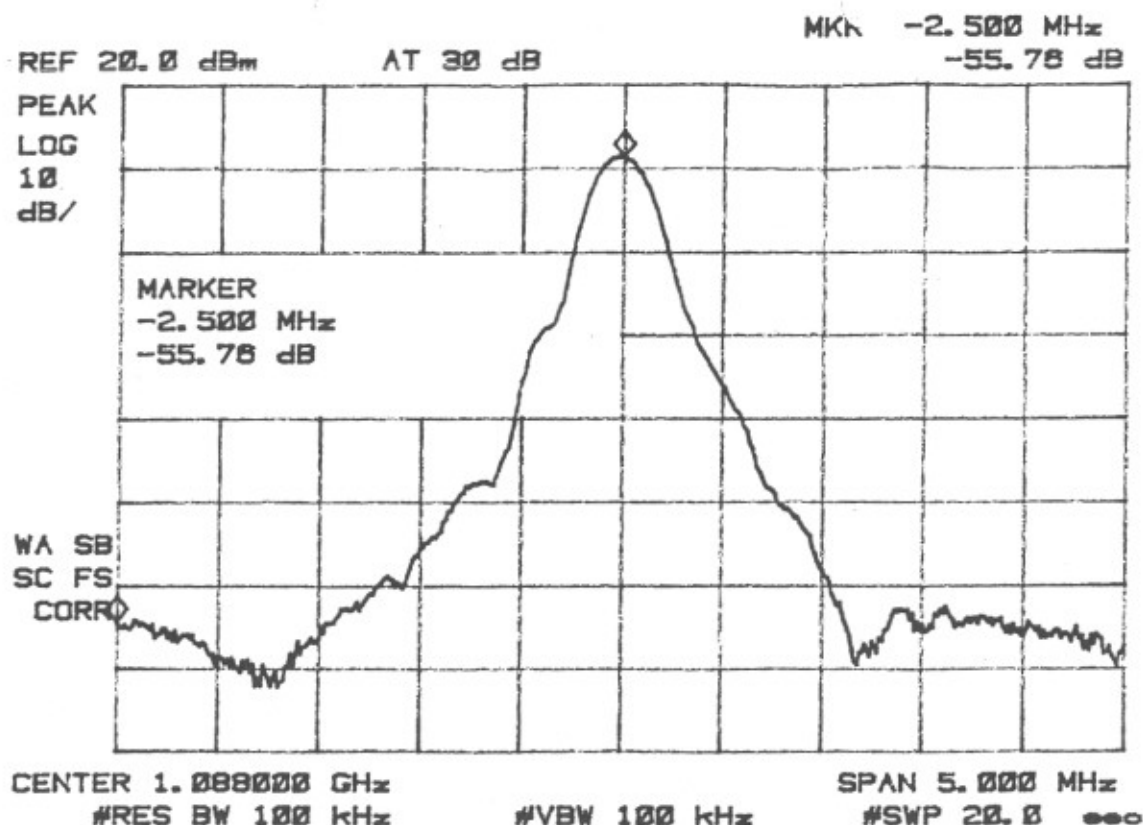


Figure 3-13e Pulse Spectrum of Channel 64X Showing Attenuation @ -250% Authorized Bandwidth

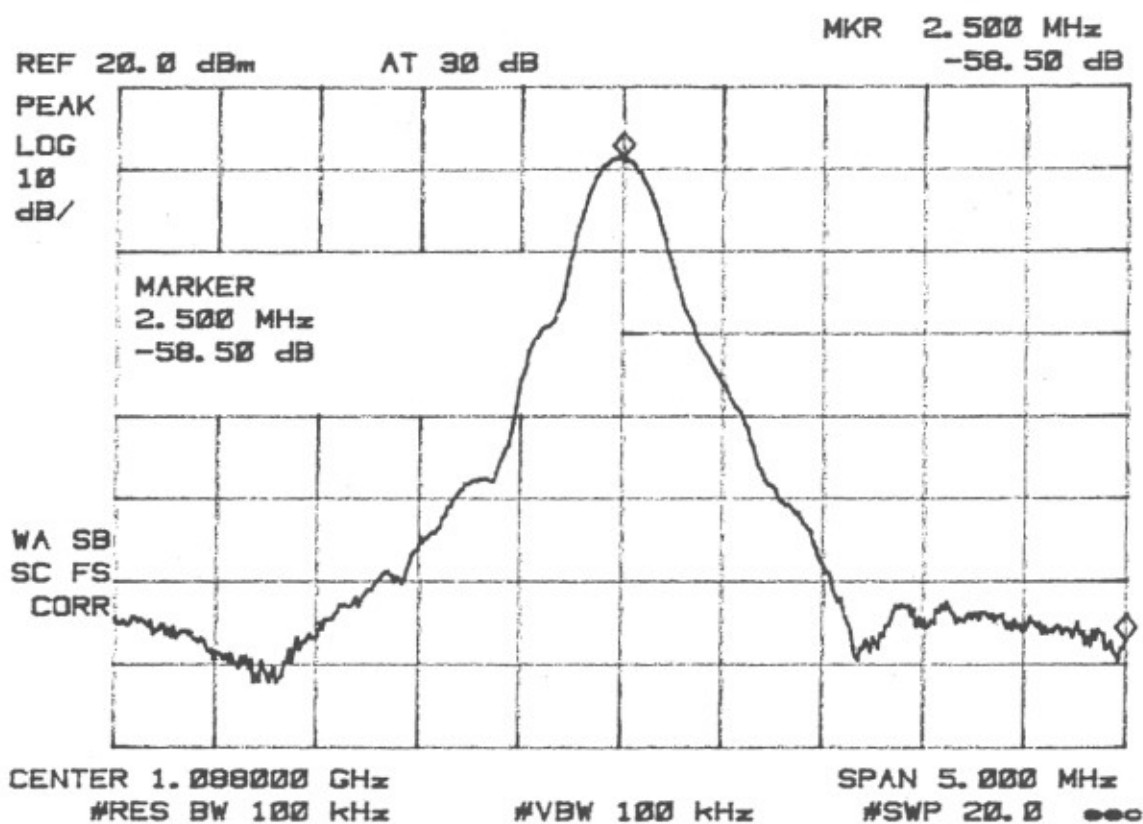


Figure 3-13f Pulse Spectrum of Channel 64X Showing Attenuation @ +250% Authorized Bandwidth