MICROWAVE RADIO COMMUNICATIONS

101 Billerica Ave., Bldg. 6
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ENGINEERING CERTIFICATION

It is here by stated that as an ISO-2000 certified company the Certification tests on the Microwave Radio Communications STRATA Transmitter (STATXU2D) where made under factory test conditions. All test equipment calibration certification is on file here at the Microwave Radio Communications Inc. facility. All of the submitted data in the attached report is true and correct to the best of my knowledge and belief.

Report No 0092903

Manufacturer	Microwave Radio Communications Inc.
Model	STA019T10K
FCC ID	**FC3**
Equipment Type	TNB
Results	As detailed within this report

Prepared by

10/1/03

Richard Miller
Systems Engineering

Authorized By

10/2/03

Michael Payne

Vice President, Operations

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APPLICATION FOR CERTIFICATION

OF

STATXU2D

PORTABLE MICROWAVE TRANSMITTER

SEPTEMBER 15, 2003

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Introduction:

The STATXU2D is a general mobile transmitter designed for use in the **1999 Mhz. to 2700 Mhz.** band.

Emissions: 17M0D9W (Digital Modulation)

Operation under FCC rule parts **74, 78, 90 101**

Application:

For transmission of video, audio, data, and related Television Broadcast program material from events occurring at points removed from the TV Broadcast station or other users.

A compact, portable, weatherproof, modular transmitter. Designed to be adaptable over a wide range of outdoor field applications, The transmitter accepts a wide range of SMPTE defined video inputs (SDI, ASI, NTSC…) delivered to a highly integrated internal MPEG-2 Encoder and COFDM modulator.

A front panel LED display details the internal RF and Baseband configurations. Status display of frequency, power, modulation, and RF output… is also viewable from the same LED display.

The STRATA TX can be deployed as a single or multi box configuration. The Transmitter (TXU) is be deployed as a single box digital transmitter utilizing an internal COFDM modulator and MPEG-2 encoder. A two-box design utilizing a transmitter control unit (TCU) places the baseband units internal to the TCU outputting 70MHz. To the TXU. The TXU is complete with the RF Amplifier and Up-Converter, the Baseband components integrated into the TCU. The TCU provides control and RF (70MHz) as drive to the RF Up-Converter. System control can be displaced from the RF unit by as much as 100 meters. For the sake of this application the unit (TXU) is configured as a Digital Transmitter with internal COFDM modulator and MPEG-2 encoder.

Digital Modulation:

A COFDM architecture utilizing QPSK modulation has been integrated into the STRATA design. The imbedded control allows the user to select various digital modulation formats while maintaining the specifications as set forth by ETSI TR 101 190 v1.1.1 for Digital Video Broadcasting. Output of the modulator at 70 MHz. is applied to the input to the transmitter, frequency is selected, and the RF output is delivered to the antenna.

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TECHNICAL DESCRIPTION

A technical description is contained within the manual

MEASUREMENT DATA

In Order to demonstrate compliance to the FCC Rules and Regulations as set forth in CFR 47 (as revised October 1, 2002), measurement data per paragraphs2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055 where performed at Microwave Radio Communications facilities. The results of these measurements show that the STATXU2D transmitter meets or exceeds all requirements for parts 74, 78, 90 and 101.

SPURIOS EMISSIONS AT ANTENNA TERMINAL

The Antenna conducted spurious emissions test set up is shown in Figure 1. The analyzer was first tuned for a reference carrier level at the fundamental operating frequency. The output spectrum was then slowly scanned from 50MHz to 26 GHz. Special attention was given to those frequencies that correspond to the possible harmonic and sub – harmonics.

The FCC limit for antenna conducted spurious emissions is 43+10LOG P below the main carrier. For the STATXU2D with P= 1.76 W this corresponds to 45.4551db below the main carrier (+32.6dbm) , or a level of –12.95dBm. Signals where observed at the following points:

900 MHz @ –30.4dBm
2950 MHz @ -22.4dBm
4101 MHz @ -27.7dBm
6151.5 MHz @ -32.4dBm

* Frequencies within 20db of FCC specification

With the exception of the above noted points, no other signals were noted within 20db of the FCC limit. Therefore, the STATXU2D meets the requirements set forth in paragraphs , 74.637, 78.103, 90.209, and 101.111.

FIELD STRENGTH OF SPURIOUS RADIATION

Case radiated spurious emission test set up is shown in figure 2. Observations where made at one meter from the transmitter in all planes of polarization. The output spectrum as received at one meter was slowly scanned upwards from 50MHz to 26GHz. Spacial attention was given to those frequencies which correspond to possible harmonics and sub harmonics.
A radiated reference level can be calculated using the formula:

$$E = \sqrt{\frac{30xGxP}{R}}$$

Where: G = Power Gain of Antenna
P = Transmitter Power Output in Watts
R = Distance from Radiator at which field intensity is measured.

In this case: G = 1.64 (gain of dipole over isotropic)
P = 1.76
R = One Meter

Therefore:

$$E = \sqrt{\frac{30x1.64x1.76}{1}} = 9.3055V/meter = 139.4dBuV/M$$

The FCC requires case radiated signals to be attenuated by a factor of 43+10LOG P or 43+10LOG 1.76 = 45.4551dB. Thus 139.4dBuV/M reduced by 45.4551dB = 93.9449dBuV/M. No case radiated signals were detected within 20 dB of the FCC limit and, therefore, the transmitter meets the requirements set forth in paragraphs 74.637, 78.103, 90.209, and 101.111.

NECESSARY BANDWIDTH

The OFDM pedestal operating at 1705 OFDM carriers with the spectral density of each carrier at 4.464KHz.

Therefore: 1705 X 4.464KHz = 7.6111200 MHz

OCCUPIED BANDWIDTH

To measure the occupied bandwidth, the equipment was set up as shown in figure 1, and the transmitter was modulated with a digital COFDM pedestal of 7.61MHz (8MHz). The output of the transmitter was viewed on a spectrum analyzer. The current COFDM standard adopted by Microwave Radio Communications is the ETSI EN 300 744 V1.2.1 (2001-01) for framing structure, channel coding and modulation. Since the spectrum is digitally modulated, at the center frequency, calculations where performed by establishing a reference at Fo (2050.5MHz) and the amplitude readings where calculated from a CW signal input to the transmitter. Amplitude readings where then recorded as specified in part 101.111 for emission limitations.

Method of Measuring and Calculating Occupied Spectrum Requirements (Digital Mode)

Steps:

1. Determine 3 dB down points on SIN(X)/X center frequency spectrum energy plot.
2. Use the following formula to calculate the total power signal level versus the spectral energy plot:

   10log (3dB bandwidth) / (Resolution Bandwidth filter used)

   3dB bandwidth = **7.61 MHz** (4.4 KHz w/1705 COFDM carriers)
   Resolution Bandwidth used = **100 KHz**

   for Strata TX system: 10log 7.61E6/1E5 = **18.8 dB**

3. Adjust for FCC requirement to calculate using **1 MHz** resolution bandwidth (per FCC ruling 02-098, November 2001). Adjust RBW: 10log 1E6/1E5 = 10 dB

TOTAL POWER ADJUSTMENT FACTOR = **8.8 dB** above highest spectral energy point.

RF POWER OUTPUT

The RF output power test set up is shown in figure 6A.

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POWER OUTPUT AND FREQUENCY STABILITY

PARAGRAPHS 2.1046 AND 2.1055

Measurements where made to determine the transmitter stability and power output over the temperature range 25 degrees C to –35 degrees C. The equipment was connected as shown in figure 6A and the temperature was cycled automatically as recorded in table 1. The transmitter was allowed to stabilize a minimum of 30 minutes before measurement. Power and frequency measurements where performed simultaneously

Measurements where also made to determine transmitter frequency stability versus primary supply variation of the DC input voltage range of 12V to 48V. The equipment was connected as shown in figure 6B. The test data is listed in Table 1 which shows no frequency change.

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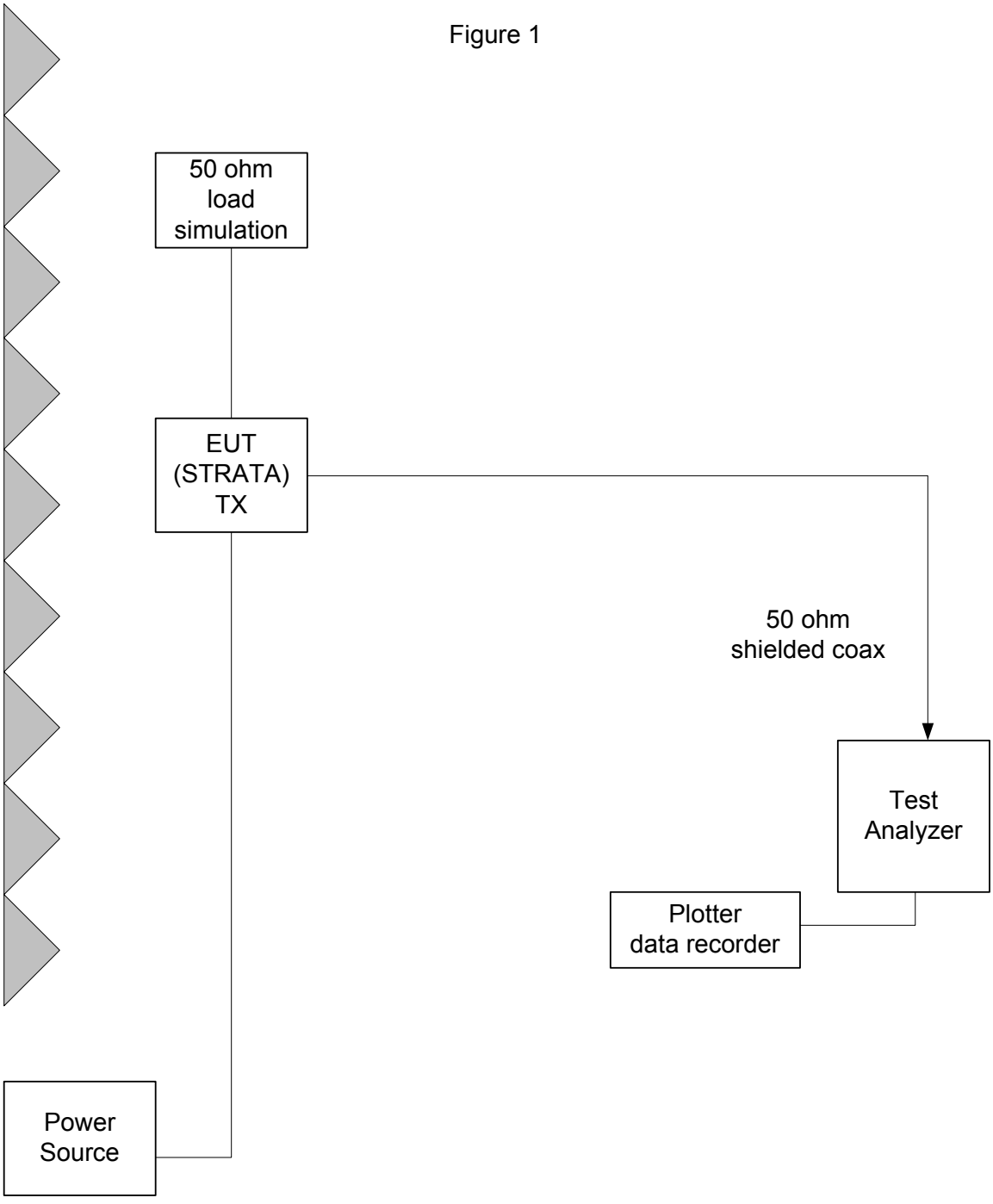
Richard Miller
Systems Engineering

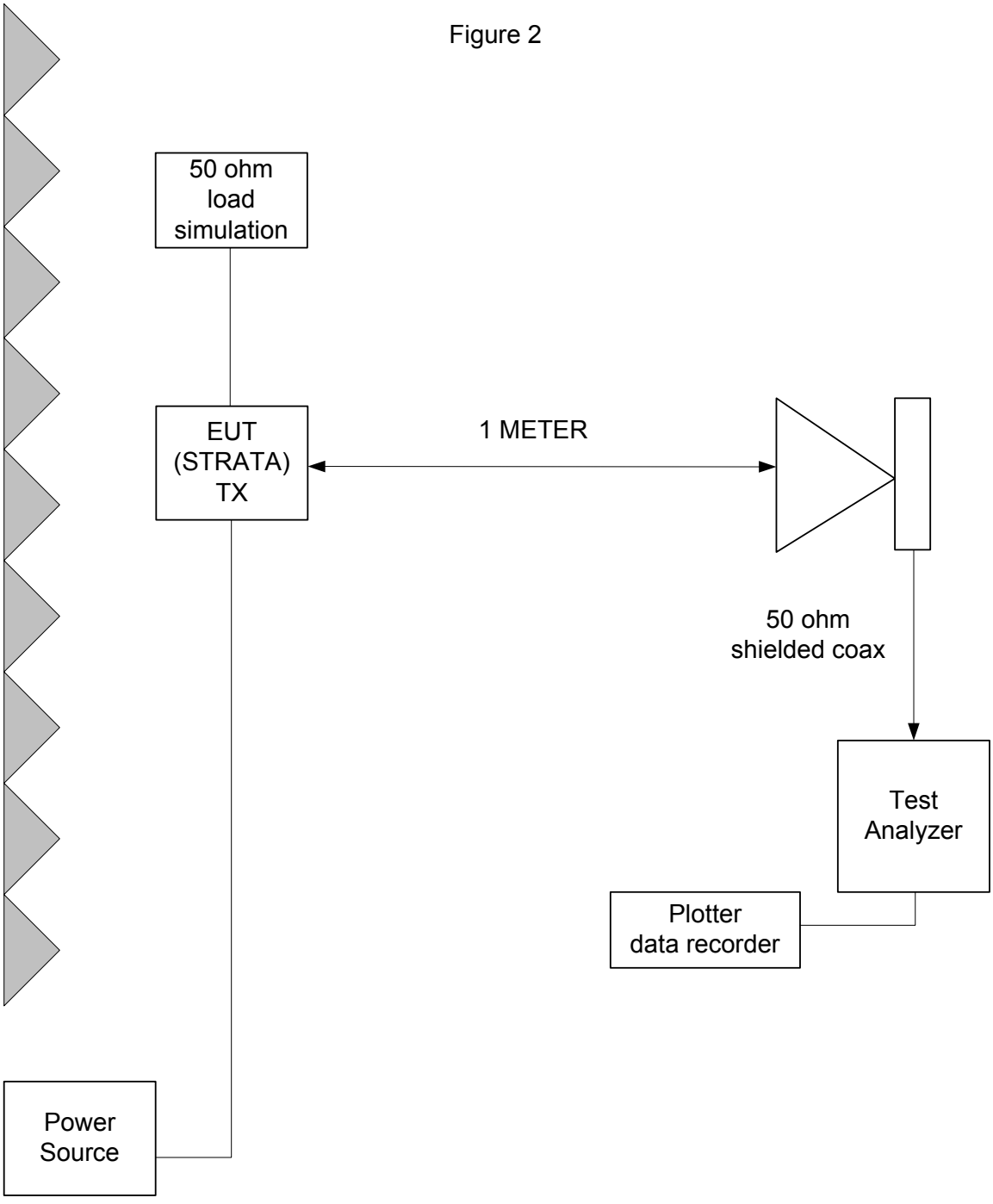
Spurious Emissions at
AntennaTest Set Up

Figure 1



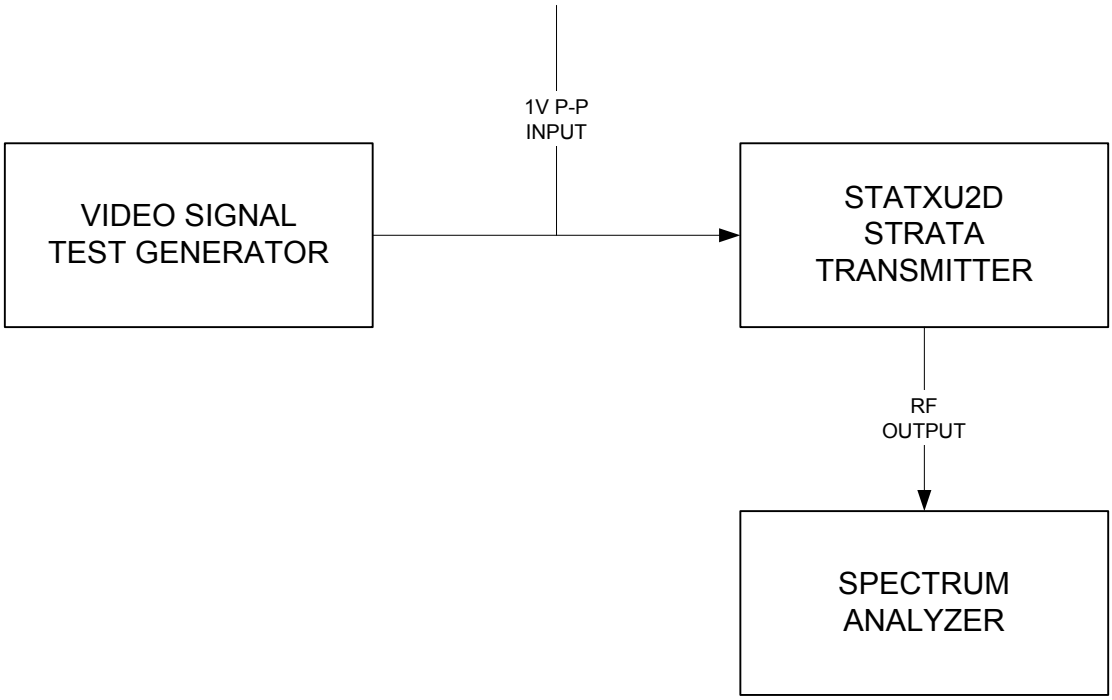
Radiated Emissions
Set Up

Figure 2

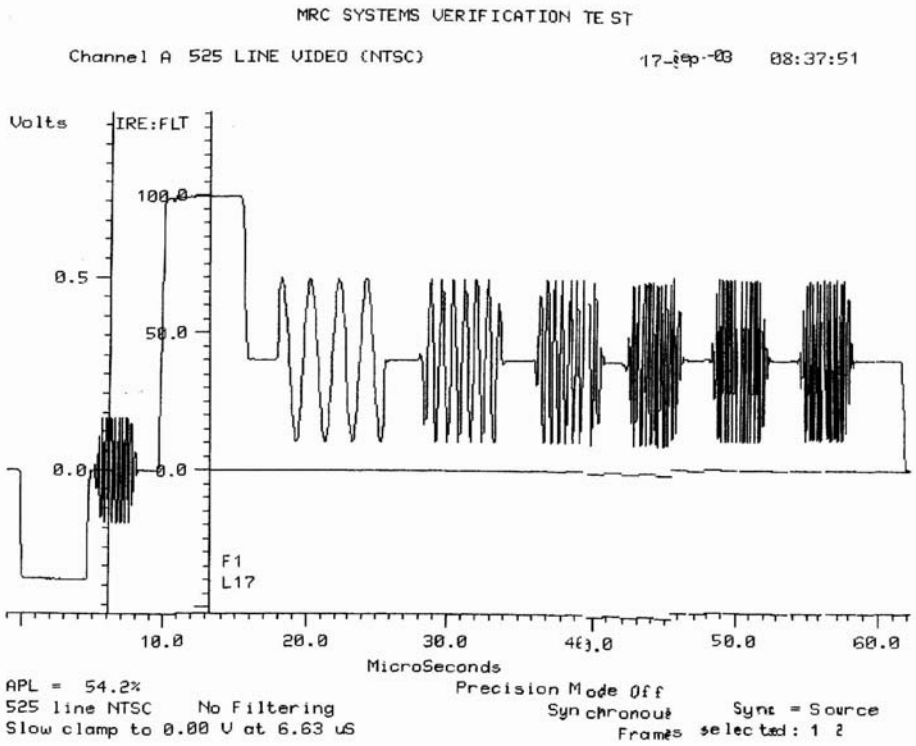


MODULATION CHARACTERISTICS TEST SET UP

FIGURE 3

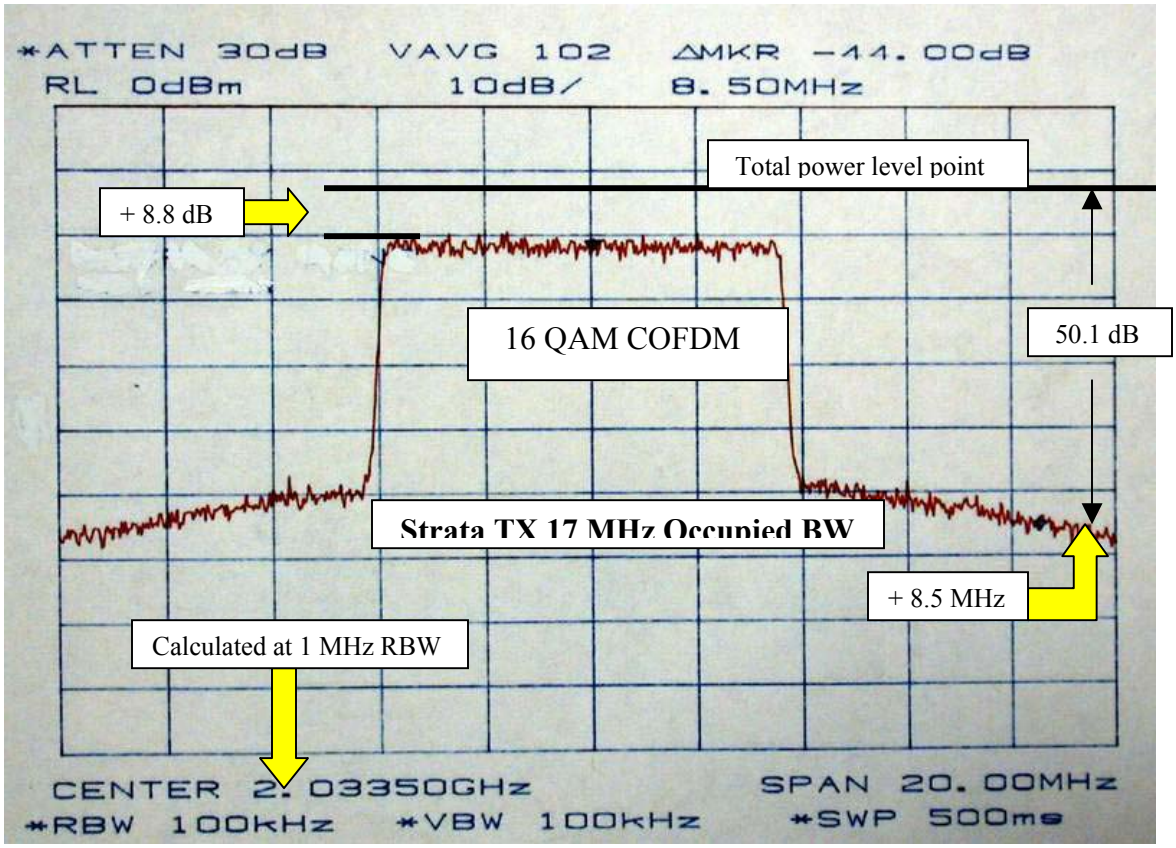


MODULATION INPUT
TO TRANSMITTER
FIGURE 4

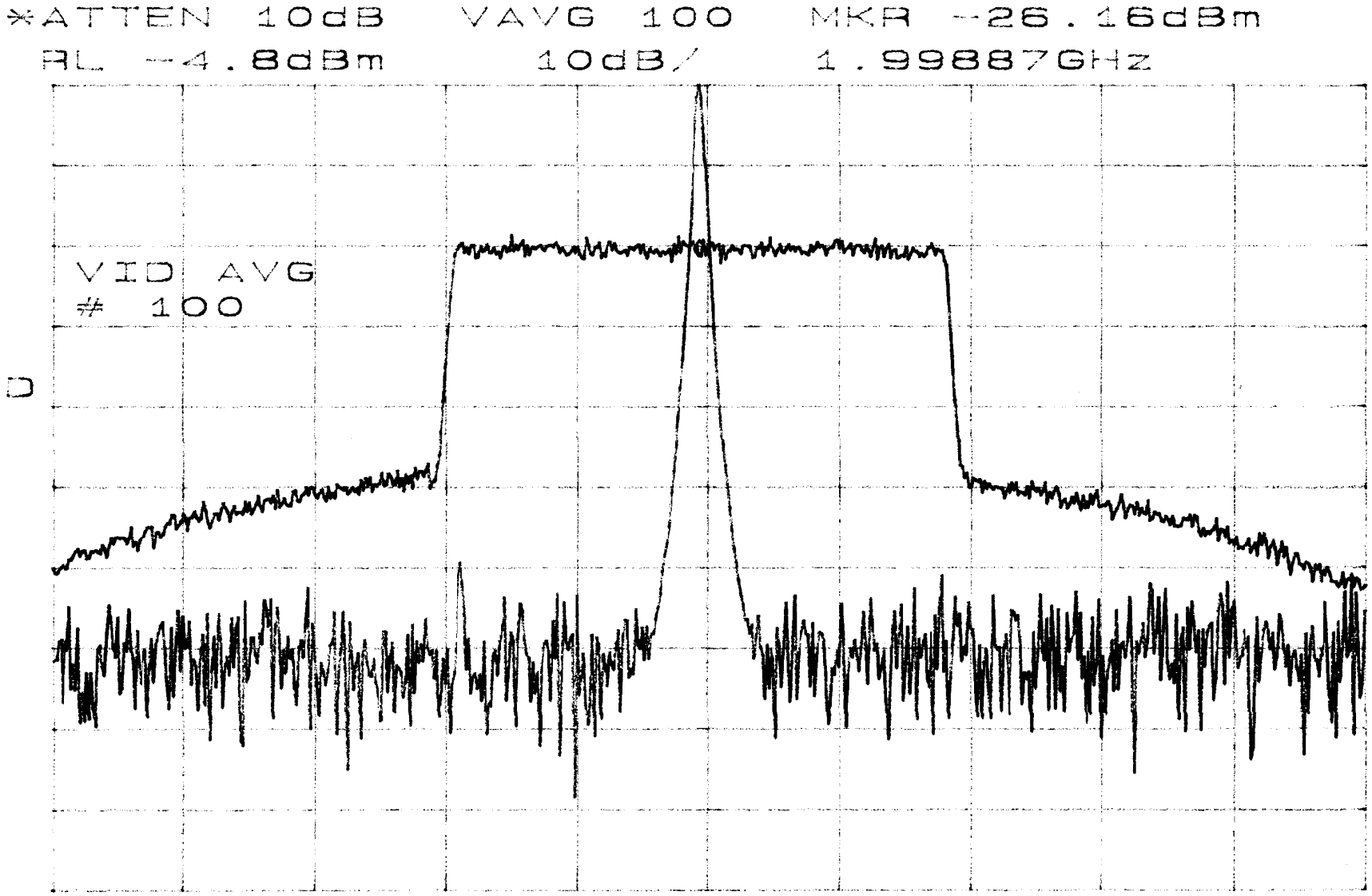


OCCUPIED BANDWIDTH SPECTRUM

FIGURE 5

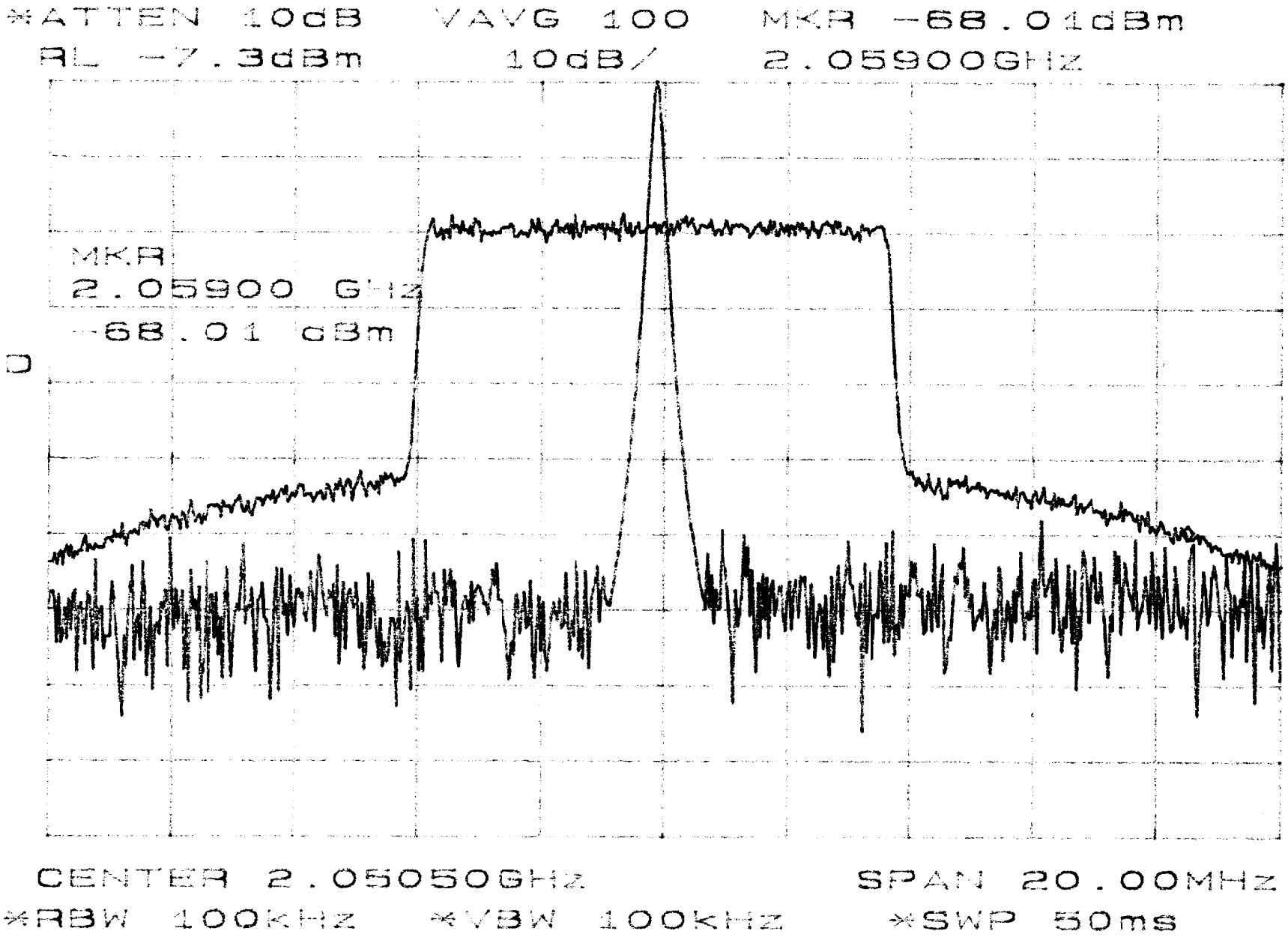


MRC STraTa 9/30/03



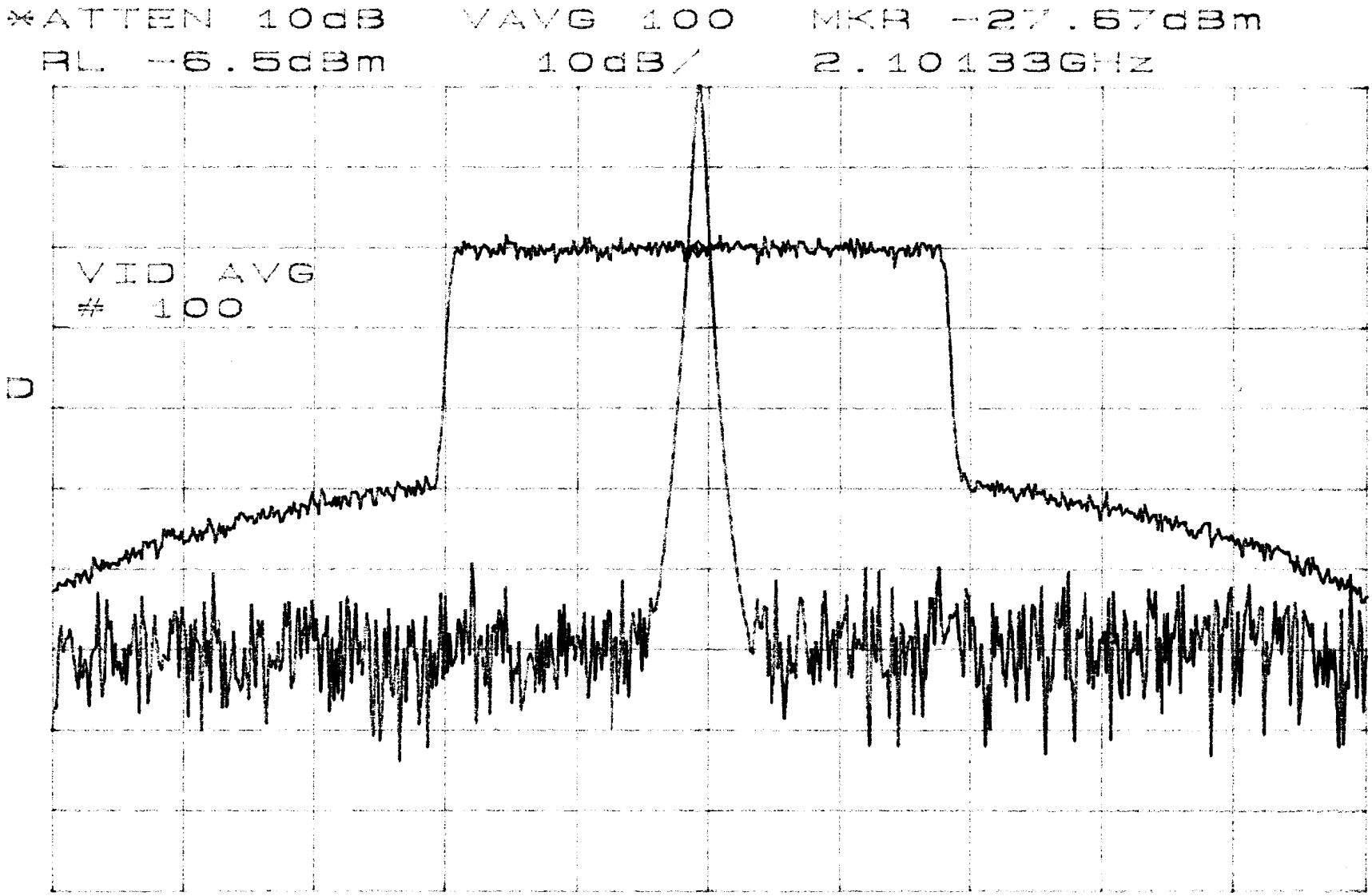
BAS Channel 1 P OUT = 28.5 dBm

MRC Strata 9/30/03



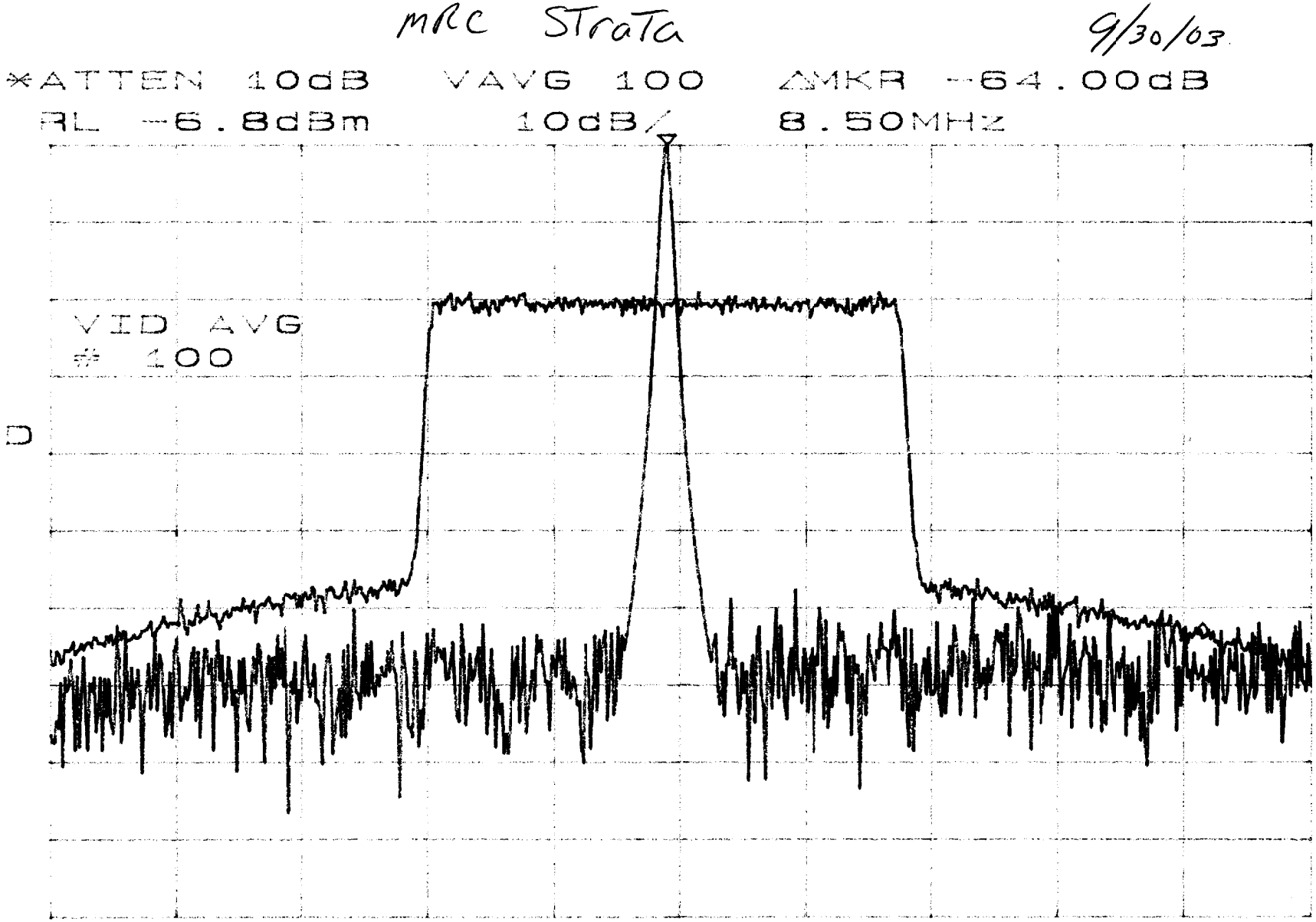
BAS Channel 4 P OUT = 28.0 dBm

MRC STraTa 9/30/03



BAS Channel 7 POUT = 27.8 dBm

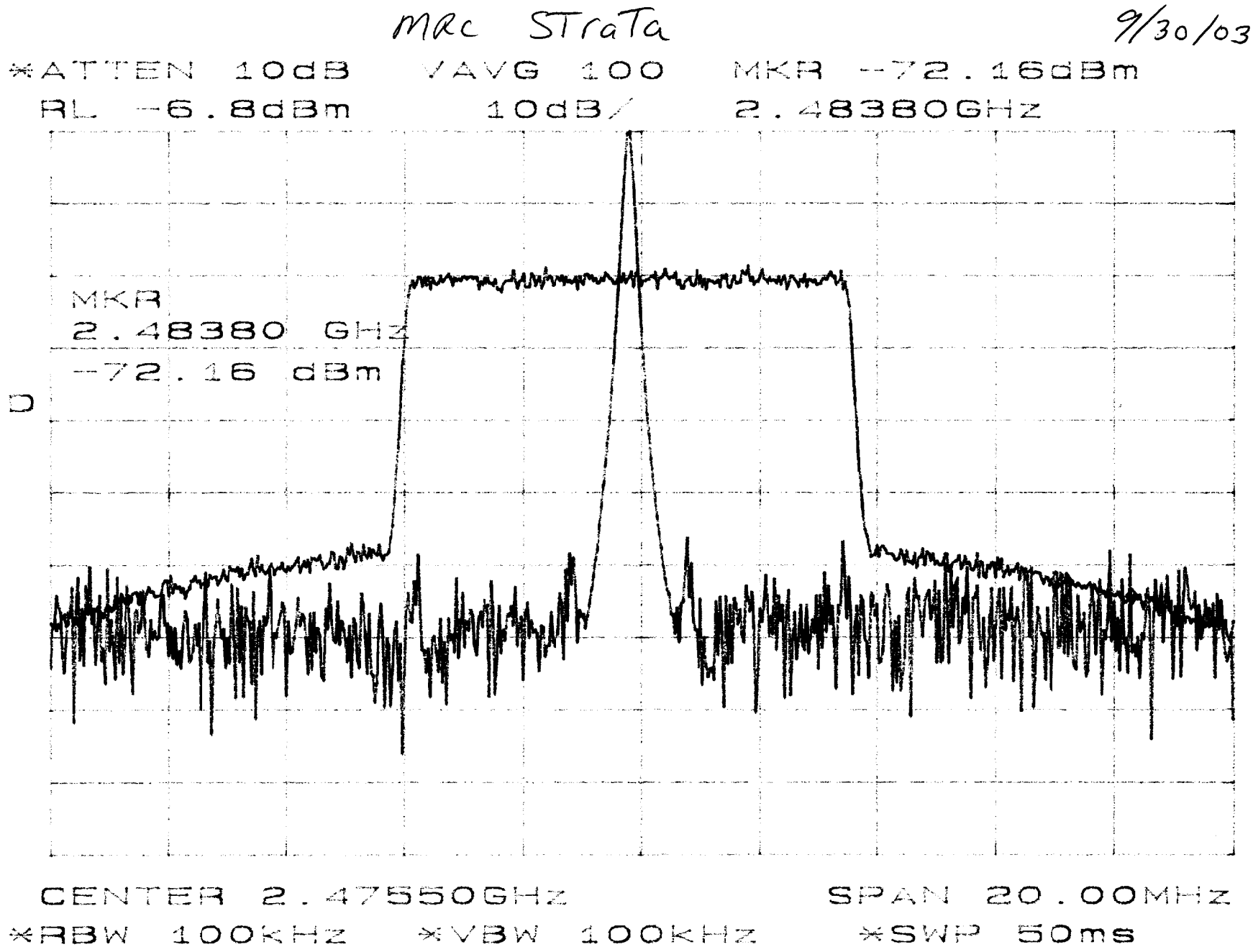
MRC STRATA 9/30/03



BAS Channel 8

POUT = 27.2 dBm

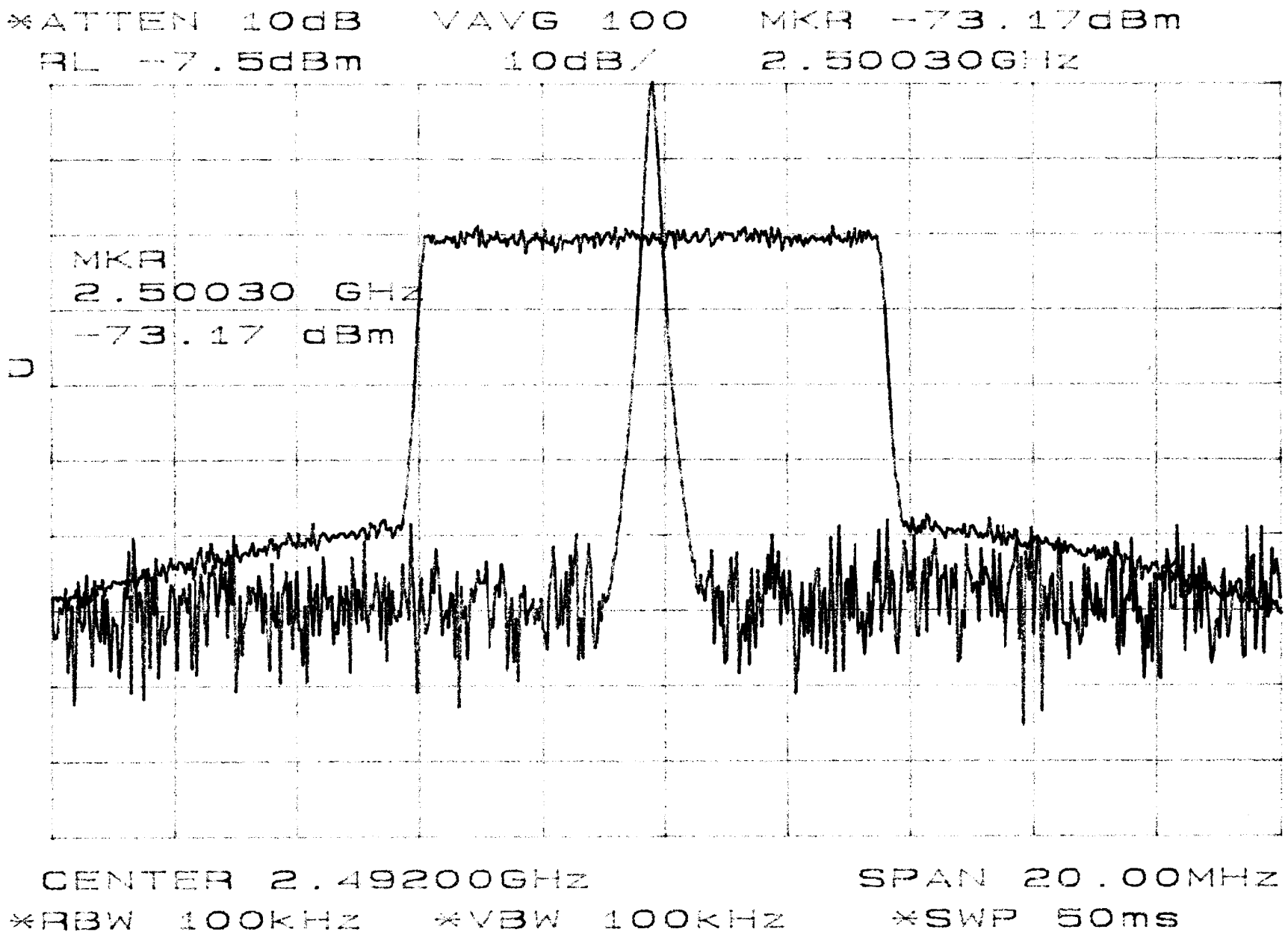
MRC STRATA 9/30/03



BAS Channel 9

P. OUT = 26.9 dBm

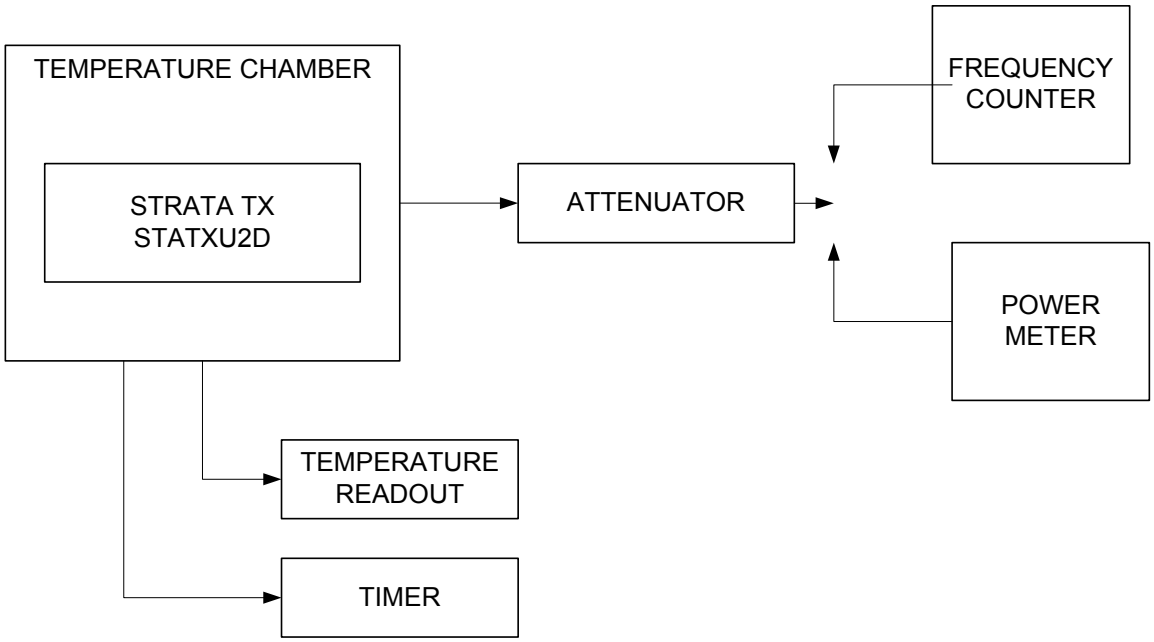
MRC Strata 9/30/03



BAS Channel 10 POUT = 26.6 dBm

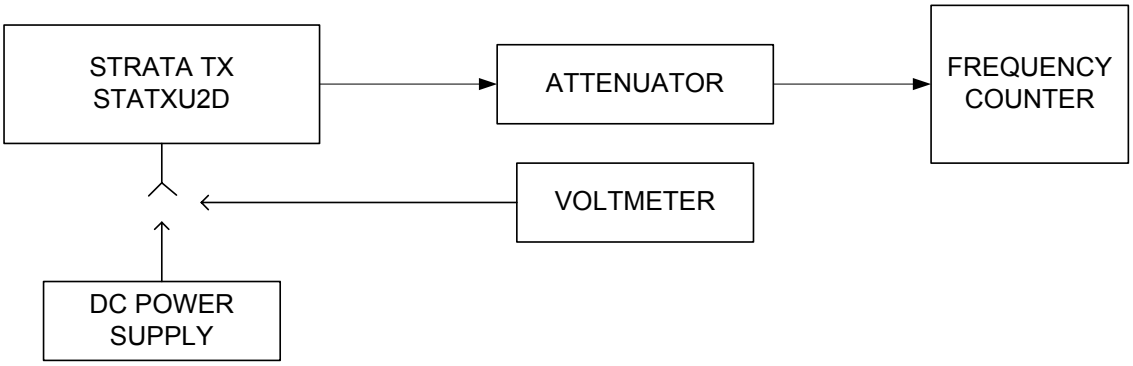
FIGURE 6A

RF OUTPUT POWER AND FREQUENCY STABILITY TEST SET UP

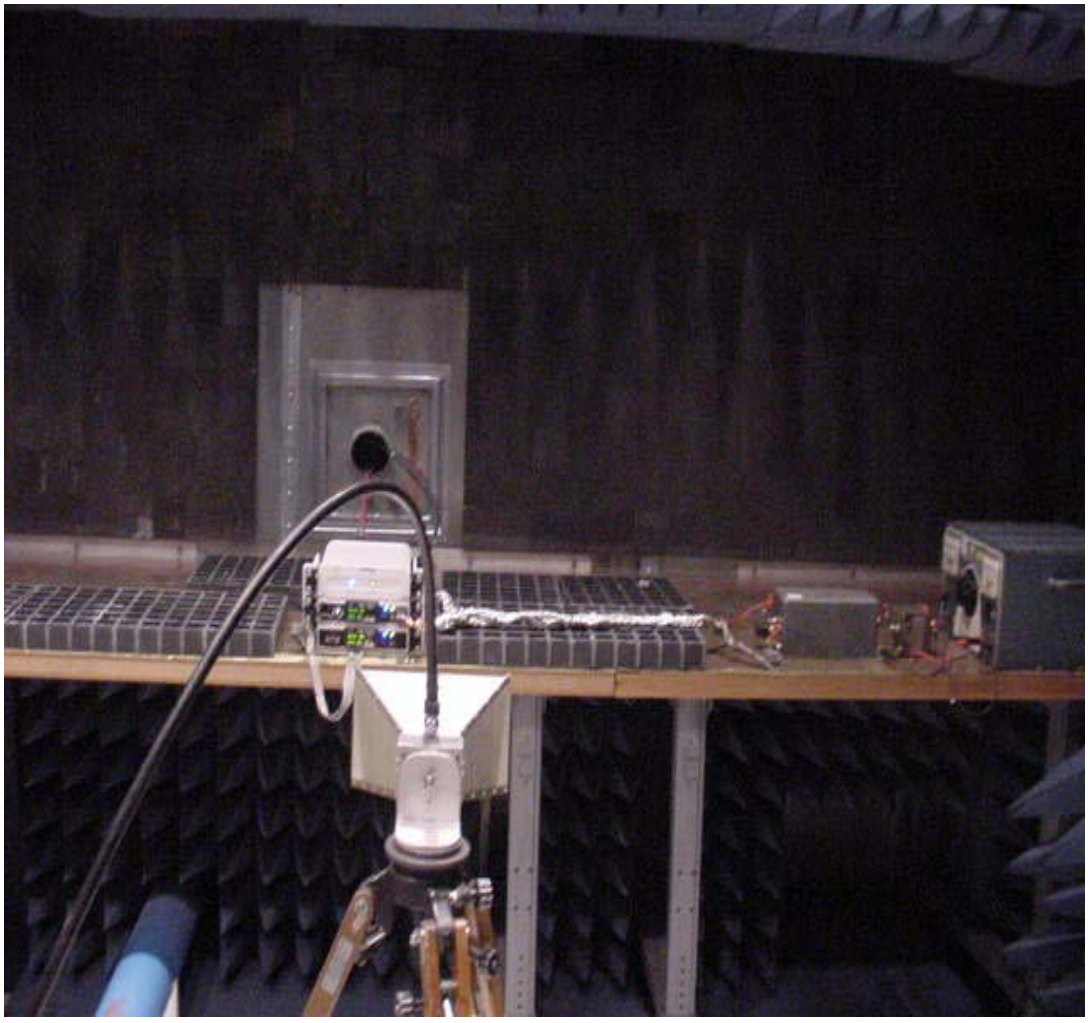


FREQUENCY STABILITY
VERSUS DEVIATION OF PRIMARY VOLTAGE

FIGURE 6B



ATTESTATION TEST SET UP
FIGURE 7



FREQUENCY STABILITY TEST DATA

TABLE 1

TEMPERATURE

TEMP ©	TIME	VOLTAGE D.C.	POWER O/P	FREQUENCY (MHz)	FREQUENCY CHANGE IN (MHz)
Rm temp.	1037	+12/+28/+48	31.2	2,067,534,07X	REF.
-20degC	1325	+12/+28/+48	31.4	2,067,534,38X	.0003
-5degC	1355	+12/+28/+48	31.4	2,067,533,99X	.0001
10degC	1445	+12/+28/+48	32.1	2,067,535,05X	.0010
25degC	1515	+12/+28/+48	32.4	2,067,535,70X	.0016
40degC	1540	+12/+28/+48	32.5	2,067,536,17X	.0021
50degC	1650	+12/+28/+48	32.5	2,067,535,95X	.0011

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TABLE 2

TEST EQUIPMENT

The following test equipment was used to perform attesstation tests

DESCRIPTION	MANUFACTURER	S/N	TYPE
Frequency Counter	Systron Donner	13003-5	6245A
Spectrum Analyzer	H.P	101	4564E
Power Meter	H.P.	9182	436A
Power Sensor	H.P.	2326	4841A
Temperature Chamber	CSZ	05913187	3030-22810-0001
Voltmeter	FLUKE	8417	70III
Power Supply	H.P.	8162	6291A
Antenna	AEL		APN-101B
Antenna	Electro-Metrics		TDA-25
Antenna	Electro-Metrics		TDS-25
Antenna	Waveline		799
Antenna	AEL		H-1459