TEST REPORT

FCC ID: JR9-VT20SALCD

1.0 TEST DATA

1.10 Technical Qualifications

The following tests and measurements were performed in the engineering laboratories of Southern California Microwave 2732 Via Orange Way, Suite E, Spring Valley, CA 91978-1744 and by the prepares of this report, Consolidated Spectrum Services, 22 Merrill Drive, Atkinson, N.H. 03811.

All equipment utilized is calibrated with accuracy traceable to the National Bureau of Standards.

1.11 Test Data Division

The test data herein presented, is divided into three sections, as follows:

A) Environmental Test Data,
B) Modulation Characteristics and
C) Electromagnetic Compatibility Test Data.

Each section is further subdivided.

1.2 ENVIRONMENTAL TEST DATA

1.21 General

Pursuant to FCC rule parts 2, 21, 74, 78 and 90 Certification of the JR9-VT20SALCD is respectfully requested. The JR9-VT20SALCD, herein referred to as transmitter under test, was subjected to environmental testing. These tests are subdivided into two sections, as follows:

A) Test Constraints
B) RF Output Power Stability and
C) Frequency Stability

1.22 Test Constraints

The temperature range, over which testing occurred was -30 to +55 degrees Celsius. This was spanned in increments of 10 degrees or less. All readings were taken after a thirty minute stabilization time. Since the unit is intended to operate off a 12 V DC battery, the supply voltage to the transmitter was varied from 10.8 - 14.6 V Dc.

1.23 RF Output Power Stability

For 12 watts maximum RF output, the highest power output recorded, over the specified temperature range, was 11.3 Watts at +25 Degrees Celsius.

The transmitter can be optionally limited to 10.0 Watts, maximum power, pursuant to FCC rule part 90.423 (a) (2).

The commission limit, reference rule part 74.636, is 20 watts for fixed stations and 12 watts for mobile stations.

The RF output power for the transmitter, over temperature, is within acceptable limits as set forth by FCC rules.

1.24 Frequency Stability

The commission limit for frequency stability is ±0.005%. For the unit under test on 2450.5 MHz, this calculates to a frequency variation of 2450.37745 to 2450.6225 MHz. For a center frequency of 2471.5 MHz this calculates to 2471.376425 to 2471.62375 MHz.

The transmitter under test was found to be well within the commission limit.

1.25 Test Constraints & Results

Cold start testing was performed at -30, +25 and +55 degrees Celsius using DC input voltages of 10.8 -14.6 V DC. In all cases the tests were conducted after thirty minutes of stabilization time. When subjected to the above variations, the transmitter came on frequency in less than 16.8 seconds,

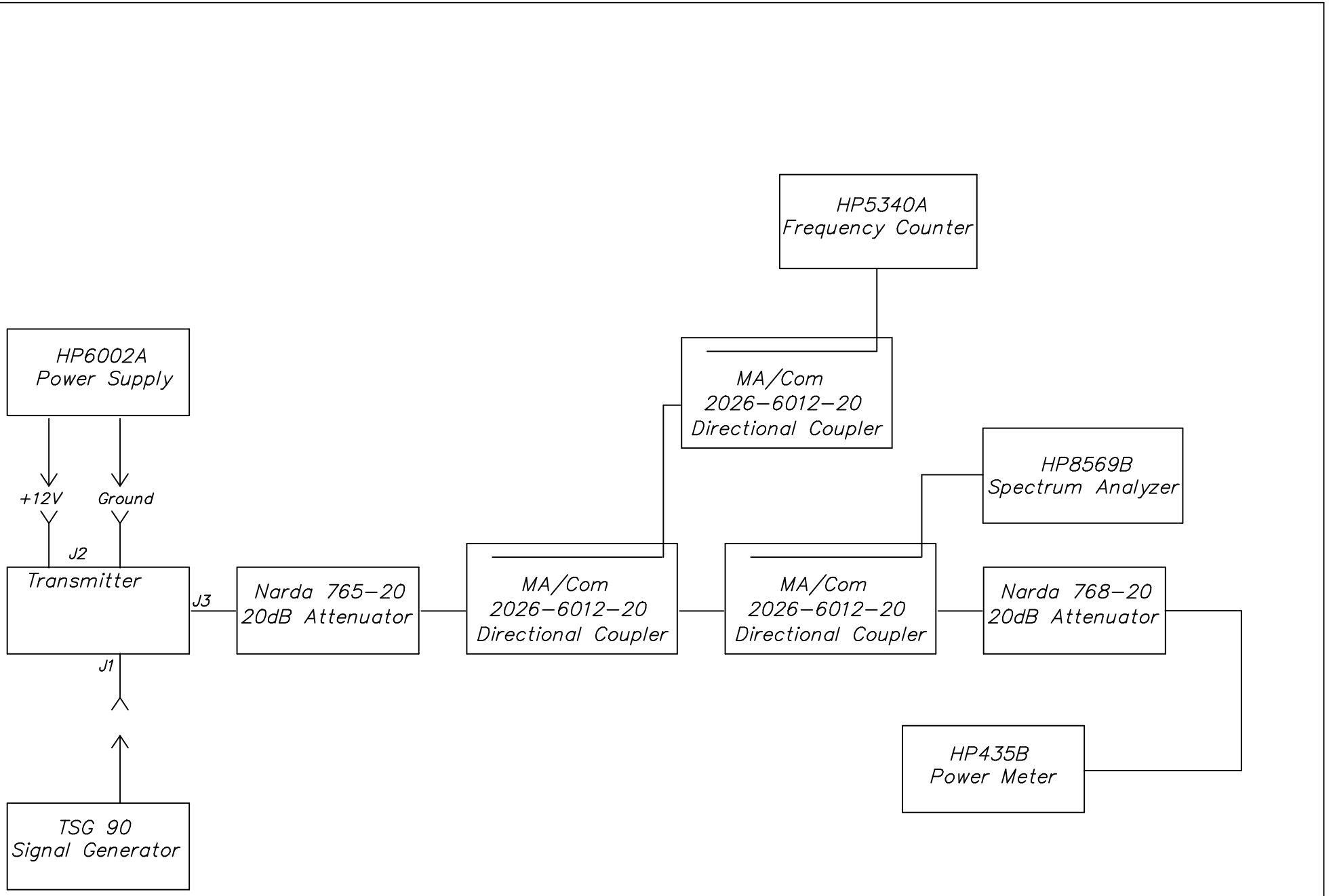
At all temperatures the DC input voltage was varied from 10.8 - 14.6 V DC. In all cases, no change in frequency was noted as a result of input voltage variation.

JR9-VT20SALCD TRANSMITTER POWER & FREQUENCY VERSUS TEMPERATURE

Temp- degrees C	Output Power	Frequency	Lock Time
-30	10.5W	2050.483 MHz	15.3 sec
	9.2W	2471.498 MHz	15.3 sec
-20	11.1W	2050.532 MHz	N/A
	10.3W	2471.540 MHz	N/A
-10	11.2W	2050.530 MHz	N/A
	10.5W	2471.545 MHz	N/A
0	11.2W	2050.530 MHz	N/A
	10.7W	2471.554 MHz	N/A
10	11.1W	2050.531 MHz	N/A
	11.2W	2471.553 MHz	N/A
20	11.1W	2050.525 MHz	N/A
	11.3W	2471.547 MHz	N/A
25	11.1W	2050.526 MHz	16.6 sec
	11.3W	2471.543 MHz	16.4 sec
35	10.8W	2050.519 MHz	N/A
	11.1W	2471.540 MHz	N/A
45	10.7W	2050.516 MHz	N/A
	11.0W	2471.537 MHz	N/A
55	10.4W	2050.510 MHz	16.4 sec
	10.7W	2471.529 MHz	16.8 sec

Channel 4= 2050.5 MHz
Channel 9-= 2471.5 MHz

Test setup- power, modulation, and frequency measurements.



BLOCK DIAGRAM- TEST SET UP
FREQUENCY, POWER, & MODULATION
MEASUREMENTS

1.3 MODULATION CHARACTERISTICS

1.31 General

The modulation characteristics are divided into two sections:

A) Calculated Bandwidth and
B) Measured Bandwidth

1.32 Calculated Bandwidth

In determining the calculated bandwidths, the level for "M" utilized, does not take into account audio sub-carriers. Up to four audio sub-carrier are offered for the transmitter under test. The audio sub-carriers do not deviate the main carrier one hundred percent. With a 1KHZ, 0 DBM test tone applied to the audio input connector, the main carrier will be deviated less than 75 KHZ peak. The highest frequency to deviate the main carrier one hundred percent is the video signal.

Audio Sub-carrier frequencies are 4.83 MHZ minimum to 8.5 MHZ maximum. The resulting modulation index, which is determined by dividing the 75 KHZ peak deviation into the audio sub-carrier modulating frequency, ranges from .0088 to .0155. Treatment of the audio sub-carriers can be referenced to rule part 2.202 due to the similarity in the character of the continuity pilot sub-carriers to audio sub-carriers. Accordingly, 2M + 2D would predominate over 2P (in the case of the transmitter under test, P = the highest audio sub-carrier frequency).

For 2 M + 2D where:

M = The highest modulating signal to deviate the main carrier one hundred percent.

D = The peak deviation.

For the transmitter under test:

M = 4.5 MHz and

D = 3.75 MHz

therefore, 2M + 2D = 2(4.5) + 2(3.75) = 16.5 MHz

1.33 Measured Bandwidth 16M5F8W

The occupied bandwidth was calculated according to rule part 2. A worst case modulating signal consisting of four 1 KHZ, 0 Dbm audio test tones and a 1 V peak to peak multi-burst signal were used for the test. Audio sub-carrier frequencies of 4.83 and 8.5 MHZ were utilized. The resulting output spectrums as well as the minus 25 and 35 db points, used for integration are shown on the next page.

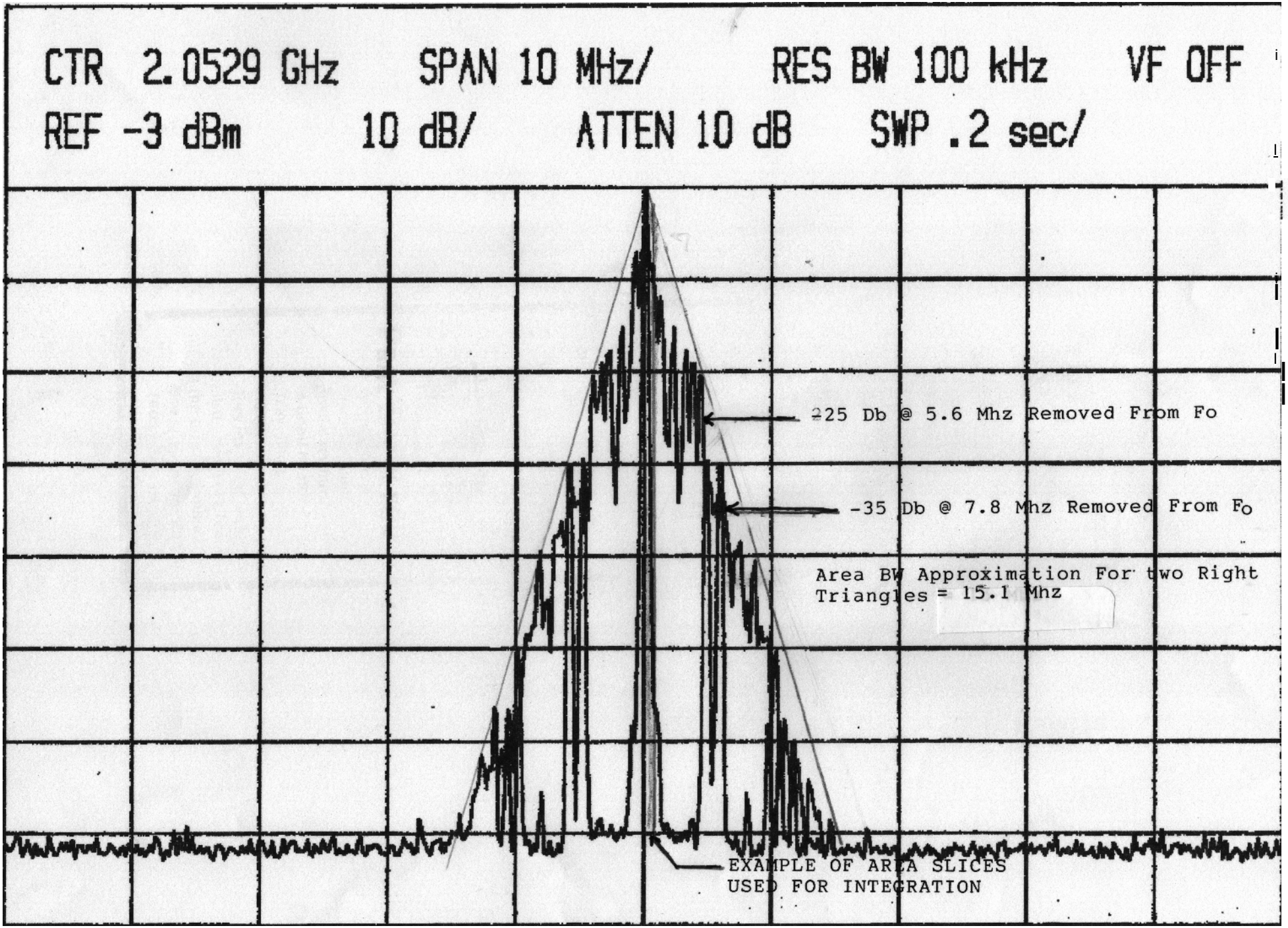
The spectrum analyzer resolution bandwidth was 100 KHz, attenuation 10 Db per division vertical, 10 MHz per division horizontal.

For 16M5F8W, the minus 25 at 6.6 MHz removed from the main carrier. The 35 db point occurred at 7.8 MHz removed from the main carrier.

The total integrated occupied bandwidth was estimated at 15.1 MHZ, using two right triangular approximations. The initial integration slice was from 0-1 Mhz. It was increased after 3 Mhz removed from the carrier to 5 MHz increments.

This is within the requested 16.5 MHZ emission bandwidth.

These tests were performed at 10.8 and 14.6 V DC. No differences in occupied bandwidth were noticed between the various voltage levels.


CTR 2.0529 GHz
SPAN 10 MHz/
RES BW 100 kHz
VF OFF
REF -3 dBm
10 dB/
ATTEN 10 dB
SWP .2 sec/
-25 Db @ 5.6 Mhz Removed From Fo
-35 Db @ 7.8 Mhz Removed From Fo
Area BW Approximation For two Right Triangles = 15.1 Mhz
EXAMPLE OF AREA SLICES USED FOR INTEGRATION

1.4 ELECTROMAGNETIC COMPATIBILITY TEST DATA

1.41 General

Electromagnetic Compatibility Testing is divided into three sections, as follows:

A) Spectrum Analyzer Calibration,
B) Antenna Conducted Spurious Emissions and
C) Case Radiated Spurious Emissions

The requirements are to the tenth harmonic of the fundamental frequency or 100 Ghz which ever is the lesser. Accordingly, tests were conducted to 40 Ghz. This well exceeds the tenth harmonic of the fundamental frequency of roughly 2.5 Ghz.

1.42 HP141T Spectrum Analyzer Calibration

The spectrum analyzer 3 db IF bandwidth or resolution bandwidth was set to 10 KHZ for all measurements. The FCC requires a bandwidth of 4 KHZ. Therefore the observed data is 10 log (10/4) = 4.0 db too high. The noise bandwidth as defined by Hewlett Packard application note 150-4, April 1974, is 1.2 times the three decibels bandwidth. Therefore the observed data is an additional 10 Log (1.2) = 0.8 db too high.

From the previously mentioned application note it is stated that "the detected signal is smaller than its true rms value. This correction for the log display mode combined with the detector characteristics gives a total correction of 2.5 db, which should be added to any random noise measured in the log display mode. " The summation of corrections is as follows:

- 4.0 db	Bandwidth
- 0.8 db	Noise Bandwidth
+ 2.5 db	Detector Characteristics
- 2.3 db	Total

The observed power levels are therefore 2.3 db too high for noise or noise like random signals.

1.43 Antenna Conducted Spurious Emissions

Test equipment was setup as shown. The analyzer was first tuned for a reference carrier level at the fundamental operating frequency. The output spectrum was then slowly scanned upward from .1 to 40 GHZ and back down again. Special attention was given to those frequencies which corresponded to possible harmonics and sub-harmonics.

The FCC limit for Antenna Conducted Spurious Emissions is 43 + 10 Log P below the main carrier. For the transmitter under test with P = 12 Watts (40.79 dbm) this corresponds to 53.79 below the main carrier or a relative level of -13 dbm.

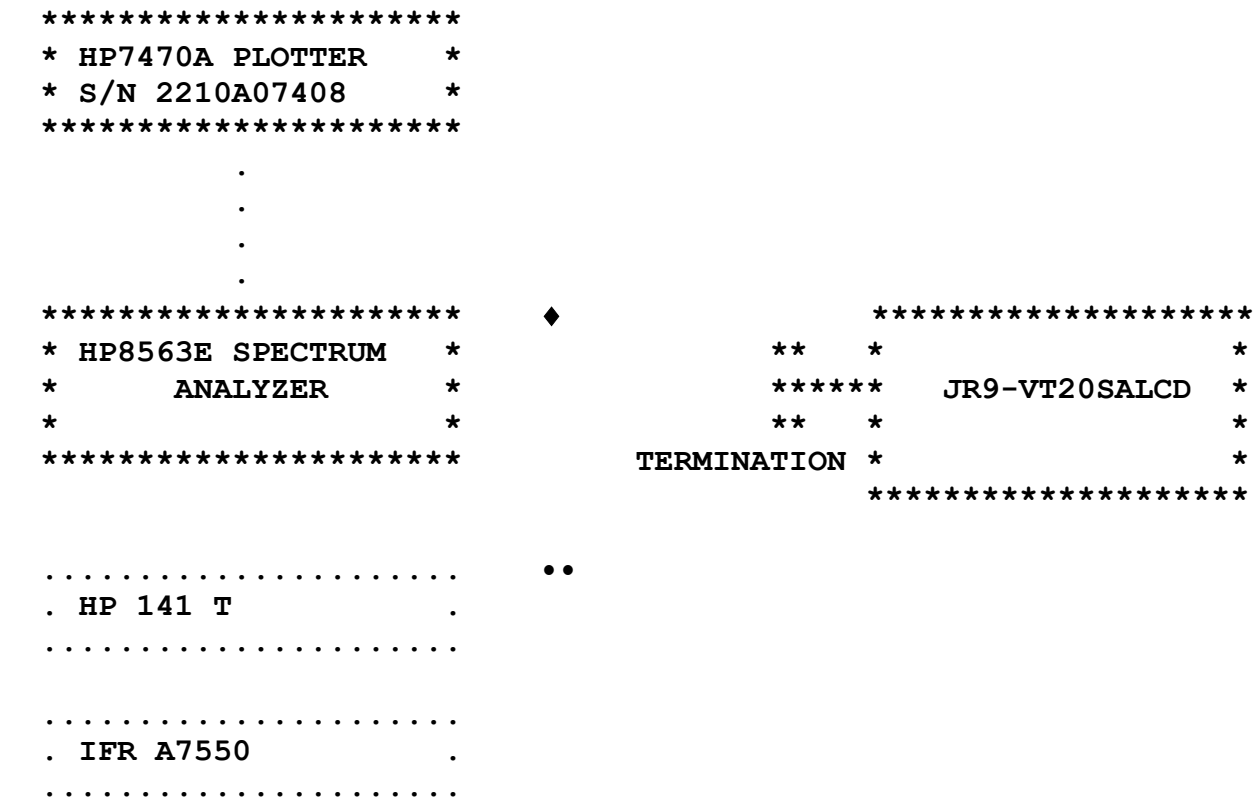
The antenna conducted spurious emissions reported on the next page are all well within this limit.

1.44 Case Radiated Spurious Emissions

Case Radiated Spurious Emission tests were conducted at a characterized open field site utilizing the test setup shown. Observations were made at one meter from the unit. All signals were recorded at maximum strength in terms of antenna polarization. In determining the maximum strength of emission the transmitter under test, were rotated on a turntable. The output spectrum, as received at one meter, was slowly scanned upward from .1 to 40 GHZ and back down again. Special attention was given to those frequencies which corresponded to possible harmonics and sub-harmonics.

There were no signals recorded with 20 db of the FCC limit. In fact the only signals, recorded were the second and third and harmonic of the fundamental frequency. These signals were recorded at 50 Dbuv/m and 45 dbuv/m, respectively.

CASE RADIATED SPURIOUS EMISSIONS TEST SETUP

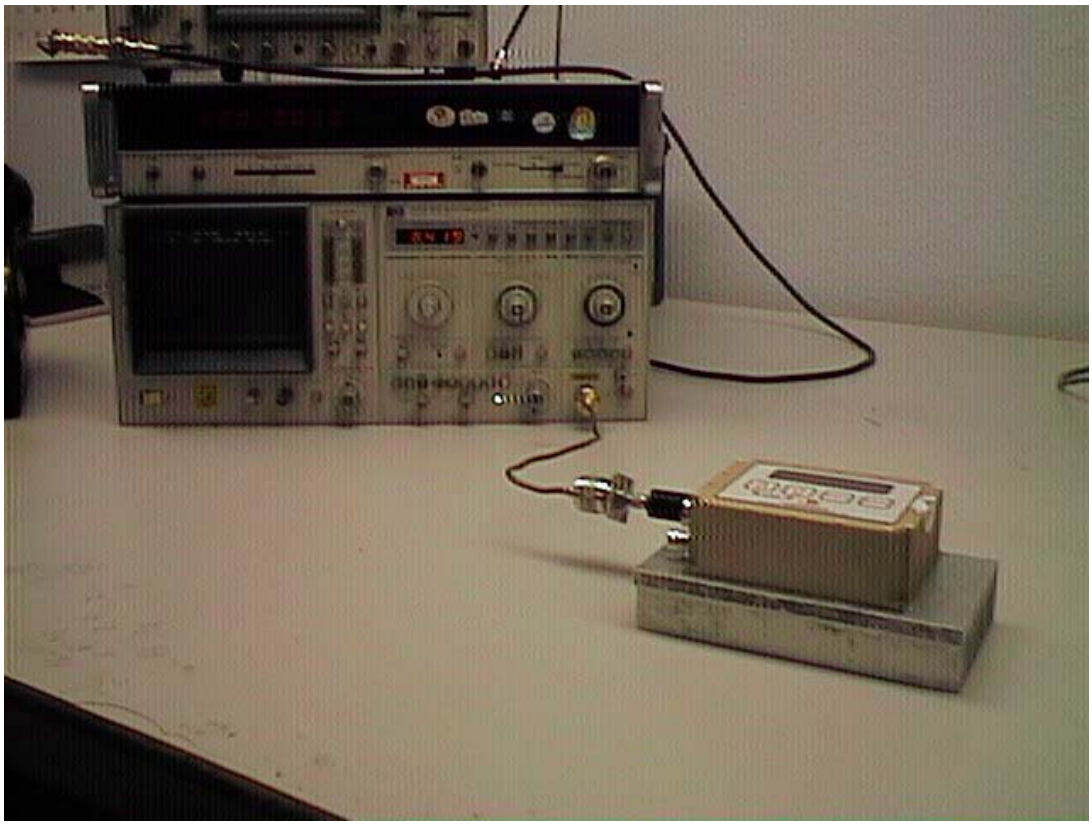


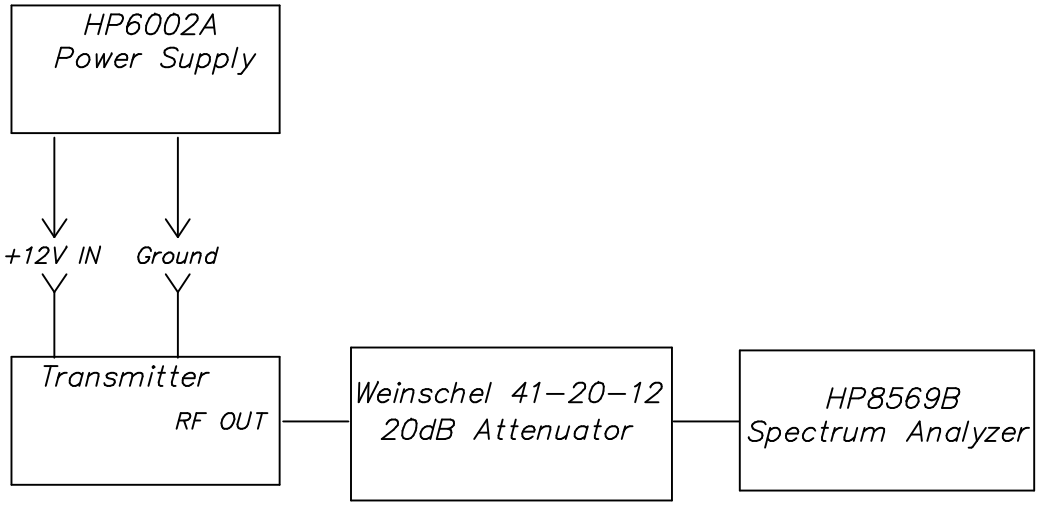
♦ ANTENNAS UTILIZED

EMPIRE DEVICES QUARTER WAVE DIPOLE SET
EMCO 3146 LOG PERIODIC
APN101A PYRAMIDAL LOG PERIODIC
MR STANDARD GAIN HORN
WAVELINE 799
NARDA 56K1
WAVELINE 1099

•• EXTERNAL MIXERS

ANTENNA CONDUCTED SPURIOUS EMISSIONS TEST SETUP





BLOCK DIAGRAM- TEST SET UP
SPURIOUS EMMISIONS MEASUREMENTS

For 12 Watts nominal output, a radiated reference level ca be calculated using the formula:

$$E = \sqrt{(30 \times G \times P)/R}$$

where:

G = Power gain of antenna (ratio),
P = Transmitter power in watts and
R = Distance from radiator at which field intensity is measured.

For the low power option:

G = 1.64 (gain of dipole over isotropic),
P = 12 watts and
R = 1 meter

Therefore:

$$E = \sqrt{(30 \times 1.64 \times 3)/1} = 24.298 \text{ volts/meter}$$

$$= 147.7114 \text{ Dbuv/m}$$

The FCC rules require case radiated signals to be attenuated by a factor of 43 + 10 Log P or 43 + 10 Log 12= 53.792 Db. Thus 147.7114 Dbuv/m attenuated 53.792 db equals 93.9194 Dbuv/m.

1.5 - PERTINENT FCC DATA

APPLICANT:	**Southern California Microwave, Inc. 2732 Via Orange Way, Suite E Spring Valley, CA 91978-1744**
FCC ID:	**JR9-VT20SALCD**
FREQUENCY RANGE:	**1990 - 2500 Mhz**
FREQUENCY TOLERANCE: FCC LIMIT:	**Plus and Minus 0.005 Percent**
RF POWER OUTPUT:	**12.0 Watts, Maximum 10.0 Watts, Optional**
EMISSION DESIGNATOR:	**16M5F8W**

DESCRIPTION OF EMISSION: **The emission is frequency modulated carrying video/audio information.**

USE: **The transmitter is intended for use in air and ground mobile telecommunication systems. The applicable FCC rule parts are 74, 78 and 90.**

2.6 SUMMARY & ANTI-DRUG ABUSE STATEMENT

This equipment has been tested in accordance with the requirements contained in the appropriate commission regulations. To the best of my knowledge these tests were performed using measurement procedures consistent with industry and commission standards and demonstrate that the equipment complies with the appropriate standards. The manufacturer has been informed and understands that each unit marketed shall be manufactured to conform to the sample tested within the variations that can be expected due to quantity production and testing on a statistical basis. I further certify that all measurements were performed at SOUTHERN CALIFORNIA MICROWAVE, 2732 VIA ORANGE WAY, SUITE E, SPRING VALLEY, CA 91978-1744 and CONSOLIDATED SPECTRUM SERVICES, 22 MERRILL DRIVE, ATKINSON, N.H. 03811.

SOUTHERN CALIFORNIA MICROWAVE is not subject, nor is any party affiliated with SOUTHERN CALIFORNIA MICROWAVE, subject to denial of Federal benefits pursuant to section 5301 of the anti-drug act of 1988, 21 USC 862.

Respectfully Submitted,

Howard Epstein,
President

On behalf of:

SOUTHERN CALIFORNIA MICROWAVE
2732 VIA ORANGE WAY, SUITE E
SPRING VALLEY, CA 91978-1744